Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter

Prepared for:
Hydro Aluminium Kurri Kurri Pty Ltd

On behalf of:

Prepared by:
ENVIRON Australia Pty Ltd

Date:
22 October 2013

Project Number:
AS130336

ENVIRON

Prepared by:

Name: Kirsty Greenfield
Title: Environmental Scientist
Phone: 02 4962 5444
Email: kgreenfield@environcorp.com
Signature: KGreenfield Date: 22/10/13

Authorised by:

Name: Fiona Robinson
Title: Manager - Hunter
Phone: 02 4962 5444
Email: frobinson@environcorp.com
Signature: Date: 22/10/13

VERSION CONTROL RECORD

Document File Name	Date Issued	Version	Author	Reviewer
AS130336_Hydro_Phase 1	20 August 2013	Draft 1	K Greenfield	F Robinson
AS130336_Hydro_Phase 1	26 August 2013	Draft 2	K Greenfield	F Robinson
AS130336_Hydro_Phase 1	22 October 2013	Final	K Greenfield	F Robinson

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Acronyms and Abbreviations

ACM	Asbestos Containing Materials
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ASET	Australian Safer Environment and Technology Pty Ltd. (Laboratory)
ANZECC	Australian and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes (Monocyclic aromatic Hydrocarbons)
CN	Cyanide (total or free)
CT	Certificate of Title
DP	Deposited Plan
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Ha	Hectare
km	Kilometres
LOR	Limit of Reporting
m	Metres
MAH	Monocyclic Aromatic Hydrocarbons
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury, Se: Selenium
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
m BGL	Metres below ground level
mg/L	Micrograms per Litre
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
n	Number of Samples
OCPs	Organochlorine Pesticides
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
pH	a measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SILs	Soil Investigation Levels
SMF	Synthetic Mineral Fibre
SPL	Spent Pot Lining
SVOCs	Semi Volatile Organic Compounds
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VENM	virgin excavated natural material
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Litre
-	On tables is "not calculated", "no criteria" or "not applicable”

1 Introduction

1.1 Background

This report presents the findings of a Phase 1 Environmental Site Assessment (ESA) which was performed at the former Hydro Kurri Kurri Aluminium Smelter located off Hart Road, Loxford, New South Wales (NSW). The site incorporates 60ha of Smelter Site and 2,500ha of surrounding buffer land and is hereinafter referred to as 'the site'. The work has been performed at the request of Mr Richard Brown, Hydro Aluminium Kurri Kurri Pty Limited (the 'Client') (Hydro).

Operations undertaken by Hydro at the Kurri Kurri site were curtailed in September 2012 and the site is currently in a care and maintenance phase. Hydro has commissioned environmental studies to develop an understanding of their obligations in relation to site restoration in the event that a decision is made to exit the site. ENVIRON has previously completed several environmental assessments, as outlined below:

- Kurri Kurri Environmental Status Review 2012, dated January 2012. The objectives of the environmental status review were to determine the current situation at the site, and summarize potential liabilities and costs associated with the potential discontinuation of site operations, mothballing of the facility, and/or dismantling and remediation. In addition, a first assessment of potential future use opportunities was to be outlined. This was a high level review;

- Hydro Kurri Kurri Smelter, Landuse Study, dated May 2012. The purpose of the landuse study was to determine the use of land surrounding the smelter to better understand the most feasible future land use for the smelter area and Buffer Zone. The study identifies existing landuse in Kurri Kurri and surrounding areas, changes in land use and contributors to change.

- Waste Disposal, Kurri Kurri Aluminium Smelter, dated 8 June 2012. This letter report details an inventory of all wastes located at the smelter, estimated volumes and disposal options. Waste identified included pan metal, tap outs, pot bottoms, bail aluminium, returns from Weston Aluminium, aluminium doors, concrete key slabs, aluminium bus bars, white waste, material left in 132 stopped pots, pot shells, pit cleaning, shot blast waste, cooling water within Carbon Plant, ahead of schedule anodes, SPL in storage sheds, Alcan Mound, refractory bricks, illegal dumping, filling within the Clay Borrow Pit and sediments within the dams.

- Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter, dated 1 November 2012. The investigation comprised a review of historical and background data, site inspections and soil and groundwater sample collection and analysis. The investigation was undertaken of an operational site and is considered a preliminary investigation. The purpose of the investigation was to evaluate soil and groundwater concentrations that may represent a risk to human health at the site, and human health and the environment within the Buffer Zone. This investigation identified areas of potential environmental concern at the smelter, including the Alcan Mound, the Anode Waste Pile, East Surge Pond and associated drainage lines, Diesel Spray Area, Carbon

Plant, Glen Ayr Drift, Clay Borrow Pit, fluoride in soil and groundwater and aluminium in groundwater;

- Section 60 Notification Supporting Information, dated 21 August 2012. Based on the information reviewed during the Phase 2 ESA, ENVIRON recommended notification to the NSW EPA under Section 60 of the Contaminated Land Management Act 1997 of the Alcan Mound, a waste stockpile of Spent Pot Linings (SPL) and other smelter wastes that was capped in 1995. The Alcan Mound is known to generate leachate with elevated sodium, fluoride, cyanide and sulphate concentrations. This leachate has impacted shallow groundwater and there are two areas of vegetation impact down gradient of the Alcan Mound;

- Environmental Site Assessment, Alcan Mound, Kurri Kurri Aluminium Smelter, dated 12 December 2012. Following notification, the NSW EPA requested further information about the Alcan Mound. This ESA focussed on the Alcan Mound and included the review and collation of historical information pertaining to the Alcan Mound and surrounding leachate impact area, water quality sampling of 14 existing wells and a pump test to assess aquifer behaviour. Reporting also included the identification of data gaps and recommendations for further investigations to address these data gaps;

- Phase 2 Environmental Site Assessment, Dickson Road, Loxford, dated 17 December 2012. A known waste disposal area in the Buffer Zone was made known to ENVIRON following the Phase 2 ESA. An assessment of this site was undertaken to identify, review and report on the potential for contamination at the site based on historical and current landuse and to assess the implication of any identified contamination in terms of the current and proposed land use;

- Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter, dated March 2013. As there are no ecological assessment guidelines in Australia for fluoride and aluminium, ENVIRON completed a Tier 2 ecological risk assessment associated with potential fluoride and aluminium contamination of groundwater, soils and surface water down gradient of the Alcan Mound;

- Preliminary Screening Level, Health Risk Assessment for Fluoride and Aluminium, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxford, dated 2 April 2013. As there are no human health assessment guidelines in Australia for fluoride and aluminium, ENVIRON completed a preliminary screening level human health risk assessment of fluoride and aluminium contamination of soils, groundwater and surface water down gradient of the Alcan Mound.

At present, investigations into the Alcan Mound and associated leachate plume are on-going. Assessment of other identified potential areas of concern are planned as required. To facilitate potential landuse changes at the smelter and Buffer Zone, the need for a more detailed Phase 1 Environmental Site Assessment was recognised to identify any potential areas of concern that were not identified in the high level review.

1.2 Objectives and Scope of Work

The objectives of the Phase 1 ESA were to identify, review and report on the potential for historic and current site contamination. The scope of work performed to meet these objectives comprised:

- A review of historical reports (listed below) relating to land use and operations at the site and Buffer Zone to assess the potential for soil, groundwater or surface water contamination arising from historic and current uses;
- A review of published geological, hydrogeological and hydrological data associated with the site to establish the site environmental setting and sensitivity;
- Detailed review of historical aerial photographs from 1951 (earliest available aerial photo), 1957, 1961, 1966, 1975, 1978, 1987, 1994, 2001, 2006 and 2013;
- Detailed site walk over;
- Interview with site environmental manager Kerry McNaughton;
- Review of previous investigations undertaken by ENVIRON and others.

The following reports were reviewed as part of this investigation:

- "Environmental Assessment, Phase 1 Report" May 2000 by ERM;
- "Hydro Aluminium Smelter, Hazard Audit" 20 August 2010 by AECOM;
- "Hydro Aluminium 2010 Annual Environmental Management Report" 27 June 2011 by AECOM
- ENVIRON investigations undertaken in 2012 and 2013, as summarised in Section 1.1.

A site visit was conducted on 19 July 2013 by Kirsty Greenfield of ENVIRON Australia Pty Ltd (ENVIRON). The site visit included an inspection of the site and a review of aerial photographs with Hydro's Environment Officer, Mr Kerry McNaughton.

1.3 Limitations

The scope of the Phase I ESA was primarily based on relevant guidelines and the scope as described in this report. Additionally, environmental operational compliance, flood risks, radon, climate change, greenhouse gas issues and carbon footprint, transportation, product liability and occupational health and safety issues were not included in the scope of works.

There is no national register of 'contaminated sites' in Australia, however, a NSW register is available and the results of this search included within this report.

Specific assumptions and limitations identified by ENVIRON as being relevant are set out in the report. The methodology adopted and sources of information used by ENVIRON are outlined in our scope of work. ENVIRON has made no independent verification of this information beyond the agreed scope of works and assumes no responsibility for any inaccuracies or omissions.

Limited third party searches have been undertaken as part of the ENVIRON review. Unless ENVIRON has knowledge to the contrary, information obtained from the site has been assumed to be correct and complete. ENVIRON does not assume any liability for misrepresentation of information or items available at the time of the review. Opinions and judgements expressed herein, are based on ENVIRON's understanding of the site as described.

This report should be read in full. No responsibility is accepted for use of any part of this review in any other context or for any other purpose or by third parties. This review does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners

1.4 User Reliance

This report has been prepared exclusively for use by Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without ENVIRON's express written permission.

Any reliance on this report by third parties shall be at such parties' sole risk unless otherwise agreed in writing by ENVIRON Australia Pty Ltd.

1.5 Guide to the Report

This report presents the findings of the Phase 1 ESA performed at the former Hydro Kurri Kurri Aluminium Smelter located off Hart Road, Loxford, NSW. Section 2.0 provides an outline of background information that has been gathered on the site and describes the site's location, provides a review of the historical development of the site and the surrounding land and a description of the environmental setting; Section 3.0 presents the findings of the site assessment; Section 4.0 presents environmental database findings; Section 5.0 presents environmental assessment findings; Section 6.0 present an Environmental Issues Register and Section 7.0 presents the conclusions.

2 Site Description

2.1 Site Location

The site includes a 60ha plant area ('the Smelter Site'), which is described by 10 different allotments, Lots 318, 319, 411, 412, 413, 414, 415, 769, 776 in DP 755231, and Lot 3 in DP 456769; and a 2,500ha land parcel, which includes a Buffer Zone around the Smelter Site and land owned by Hydro that is outside the Buffer Zone. The 2,500ha land parcel is described by approximately 75 different allotments. A full list of the allotments is included in Table 6.1. The Smelter Site, Buffer Zone and land owned by Hydro outside the Buffer Zone together are referred to as 'the site'. A site location plan is provided in Figure 1. The site layout is shown in Figure 2.

The site is located approximately 30km west of the town of Newcastle and 150km north of Sydney in New South Wales, Australia.

The site address is:

Hart Road
Loxford
New South Wales 2327
AUSTRALIA

The Buffer Zone comprises 2500ha and surrounds the Smelter Site. The Buffer Zone is further described in Section 2.3.2. Land owned by Hydro outside the Buffer Zone is further described in Section 2.3.3.

Land uses surrounding the Buffer Zone comprise the following:

- To the north: rural/ agricultural land;
- To the east: the township of Heddon Greta;
- To the west: rural/ agricultural land;
- To the south: sewerage treatment works followed by township of Kurri Kurri.
- The site is situated within the Hunter Valley region known for grape growing and coal mining.

Most of the site is zoned 'RU2 Rural Landscape' under the Cessnock Local Environmental Plan (LEP) 2011, with a small portion zoned 'E2 Environmental Conservation'. The objectives of the RU2 Rural Landscape zoning are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- To maintain the rural landscape character of the land;
- To provide for a range of compatible land uses, including extensive agriculture;

- To enable other forms of development that are associated with rural activity and require an isolated location or support tourism and recreation; and

- To ensure that the type and intensity of development is appropriate in relation to the rural capability and suitability of the land, the preservation of the agricultural, mineral and extractive production potential of the land, the rural environment (including scenic resources) and the costs of providing services and amenities.

It is noted the current site use is permissible under existing use rights as established within the NSW *Environmental Planning and Assessment Act 1979.*

2.2 Overview of Site Operations

The Smelter Site encompasses a three pot-line aluminium smelter with 360 pots and a capacity of up to 170,000 tonnes per annum. Pot Line 1 was taken out of active production in January 2012 reducing the capacity by 120 pots. The remaining two pot lines were taken out of active production in September 2012 and the plant is currently on care and maintenance.

The overall process comprises four main operational areas:

- Carbon Plant, where ring furnaces are used to bake anodes. The Anode Plant is included in the Carbon Plant;

- Anode Plant, where carbon anodes are manufactured. The anode plant includes the Greenmix Plant, the Baking Furnaces and the Rodding Plant;

- Potrooms, where alumina is reduced to molten aluminium in three pot-lines; and

- Casthouse, where molten metal is cast into ingots and billets.

Ancillary facilities comprise the storage of alumina, petroleum coke, tar pitch, appropriate dry air scrubbers, diesel storage, compressed air supply, process water treatment, support services and maintenance installations.

The Buffer Zone is an area of land purchased around the planned facility as required by planning approval for the smelter. The Buffer Zone comprises four distinct areas with regard to landuse, as follows:

- The north eastern portion is mainly used for cattle grazing and poultry farming. Wetlands known as Wentworth Swamp are located in this area;

- The north western portion comprises undeveloped bushland on ground of higher elevation;

- The south eastern portion comprises an area of residential landuse and small scale farming activities. This is the most developed portion of the Buffer Zone;

- The south western portion comprises predominantly undeveloped bushland with three former small hobby farms.

Hydro also own two areas of land to the north and north east of the Buffer Zone, as shown on Figure 2.

2.3 Site Description

2.3.1 Smelter Site Layout

The site includes a 60ha plant area for the aluminium smelter, as shown in Figure 2. The majority of the smelter is developed with buildings and associated hardstand areas. The majority of the areas adjacent to the buildings are sealed with concrete or bitumen (car parks, roadways and turning areas). Established garden beds and grassed areas surround some buildings on the eastern portion of the Smelter Site.

The Smelter Site is accessed through one main entrance located on the southern boundary of the plant off Hart Road. The Smelter Site is currently on care and maintenance and is maintained by a small team of Hydro employees.

The Smelter Site was originally developed in 1969 with the construction of one pot line and associated infrastructure. The plant was expanded in 1973 and again in1985 with the addition of two pot lines and the expansion of other infrastructure. The Smelter Site layout, as shown in Figure 3, is described as follows:

- Pot Lines 1, 2 and 3 are located on the western portion of the smelter. Alumina and cryolite are placed within pots and a current is added. Molten aluminium is siphoned from each pot and taken to the Cast House;

- The Cast House is located immediately east of Pot Line 1 near the main entrance. The Cast House produces cast aluminium products to product specifications often including the addition of alloys. The Cast Houses utilises chlorine gas to avoid oxidation during the casting process. The gas is captured when the casting chamber is filled. Wastes from the Cast House include dross and swarf, which have a high aluminium content and are sent for recycling off-site;

- The Carbon Plant is located near the northern plant boundary to the east of the potlines. The Carbon Plant produces anodes from a mixture of coke, pitch and recycled anode butts to produce a green anode. This green anode is then baked within a ring furnace prior to the additional of a cast iron rod, and dispatched to the Pot Rooms. The ring furnace is gas heated however it was previously oil heated. Ancillary operations associated with the Carbon Plant include a liquid pitch tank, petroleum coke storage, the ring furnace scrubber, the rodding building, rodding mix storage building, baked anode storage;

- A pot reconditioning area is located to the south of Pot Line 1. The pot reconditioning area contains one large building where pots are reconditioned for re-use.

2.3.1.1 Infrastructure and Ancillary Structures on the Smelter Site

Infrastructure and ancillary structures located within the Smelter Site include:

- A transformer yard and substation are located in the north western corner of the Smelter Site.

- Stormwater on the plant's paved areas is directed via conduits to either the West Surge Pond, which is located on the western boundary of the smelter or the East

Surge Pond, which is located on the eastern boundary of the smelter. The East Surge Pond overflows into the North Dam, located to the north of the Carbon Plant;

- Spent Pot Lining (SPL) waste was stockpiled on a low lying area of the smelter near the eastern plant boundary between 1969 and the early 1990s. The SPL waste mound (known as the Alcan Mound) was capped with clay in 1995. SPL wastes are now stored in purpose-built sheds, of which there are ten located to the south of the Alcan Mound;

- A maintenance compound is located in the centre of the smelter, south of the Carbon Plant. The compound is used for storage of degreasers, paints, oils and greases;

- A diesel refuelling area is located in the centre of the smelter. The diesel refuelling area contains one underground storage tank (UST) and a wash bay;

- A diesel spray area is located at the rear of the Carbon Plant on the northern smelter boundary, which was used to treat rust coatings from cathode rods prior to reuse;

- Offices, a security gate house, canteen, two playing fields and a gym are located within the smelter.

The infrastructure and ancillary structures described above are included on Figure 3. It is noted that the site is currently in care and maintenance and much of the Smelter Site is no longer in use.

2.3.2 Buffer Zone

The Buffer Zone is an area of 2,500ha surrounding the Smelter Site that was purchased around plant as required by the planning approval for the smelter. The Buffer Zone comprises the following, as shown on Figure 4:

- Residential housing that is leased to tenants is located in the south eastern portion of the Buffer Zone. Several houses have been demolished in recent years. It is noted that the houses were constructed with asbestos containing materials (ACM). Currently, there are approximately 14 leased residential properties in the Buffer Zone;

- Five residential properties within the Buffer Zone are privately owned;

- Two motocross tracks are located immediately east of the smelter in the Buffer Zone accessed from Dickson Road. The motorcross tracks are maintained by Kurri Kurri Junior Motorcycle Club;

- A large agricultural property known as Wangara is located in the northern eastern portion of the Buffer Zone. Grazing of cattle and poultry farming, comprising two poultry sheds, occurs on the Wangara property;

- A coal train line extends through the portion of the Buffer Zone close to the eastern boundary of the Buffer Zone within Wangara;

- An irrigation area immediately north east of the North Dam, where stormwater from the North Dam is irrigated on grassed paddocks;

- A Clay Borrow Pit is located to the west of the plant at the location of a former hobby farm. Clay was won from this area to cap the Alcan Mound. This area has been used to stockpile excess refractory bricks and concrete from the plant;

- The Hunter Expressway is under construction in the southern portion of the Buffer Zone, due for completion in 2014. Land for the Hunter Expressway was acquired from Hydro. Road construction has involved cut to fill earthworks, with excess Virgin Excavated Natural Materials (VENM) stockpiled adjacent to the road alignment within the Buffer Zone;

- Energy Australia maintain access tracks to high voltage power lines that extend east to west and north to south through the north western portion of the Buffer Zone within an easement. Low lying portions of the access tracks were formed with used tyres to prevent bogging;

- Hydro Australia maintains access tracks through the Buffer Zone. Low lying portions of these tracks are constructed with excess refractory bricks from the smelter;

- There are two areas of bare vegetation known as the Northern and Southern Impact Areas located to the north east of the Alcan Mound in the Buffer Zone. The vegetation impact areas relate to the leaching of contaminants, including fluoride, cyanide, sodium and aluminium, from the Alcan Mound;

- The remainder of the Buffer Zone comprises natural bushland vegetation to the west of the plant and a low lying swamp, known as Wentworth Swamp to the north of the Smelter Site near Wangara.

2.3.3 Land Owned by Hydro Outside the Buffer Zone

Hydro is the owner of approximately 25 allotments located immediately to the north and north east of the Buffer Zone. Land owned by Hydro outside the Buffer Zone comprises the following, as shown on Figure 5:

- A portion of the Wangara property extends over all of the allotments outside the Buffer Zone. Two poultry sheds, dams and other minor infrastructure is located within the allotments to the north east of the Buffer Zone;

- The former Glen Main colliery is located near the entrance to the Wangara property, to the north east of the Buffer Zone. Mine subsidence has occurred in this area, with one area of mine subsidence filled with concrete rubble and another gully (formed due to mine subsidence) filled with illegally dumped wastes;

- A train line extends through Wangara between the former Glen Main colliery and the Buffer Zone. The train line continues close to the eastern boundary of the Buffer Zone further south.

2.4 Site Setting

2.4.1 Topography

The Smelter Site is located between low residual hills to the west of the Buffer Zone and low lying swampy land to the north and east of the Buffer Zone. Low lying areas were filled to create a flat, elevated platform at approximately 14mAHD for construction. The Smelter Site is relatively flat with a gentle slope from west to east, from the plant area towards the surrounding water courses.

Landforms in the north and east of the Buffer Zone comprise low-lying swamps, with many surface water drainage ponds and creeks, interspersed with topographical rises comprising residual soils. In the south and west of the Buffer Zone, the landform is predominantly residual hills with gully formations draining to the north and east.

2.4.2 Geology

According to the review of the regional geology described on the Sydney Basin Geological Sheet, the Smelter Site and Buffer Zone are underlain by siltstone, marl and minor sandstone from the Permian aged Rutherford Formation (Dalwood Group) in the Sydney Basin.

The Sydney Basin is a sedimentary basin consisting of Permian and Triassic sedimentary rocks, which extends from Newcastle in the north to Batemans Bay in the south and to Lithgow, just west of the Blue Mountains. The basin overlies older basement rocks of the Lachlan Fold Belt. The sedimentary rocks of the basin generally consist of near horizontal sandstones and shales, with some recent igneous dykes. Only minor folding and faulting has occurred since these sedimentary rock sequences first formed. The Dalwood Group is stratigraphically located near the base of the Sydney Basin below both the Greta Coal Measures and Newcastle Coal Measures and was deposited in a marine environment.

Undifferentiated Quaternary alluvium occurs in the east and northeast of the Buffer Zone associated with surface water bodies. Quaternary sediments which are associated with Swamp Creek (located to the east of the site), Wentworth Swamps and the Hunter River consist of complex interbedded fluvial and marine sands and estuarine muds deposited within an estuarine environment during periods of sea level rise and fall.

2.4.3 Hydrology

There are five storage ponds located at the smelter as shown on Figure 3. Surface water from the smelter is directed to these storage ponds via open channels and some concrete subsurface drainage lines. Surface water ponds known as ‘East’, ‘West’ and ‘South’ are pumped to the North dams where surface water is discharged to an irrigation area under license. Surface water dams were constructed by excavation into the residual underlying extremely weathered bedrock.

The closest surface water receptor is a natural drainage area called Swamp Creek located approximately 1km to the northeast of the smelter within the Buffer Zone (refer to Figure 1). This drainage area discharges to Wentworth Swamp which in turn discharges to the Hunter River approximately 15km northeast of the site near Maitland.

2.4.4 Hydrogeology

Regionally groundwater is expected to follow the topography and flow northeast towards surface water bodies that feed into the Hunter River, located approximately 7km north east of the site.

The Hunter River Alluvium Groundwater Management Unit (GMU) is an important groundwater resource to the region. Groundwater extraction for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use occurs, with volumes in excess of 10,000ML per annum extracted from the Hunter River Alluvium GMU. Aquifer storage and recovery is also an important use of this GMU.

According to the Office of Industry and Investment, NSW, there are 17 licensed groundwater abstractions (bores) located within the Buffer Zone. There are no other licensed groundwater bores within 2km of the smelter. There is a group of seven groundwater bores located just over 2km to the northwest of the site.

Fourteen of the on-site bores are located within the Rutherford Formation close to or north-east of the evaporation ponds. The remaining three on-site bores are located within Quaternary Alluvium on the western bank of Swamp Creek. Data associated with these bores is limited, with no information regarding the depth of the bores, water bearing zone, or standing water depth. It is understood these bores are monitoring wells and not used for groundwater abstraction.

2.4.5 Overall Site Sensitivity

The site's sensitivity with respect to groundwater as a resource is considered moderate given the site's location upgradient of the Hunter River Alluvium GMU. Sensitivity to surface water contamination is considered moderate given the relatively short distance to Swamp Creek and the use of water from Swamp Creek for stock watering and recreational use.

3 Site History

3.1 General Operations History

The facility was built on previously undeveloped agricultural land (red outline in Figure 1). A Buffer Zone of land (blue outline in Figure 1) was purchased around the planned facility as required in the planning approval for the smelter.

The site was developed in 1969 by Alcan Australia Ltd., later Capral Aluminium, with pot-lines commissioned in 1969 (Line 1 – 120 cells; expanded in 1973 to 50,000 tonnes per annum), in 1979 (Line 2 – 120 cells), and in 1985 (Line 3 – 120 cells) for a final capacity of 170,000 tonnes per annum.

The site was purchased by VAW Aluminium in 2000, and became part of Hydro with the purchase of VAW Aluminium in 2001.

3.2 Historical Data Review

3.2.1 Aerial Photographs and Interview

The following information on site history and development has been obtained from reviewing historical aerial photographs and from an interview with Mr Kerry McNaughton, Environment Officer, who has more than 30 years experience working at the site.

A summary of this review is presented in Table 3.1. A copy of the aerial photos is included in Appendix A.

Table 3.1: Site History		
Year	**Data Source**	**Description of Observations**
1951	Aerial Photograph and Interview	The bulk of the site and the Buffer Zone comprise undeveloped land. Hart Road and Dickson Road exist, with sparse rural housing observed adjacent to these roads. Mr McNaughton indicated these 25 acre rural lots were originally granted to returned soldiers. Three farms are located off Bishops Bridge Road, two hobby farms and one small dairy farm. Wentworth Swamp and Swamp Creek are clearly visible in the aerial photograph. An unnamed creek located to the east of one of the hobby farms flows north into Wentworth Swamp at the current location of the smelter.
1957	Tenth Edition Map, Parish of Heddon, County of Northumberland, Land District of Maitland	This map shows the location of the site within the Parish of Heddon. The creeks draining to Wentworth Swamp are labelled. The creek now known as Swamp Creek is labelled Fishery Creek upstream of Wentworth Swamp and Swamp Creek downstream of the swamp. The unnamed creek to the east of one of the hobby farms is labelled The Black Waterholes. Each land parcel (25 acre lots and other lots) are labelled with their owners. The smelter location includes a number of larger land parcels owned by individuals, including R.J Bryson, J.R.G Wood, A.W Bryson and P.J Clements.
1961	Aerial Photograph	The aerial photographs indicate there are no major changes in landuse between 1951 and 1961. There has been an increase in agriculture at rural residential properties along Hart Road and Dickson Road. Small scale poultry sheds are present on Hart Road and Horton Road.
1966	Aerial Photograph	The aerial photographs indicate there are no major changes in landuse between 1961 and 1966. A poultry shed has been constructed at the northern end of Bowditch Avenue to the east of Dickson Road.
1971	1:4000 Orthophotomap Series, Heddon Greta U4565-1	This orthophotomap shows the eastern portion of the smelter and the north eastern portion of the Buffer Zone. Swamp Creek is labelled as Swamp Creek on this map. The course Swamp Creek takes to flow into Wentworth Swamp has changed since the 1957 map. Swamp Creek now meanders through this area whereas it used to flow a relatively straight course. The change is understood to be a result of the 1955 Maitland flood. The original Carbon Plant (since extended) is visible on the orthophotomap, with a disturbed area immediately east in the Buffer Zone and an extended surface water drainage channel. There are four dams visible between the smelter and Swamp Creek, associated with farming and stormwater management.
1975	Aerial Photograph Interview with Kerry McNaughton	The main change between the 1966 and 1975 aerial photographs is the construction of the smelter. Pot Line 1, the Carbon Plan and ancillary buildings are evident on the site. The beginnings of a waste heap now known as the Alcan Mound is evident immediately east of the smelter. Surface water drainage channels have been constructed on the eastern and western smelter perimeters to drain surface water into the surrounding Buffer Zone. The houses on the northern side of Dickson Road have been demolished. Three poultry sheds have been constructed off Bowditch Avenue in the Buffer Zone.

Table 3.1: Site History		
Year	**Data Source**	**Description of Observations**
1978	Aerial Photograph Interview	The 1978 aerial photograph shows that the North Dam has been constructed. Additional surface water drainage channels have been constructed along the eastern and western smelter perimeters. The waste area now known as the Alcan Mound has expanded and standing surface water (leachate) is visible around the bunded edges of the mound. Mr McNaughton indicated that as the land along the western edge of the smelter was cut and filled to create a level platform to build additional pot lines, the creek located in this area was progressively relocated to the west.
1979	1:4000 Orthophotomap Series, Kurri Kurri U3665-3 Interview	This orthophotomap shows the western portion of the smelter and the north western portion of the Buffer Zone. Pot Line 1, the substation and a cleared, cut to fill area to the west are visible, with surface water drainage channels extending west into the Buffer Zone. The three farms west of the smelter are visible, showing the extent of their infrastructure. The farm located where the Clay Borrow Pit is now, appears to have been disbanded with only an access road from Bishops Bridge Road and several small stockpiles within the cleared area of the property. The cleared area of this property extends to the north west corner of the smelter. The diary farm to the west of Bishops Bridge Road comprises a long access road with several small buildings at the southern end of the cleared property. The Black Waterholes creek extends through the western cleared portion of the farm. Mr McNaughton indicated that this diary farm was small in operation. The hobby farm to the south of the diary farm includes three small buildings at the end of an access road extending from Bishops Bridge Road. No evidence of cropping is visible on the othophotomap at any of the farms.
1987	Aerial Photograph Interview	The 1987 aerial photograph shows the main infrastructure at the smelter is in its present day location. The second and third pot lines, the Eastern and Western Surge Ponds have been constructed and the Carbon Plant has been extended. A large volume of standing water (leachate) is visible to the east of the Alcan Mound. Two playing fields have been constructed adjacent to the smelter car park at the location of a former residence. Mr McNaughton indicated that concrete rubble has been buried in this area. Following the construction of the Eastern and Western Surge Ponds, surface water from the site was collected into these ponds, then directed to the North Dams 1 and 2. From the North Dams, surface water was irrigated to a paddock in the Buffer Zone to the north east of the smelter. In the Buffer Zone, a motor cross track has been constructed to the east of the smelter, a small plantation is visible immediately north of Dickson Road and a disturbed area is visible south of Dickson Road. Mr McNaughton indicated that the plantation was used to assess the impact of fluoride fallout on various plant species and that the disturbed area south of Dickson Road was used for landfilling of smelter wastes. The construction of the motor cross track has filled in two of the dams in the Buffer Zone between the smelter and Swamp Creek. The source of the fill to create the motor cross track is unknown. The southern portion of the former hobby farm located west of the smelter, which remained a cleared area, is now used for stockpiling refractory brick and concrete waste. The northern portion of this area remains cleared.
1994	Aerial Photograph Interview	Changes to the smelter since 1987 include the construction of the pot reconditioning area to the south of Pot Line 1, the construction of the first Spent Pot Lining (SPL) storage shed south of the Alcan Mound and the stockpiling of drums in the

Table 3.1: Site History		
Year	**Data Source**	**Description of Observations**
		south west corner of the smelter. Mr McNaughton indicated the south west corner was used for fire fighting drills at this time, with the drums set alight for training. In the Buffer Zone, an area of vegetation impact (now known as the Southern Impact Area) is visible to the north east of the Alcan Mound. The northern portion of the former hobby farm located west of the smelter has had earthworks undertaken, understood to be the winning of clay for capping of the Alcan Mound. The two remaining houses on Dickson Road have been demolished. Mr McNaughton indicated that demolition of the houses involved burial of remaining wastes on the site of the former houses, which are likely to include asbestos containing materials.
2001	Aerial Photograph Interview	The major change to the smelter from the 1994 aerial photograph is the capping of the Alcan Mound. According to Mr McNaughton, the Alcan Mound was capped in 1995 and that the clay capping material was sourced from the former hobby farm west of the smelter, now known as the Clay Borrow Pit. Two of the chicken sheds have been removed from the property on Bowditch Road. Mr McNaughton indicated that one was relocated to Wangara in the northern portion of the Buffer Zone north of Wentworth Swamp and one was demolished.
2002	Interview	Mr McNaughton indicated that a deliberately lit fire impacted the Buffer Zone on 19 October 2002. The fire was lit in a north east portion of the Buffer Zone and spread across the Buffer Zone to the north of the smelter then extended south through the Buffer Zone between the smelter and the motor cross track.
2006	Aerial Photograph Interview	The 2006 aerial photograph shows little evidence of the 2002 bush fire, with complete regeneration of fire impacted vegetation in the Buffer Zone, with the exception of the Southern Impact Area which remains clear. A second area of bare vegetation is visible north of the Southern Impact Area, now known as the Northern Impact Area. The main additions at the smelter are seven additional SPL storage sheds, located south of the Alcan Mound. Additional stockpiling of refractory brick and concrete rubble is observed at the Clay Borrow Pit.
2012	Google Earth Interview	The main change to the smelter from 2006 is the construction of three additional SPL storage sheds for a total of ten. In the Buffer Zone, a second motor cross track has been constructed to the south of the first. Construction of the Hunter Expressway, which extends through the Buffer Zone to the south of the smelter, began in 2010.
2013	Interview	Mr McNaughton indicated that illegally dumped wastes are occasionally identified on the borders of the Buffer Zone, including dumped car bodies along the northern boundary, filling of a gully at Glen Ayr and recent illegal dumping of asbestos waste.

A summary of the main points from the historical document review and interview is as follows:

- The smelter site was levelled prior to construction by cut to fill of existing site soils. No fill material has been imported to site.

- The majority of the buildings constructed at the smelter remain. The Carbon Plant was upgraded, which included the demolition of the existing ring furnace and the construction of a new and larger furnace. A bulk fuel oil tank located near the diesel refuelling area was removed following upgrades to the Carbon Plant.

- The Alcan Mound (stockpiled SPL wastes and other wastes including cryolite, alumina, floor sweepings, shot blast dust, cement and potlining mix) was capped with clay from the Clay Borrow Pit (former hobby farm) in 1995. SPL waste is now stored in the purpose-built storage sheds to the south of the Alcan Mound;

- The Buffer Zone comprises a large land parcel that predominantly extends to the north, west and east of the smelter. Landuses in the Buffer Zone since the 1950s can be described as follows and is shown on Figure 6:

    - North eastern portion: low lying swamp land, including Wentworth Swamp. Land used for cattle grazing and poultry farming (2 sheds) known as Wangara. Wangara also includes land owned by Hydro outside of the Buffer Zone. A coal railway line intersects Wangara and the land between the railway line and Cessnock Road was formerly the Glen Main Colliery (outside the Buffer Zone). Further information relating to Glen Main Colliery is included in Section 3.2.2;

    - North western and south western portion: bushland, at a higher elevation. Historical aerial photographs indicate this land has never been developed;

    - South western portion: A small portion of this land was previously used for hobby farming, with the majority of this area undisturbed bushland;

    - South eastern portion: The majority of this portion was divided into 25 acre lots for returned soldiers prior to the construction of the smelter. The main farming activity on the rural residential properties was small scale poultry farming. Two large scale poultry farms were also located in this area. Houses located in the Buffer Zone have been demolished over the years, generally with remaining wastes buried at the property. These areas may be impacted with asbestos fragments resulting from onsite burial of wastes or poor demolition practices. The locations of the former houses are included in Figure 7;

    - Other known fill sites in the Buffer Zone include a property south of Dickson Road, the Clay Borrow Pit and adjacent area east of the creek (former hobby farms) and the playing fields located east of the smelter car park, access tracks and low lying areas filled with refractory brick and concrete from works undertaken at the smelter; access tracks filled with tyres (not shown on Figure 6) and the motorcross track, which is located over two former dams and

comprises fill embankments. The majority of these locations are included in Figure 4.

3.2.2 Glen Main Colliery

The following information on Glen Main Colliery has been obtained from reviewing historical information available from the Mine Subsidence Board and the Newcastle Regional Museum website (www.hosting.collectionsaustralia.net/newcastle/greta/gay) and the *Geotechnical Assessment of Mine Subsidence Hazards and Controls, Environmental Site Assessment, Proposed Wangara Development, Cessnock Road, Loxford* prepared by Newcastle Geotech, August 2013.

The Glen Main colliery is one of a series of collieries that mined the Greta and Holmesville Coal Measures, coal seams that extend in a north-south direction between Cessnock Road and the train line. The Glen Main Colliery is located on a portion of Buffer Zone land that extends from Wangara Farm to Cessnock Road. The location of the Glen Main Colliery is shown in Figure 8.

Glen Main colliery was a small colliery operating between 1930 and 1939. Mining was completed via three tunnel entrances, using a board and pillar operation. The 1928 Mines Department Annual Report indicates the maximum depth of the mine at this time was 1200 feet (366m) from the surface. Infrastructure at the mine pit top shown on the 1938 site plan included an office, garage, bowser, engine house, furnace and bath. Mines Department records show that the lease was abandoned in 1932, though this conflicts with the mine subsidence records that show the colliery operated until 1939. Mine rail tracks and the short branch line to the main railway line were removed by the mid-1940s.

Newcastle Geotech (August 2013) report that the coal from the Greta Coal Measures have a much greater propensity for self-ignition and for generating acid mine water than the Newcastle seams. In the early days this resulted in many shallow mine fires and explosions, and led to panels being abandoned prematurely.

Historical aerial photographs from 1966, 1975 and 2001 show a line of dams and disturbed land along the location of the former coal seam where mine subsidence has affected the land surface. The locations of the mine subsidence correspond to three areas of surface falls marked on the 1938 site plan. Two gullies that formed through mine subsidence are known to have been partially filled, one with concrete and one with illegally dumped waste, as shown on Figure 8.

4 Environmental Database Information

4.1 Planning Approvals

Three planning approvals have been granted at the site throughout the period of operations as follows:

- 5th November 1980: The Minister for Environment and Planning granted development approval for the proposed expansion of the Kurri Kurri Smelter by construction of a third pot line and associated production and support facilities. The approval includes 51 consent conditions relating to the upgrade and the operations at the site, including assessment of smelter emissions, monitoring of air, vegetation, native vegetation, vineyards, other cultivated vegetation, forage, rainwater, surface water, groundwater, water at Wentworth Swamp, native and feral animals, farm animals, bees and ecosystem monitoring.

- 11th January 1993: The Council of the City of Cessnock granted approval for the upgrade of waste storage facilities including capping of the Alcan Mound and construction of above ground sheds for future storage of SPL. There are 37 consent conditions relating to the capping of the Alcan Mound and construction of the storage sheds.

- 21st August 2002: The Minister for Planning granted approval for the installation of a Greenmix Plant scrubber, upgrade of the Anode Plant and upgrades to Pot Line 1. A series of consent conditions were included on this approval, including environmental performance requirements for air quality, dust emissions, discharge limits and water quality impacts.

4.2 Environment Protection Licence

The site operates under Licence EPL 1548 which licences the carrying out of aluminium production >10,000 T and metal waste generation of >100 T generated or stored.

A licence transfer was approved on 25 August 2000. Licence variations have been issued on 1 February 2002, 27 October 2004, 16 June 2011 and 30 March 2012. Thirteen notices for licence variations have been issued between 2001 and 2012. A search of the EPL on the Office of Environment and Heritage website indicates that non-compliance load based licencing data was received in annual returns from 2004 (total solid particles), 2008 (nitrogen oxides) and 2013 (clerical error).

4.3 Contaminated Sites Register

The results of a search of the NSW Environment Protection Authority (EPA) within the Office of Environment and Heritage Register of notices under the *Contaminated Land Management Act 1997 (NSW)* confirmed that as at 1 August 2013, the subject site and properties within 1km are not included on this register.

5 Environmental Assessment Findings

5.1 Findings of ENVIRON Phase 2 ESA

ENVIRON completed a Phase 2 ESA in November 2012. The Phase 2 ESA included a review of historical and background data, site inspections and soil and groundwater sample collection and analysis. The purpose of this high level investigation was to evaluate soil and groundwater concentrations that may represent a risk to human health at the Smelter site, and human health and the environment within the Buffer Zone.

Potential areas of concern were identified based on the review of historical and background data and the site inspections and included:

- The Alcan Mound leachate area;
- Anode wate pile;
- Refuelling area;
- Diesel spray area;
- Drainage lines;
- East surge pond;
- North dams 1 and 2;
- Carbon plant;
- Cathode bar wash down area;
- Flammable liquids store;
- Washdown bay;
- Pot lines 2 and 3;
- SPL storage sheds;
- South surge pond;
- West surge pond;
- Switch yard;
- Contractor’s storage compound;
- Pot rebuild area;
- Clay Borrow Pit;
- Glen Main drift infilling;

- Irrigation area; and
- The general Buffer Zone.

Contaminants of potential concern identified included fluoride, cyanide, aluminium, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), with subordinate potential contaminants likely to include heavy metals, organochlorine and organophosphorous pesticides, asbestos and polychlorinated biphenyls (PCB).

The potential areas of concern identified above were the subject of field investigations, completed under a Sampling, Analysis and Quality Plan developed for the site. Field investigations included the collection of soil, sediment, surface water and groundwater samples at the identified potential areas of concern within the smelter and in the Buffer Zone for laboratory analysis. Relevant guidelines were identified for the landuses within the smelter (commercial/ industrial) and the Buffer Zone (agricultural, recreational and ecological) and the analytical results were compared against these guidelines.

Areas of concern where contamination was identified included the Alcan Mound, the anode waste pile, the east surge pond and drainage sediments, the diesel spray area, the carbon plant, the cathode bar washdown bay, the washdown bay, north dam 1, the refueling area, the pot lines, the flammable liquids store, the western surge pond, Glen Main drift, the clay borrow pit and the general Buffer Zone.

ENVIRON made recommendations for each area that included either additional investigations to delineate the extent of the contamination, assessment of remediation requirements or the completion of site specific health and ecological risk assessments to provide guidelines values for fluoride and aluminium, which do not currently exist in Australia.

The areas of concern identified above that have recommendations for further works are currently in the process of being addressed. As this was a high level review, the potential for data gaps at the smelter and the Buffer Zone has been assessed via the completion of a more detailed review of the smelter operations in the following sections and collated in Table 6.1 and 6.2.

5.2 Storage and Use of Hazardous Materials

The smelter holds a Dangerous Goods Licence from the NSW WorkCover Authority. WorkCover inspectors are understood to have regularly visited the smelter in the past.

5.2.1 Bulk Storage Tanks

The following bulk storage tanks have been identified at the smelter, based on information in the ERM (2000) Phase 1 report and the AECOM (2010) Hazard Audit report:

- Diesel aboveground storage tank (21,000L) and diesel underground storage tank at the diesel refuelling area;
- Liquid pitch tank at Carbon Plant (max. 242,000kg);
- Two tanks for chlorine storage at the Cast House (max. 2,730L and 3,156L);
- Elevated temperature liquid NOS (aluminium) (max. 3,600,000kg and 260,000kg);

- Refrigerated liquid nitrogen stored in an above ground tank (max. 40,000L);
- Refrigerated liquid argon stored in an above ground tank (max. 30,000L).

The potential for continuation impacts to soil and groundwater from the diesel refuelling area and the liquid pitch tanks at the Carbon Plant were assessed by ENVIRON as part of the Phase 2 ESA. The storage of liquid nitrogen and liquid argon do not present a contamination risk to soil or groundwater as these chemicals would revert to gases if released. The storage of liquid NOS (aluminium) has not been assessed with regard to potential soil or groundwater contamination and is listed as a data gap in Table 6.1.

5.2.2 Drums and Other Container Storage

At least nine separate chemical stores are located within the smelter. The following materials are stored within the chemical stores, based on information in the ERM (2000) Phase 1 report and the AECOM (2010) Hazard Audit report:

- Acetylene;
- Liquid Petroleum Gas (LPG);
- Argon, compressed;
- Nitrogen, compressed;
- Oxygen, compressed;
- Paint and paint related materials;
- Sulphuric acid;
- Pyrophoric alloy;
- Hypochlorite solution.

ENVIRON notes that the flammable liquids store located near the SPL storage sheds was assessed as part of the Phase 2 ESA. The other eight chemicals stores were not assessed as part of the Phase 2 ESA. The potential for soil or groundwater contamination to have occurred through leaks and spillages from these stores should be assessed and is listed as a data gap in Table 6.1.

5.3 Atmospheric Emissions

As the site is currently under care and maintenance and is not operational, no air emissions are generated at the site.

During the operational period at the smelter, the main air emissions generated comprised fluoride, nitrogen oxides, sulphur dioxide, carbon monoxide, polycyclic aromatic hydrocarbons (PAHs), perfluorinated carbon compounds (PFCs), and coarse and fine particulates including fluoride.

The air emissions are generated from the potline stacks, the anode bake furnace stacks and the greenmix stack. The AECOM (2011) *Hydro Aluminium 2010 Annual Environmental Management Report* indicated that emission results for 2010 were within EPL limits.

ENVIRON notes there is potential for aerial deposition of fluoride to soil within the smelter and Buffer Zone such that surface soils may be impacted by fluoride at concentrations exceeding the human health and ecological criteria developed by ENVIRON. Fluoride concentrations in shallow soil at the smelter and within the Buffer Zone will require assessment against the criteria established by ENVIRON in the 2013 human health and ecological risk assessments and has been identified as a data gap in Table 6.1.

5.4 Waste Management

As the site is currently under care and maintenance and is not operational, the generation of wastes from the smelter operations has ceased. The management of existing wastes stored on site is the priority currently.

Wastes generated at the smelter during production included the following, based on interviews and information in the ERM (2000) Phase 1 report:

- Dross and swarf, which have a high aluminium content and are transported off-site to a dross recycling facility;
- Carbon dust and anode butt waste, which is stored in bulk bags on site;
- ‘Ahead of Schedule’ Broken Anodes, which is stored in a stockpile in the open south of the Carbon Plant;
- SPL, which cannot be disposed of off-site due to a Chemical Control Order. SPL was stockpiled in an on-site landfill known as the Alcan Mound, which was capped in 1995. Since 1994, SPL has been collected and stored in purpose-built sheds at the plant;
- Refractory bricks, which have previously been stockpiled at the Clay Borrow Pit and used for filling in low lying areas of the Buffer Zone;
- Non-hazardous wastes, including wood, cardboard, steel waste, used hydraulic oils, household/ other types of commercial wastes.

ENVIRON notes that broken anodes in the anode waste pile, SPL in the Alcan Mound and refractory bricks in the Clay Borrow Pit were assessed as part of the Phase 2 ESA. To prepare for site closure, ENVIRON previously completed a waste inventory which identified the waste streams remaining at the smelter and options for their disposal (ENVIRON (8 June 2012) Waste Disposal, Kurri Kurri Aluminium Smelter).

5.5 Water and Wastewater Management

5.5.1 Water Supply

The ERM (2000) Phase 1 report indicates water is provided by the local water authority, Hunter Water Corporation. There are no groundwater extraction wells on the site. Water used for cooling purposes is pre-treated with the addition of Hunter Water approved biocides and inhibitors.

5.5.2 Wastewater

The main sources of wastewater at the smelter include:

- Stormwater runoff, which discharges into on site ponds (the Eastern Surge Pond, Western Surge Pond, Southern Surge Pond and North Dams). Water from these ponds is used for irrigation purposes;
- Sanitary wastewater is discharged to a sewerage system managed by Hunter Water;
- Cooling wastewater is discharged into the sewerage system.

The ERM (2000) Phase 1 report indicates a trade waste licence has been issued by Hunter Water, which includes monitoring requirements and limits for NFR, fluorides, pH and total oil and grease.

ENVIRON assessed the sediments in the site ponds and the irrigation area as part of the Phase 2 ESA. No additional data gaps relating to waste water have been identified at the site.

5.6 Deleterious Materials

5.6.1 Asbestos Containing Materials (ACM)

ACM building materials have been identified at the smelter. An Interim Asbestos Register is maintained by Hydro Australia, with the most recent version dated Q1, 2011. The types of ACM identified at the smelter include asbestos insulation, vinyl floor tiles, AC sheeting, asbestos rope seal around doors and asbestos shrouding on some cables.

ACM within smelter buildings will need to be addressed in the event that the smelter is decommissioned. The need for management and disposal of hazardous building materials during demolition has been included in Table 6.1.

In the Buffer Zone, ACM building materials have been identified in residential properties and other structures such as small poultry sheds constructed prior to the 1980s. It is understood that some of these properties have been demolished in the past and that building materials may have been buried during the process.

ENVIRON considers that ACM building materials are likely to have contaminated surface soils within building footprints at properties where buildings have been demolished. Assessment of potential ACM contamination should be completed at each property known to have a building constructed prior to 1980.

5.6.2 Synthetic Mineral Fibre (SMF)

Synthetic Mineral Fibre (SMF) has been detected at the smelter and its presence has been recorded in the Interim Asbestos Register maintained by Hydro Australia. SMF has been identified in mastic infill and flat sheets at Pot Room 1, in SMF fire rating caulking in the switch room at the Casting Plant, in loose board on the floor of the casting plant building, in metal encased insulation in piping in the Carbon Plant greenmix tower and in the cloth expansion joint to the fume exhaust pipe in the ring furnace.

SMF materials will need to be addressed in the event that the smelter is decommissioned and this has been included in Table 6.1.

5.6.3 Polychlorinated Biphenyls (PCBs)

Transformers at the switchyard used to contain PCB-containing oils. The ERM (2000) Phase 1 report indicates that transformer oils containing PCBs were removed from site around 1990 and disposed of overseas. Replacement silicone oils were reported to be affected by residual PCBs.

The issue of replacement oils being affected by PCBs will need to be addressed in the event that the switch yard is to be decommissioned and this has been included in Table 6.1.

6 Environmental Issues Register

6.1 Potential Future Site Use

As the Hydro Kurri Kurri Aluminium Smelter is currently in Care and Maintenance and is likely to be closed in the future, landuse planning for the future use of the Smelter Site and the Buffer Zone has commenced.

To facilitate landuse planning, the Smelter Site and Buffer Zone has been separated into a number of areas and subareas based on likely future landuse, known overall as Landuse Planning Areas. The areas and subareas are presented in Table 6.1. A plan showing the different subareas is included in Figure 9.

Table 6.1: Landuse Planning Areas

Area	Subarea	Lot/ DP	Area (ha)	Total Area (ha)
Residential Land	Residential Parcel 1	Lot 1 DP456946 Lot 2 DP456946 Lot 3 DP456946 Pt 2 Lot 4 DP456946 Pt 2 Lot 5 DP456946 Lot 8 DP456946 Lot 7 DP456946 Pt 2 Lot 9 DP456946 Pt 2 Lot 54 DP975994 Lot 55 DP975994 Lot 69 DP975994 Lot 70 DP975994 Lot 71 DP975994	9.0 7.1 3.5 3.4 4.0 3.7 2.9 5.8 9.0 9.3 3.7 8.8 7.8	78
	Residential Parcel 2	Lot 3 DP456946 Pt 1 Lot 4 DP456946 Pt 1 Lot 6 DP456946 Lot 7 DP456946 Pt 1 Lot 9 DP456946 Pt 1 Lot 10 DP456946 Pt 1 Lot 11 DP456946 Lot 58 DP975994 Lot 60 DP975994 Lot 61 DP975994 Lot 63 DP975994	3.5 3.4 3.6 2.9 5.8 7.2 7.5 3.6 6.8 7.9 8.3	60.5
	Residential Parcel 3	Lot 1 DP998540 Lot 1 DP71130 Lot 2 DP62332 Lot 3 DP62332	116.9 8.7 7.6 6.0	139.2
Employment Land	Employment Land Subarea 1	Lot 16 DP1082775 Pt 1 Lot 318 DP755231 Lot 319 DP755231 Lot 411 DP755231 Lot 412 DP755231 Lot 413 DP755231 Lot 414 DP755231 Lot 769 DP755231 Lot 3 DP456769	82.2 34.1 52.1 2.9 2.5 2.6 2.7 18.1 20.8	218
	Employment Land Subarea 2	Lot 2 DP233125 Lot 415 DP755231	20.6 2.7	34.7

Table 6.1: Landuse Planning Areas				
Area	**Subarea**	**Lot/ DP**	**Area (ha)**	**Total Area (ha)**
		Lot 416 DP755231 Lot 417 DP755231 Lot 418 DP755231 Lot 419 DP755231	2.7 2.6 2.6 3.5	
	Employment Land Subarea 3	Lot 423 DP755231 Lot 424 DP755231 Lot 425 DP755231 Lot 426 DP755231	3.0 3.4 3.7 4.1	14.2
	Employment Land Subarea 4	Lot 420 DP755231 Lot 421 DP755231 Lot 422 DP755231 Lot 427 DP755231 Lot 428 DP755231 Lot 429 DP755231 Lot 444 DP755231 Lot 16 DP1082569 Lot 18 DP1082569 Lot 1 DP589169	3.1 2.7 3.0 4.3 2.4 2.4 2.9 1.2 1.0 1.2	24.2
	Employment Land Subarea 5	Lot 16 DP1082775 Pt 2	82.2	82.2
	Employment Land Subarea 6	Lot 13 DP1082775 Pt 2 Lot 15 DP1082775 Pt 2	17.9 13.6	31.5
	Employment Land Subarea 7	Lot 10 DP1082775 Pt 2	19.3	19.3
	Employment Land Subarea 8	Lot 13 DP1082775 Pt 1 Lot 14 DP1082775 Lot 15 DP1082775 Pt 1	17.9 22.8 13.6	54.3
	Employment Land Subarea 9	Lot 435 DP755231 Lot 436 DP755231 Lot 437 DP755231 Lot 438 DP755231 Lot 439 DP755231 Lot 447 DP755231 Lot 448 DP755231 Lot 449 DP755231 Lot 13 DP1082569 Lot 15 DP1082569 Lot 19 DP1082569 Lot 20 DP1082569 Lot 21 DP1082569 Lot 22 DP1082569	4.0 3.9 3.9 2.4 2.6 3.1 2.5 2.6 10.6 1.5 0.4 2.2 0.6 2.6	42.9
	Employment Land Subarea 10	Lot 450 DP755231 Lot 451 DP755231 Lot 453 DP755231 Lot 454 DP755231 Lot 456 DP755231 Lot 536 DP755231 Lot 682 DP755231 Lot 789 DP39701 Lot 2 DP502196	4.2 3.2 3.0 3.6 1.9 1.5 0.2 12.2 2.2	32
	Employment Land	Lot 1 DP543057	106.9	150.7

Table 6.1: Landuse Planning Areas				
Area	**Subarea**	**Lot/ DP**	**Area (ha)**	**Total Area (ha)**
	Subarea 11	Lot 3 DP233125	43.8	
	Employment Land Subarea 12	Lot 10 DP1082569 Lot 11 DP1082569 Lot 12 DP1082569	2.1 1.1 1.1	4.3
	Employment Land Subarea 13	Lot 458 DP755231 Lot 459 DP755231 Lot 460 DP755231 Lot 461 DP755231 Lot 462 DP755231 Lot 463 DP755231	3.8 3.8 2.8 3.1 3.0 3.1	19.6
	Employment Land Subarea 14	Lot 10 DP553543	12.3	12.3
Ecological Land	Ecological Land 1	Lot 1 DP73597 Pt 1	342	342
	Ecological Land 2	Lot 1 DP166625 Lot 316 DP755231 Lot 317 DP755231 Lot 351 DP755231 Lot 352 DP755231 Lot 353 DP755231 Lot 356 DP755231 Lot 10 DP1082775 Pt 1 Lot 11 DP1082775 Pt 1	362.1 59.3 53.3 27.4 26.8 23.7 26.6 19.3 30.7	629.2

6.2 Environmental Issues Register

ENVIRON has established an Environmental Issues Register to consolidate the findings of this Phase 1 ESA and the findings of other previously completed environmental assessments at the Hydro Kurri Kurri Aluminium Smelter. This Environmental Issues Register is intended to be a live document that will be used to document the issue identification and close out process and also to record new issues should they arise.

The Environmental Issues Register has been separated into the Smelter Site (see Table 6.2) and the Buffer Zone (see Table 6.3). The Smelter Site includes the entire area of Employment Lands Subarea 1 (see Figure 10). The Buffer Zone includes the remaining Contaminated Land Assessment Areas, including all Residential Land Subareas, all Ecological Land Subareas and remaining Employment Land Subareas (see Figure 11).

Table 6.2: Environmental Issues Register for the Smelter (Part Employment Land Subarea 1)

Issue No.	Area of the Smelter	Description	Potential Issues	Previously Assessed?
1	Alcan Mound	Stockpiling of SPL and other smelter wastes	Known fluoride and cyanide contamination to shallow groundwater, impacts to vegetation down gradient of the Alcan Mound	Assessed in ENVIRON Stage 2 ESA and on- going assessments
2	Carbon Plant	Liquid Pitch storage	PAH contamination of soil	Assessed in ENVIRON Stage 2 ESA, impact from the storage and use of liquid pitch is not significant. No further investigation required
		Manufacture of anodes	PAH contamination of soil	Assessed in ENVIRON Stage 2 ESA, known soil contamination, additional assessment required around the Green Mix area, remediation required
3	Anode Waste Pile	Stockpile of spent anodes near the Carbon Plant	PAH and fluoride contamination of soil and shallow groundwater	Assessed in ENVIRON Stage 2 ESA, known soil contamination, further investigation of the extent of soil impact should be undertaken following removal of the stockpile. Remediation of groundwater is not likely to be required as the concentrations are low and likely to naturally attenuate following removal of the contaminant source
4	East Surge Pond and associated drainage lines	Sediments accumulate in East Surge Pond and drainage lines	PAH contamination	Assessed in ENVIRON Stage 2 ESA, known PAH soil contamination, remediation of sediments recommended during routine maintenance or following a change in site use.
5	Western Surge Pond	Accumulation of sediments	Fluoride contamination	Assessed in ENVIRON Stage 2 ESA, recommended derivation of site specific guidelines for fluoride. ENVIRON HRA provided human health based investigation

Table 6.2: Environmental Issues Register for the Smelter (Part Employment Land Subarea 1)				
Issue No.	**Area of the Smelter**	**Description**	**Potential Issues**	**Previously Assessed?**
				level of 17,000mg/kg for fluoride at an industrial site. Based on a maximum fluoride concentration of 38,500mg/kg in the Western Surge Pond, additional investigations required.
6	Diesel Spray Area	Used to spray cathode bars with diesel prior to use	Surface soil contamination from diesel overspray	Assessed in ENVIRON Stage 2 ESA, known soil contamination hot spot requires delineation and remediation prior to redevelopment of the site
7	Switchyard	PCB contaminated oil was removed and replaced with silicone based oil. Silicone based oil was contaminated by residual PCBs	PCB contamination of silicone oil in transformers	Not assessed. Known issue for demolition.
8	Most buildings	Use of asbestos in construction	Degradation of asbestos products used as a construction material	No. Assessment will be required in the event the smelter is decommissioned.
		Use of synthetic mineral fibre in construction	Degradation of SMF used as a construction material	No. Assessment will be required in the event the smelter in decommissioned.
9	Diesel refuelling area	Refuelling of vehicles, historical heavy fuel oil tank understood to have been located in garden bed	Impact to soil and groundwater from petroleum	Assessed in ENVIRON Stage 2 ESA, known soil and groundwater contamination, the concentration detected is not considered significant on an industrial site and further investigation is not required
10	Washdown Bay	Used to wash down vehicles	Groundwater contamination from infiltration of contaminants	Assessed in ENVIRON Stage 2 ESA, no further evaluation of groundwater required
11	Flammable Liquids Store	Storage of flammable liquids	Spillage and leaks of chemicals	Assessed in ENVIRON Stage 2 ESA, recommended derivation of site specific guidelines for fluoride. ENVIRON HRA provided human health based investigation level of 17,000mg/kg for fluoride at an industrial site. Based on a maximum fluoride

Table 6.2: Environmental Issues Register for the Smelter (Part Employment Land Subarea 1)				
Issue No.	**Area of the Smelter**	**Description**	**Potential Issues**	**Previously Assessed?**
				concentration of 16,200mg/kg around flammable liquids store, no additional investigations required
12	Pot Lines	Aluminium production	Fluoride fallout from stacks	Assessed in ENVIRON Stage 2 ESA, recommended derivation of site specific guidelines for fluoride. ENVIRON HRA provided human health based investigation level of 17,000mg/kg for fluoride at an industrial site. Based on a maximum fluoride concentration of 41,900mg/kg between Pot Lines 1 and 2, additional investigations required

Table 6.3: Environmental Issues Register for the Buffer Zone

Sub area	Lot and DP	Development	Potential Issues	Previously Assessed?
Employment Land Subarea 1	Lot 412 DP755231	Housing (1961), demolished (KM source)	Rubble buried under playing field	No
	Lot 413 DP755231	Housing (1961), demolished (KM source)	Rubble buried under playing field	No
Employment Land Subarea 2	Lot 2 DP233125	Motor Cross Track (1987)	Use of fill in embankments	No
	Lot 417 DP755231	Housing (1961, demolished before 1978)	Asbestos	No
Employment Land Subarea 3	Lot 423 DP755231	Housing (1975), now demolished	Asbestos	No
	Lot 424 DP755231	Housing (1975), now demolished, waste dumping at rear of block	Asbestos, landfilling of smelter wastes	Assessed in ENVIRON (2012) Phase 2 Environmental Site Assessment, Dickson Road, Loxford, remediation required
	Lot 425 DP755231	Housing (1975), now demolished, waste dumping at rear of block	Asbestos, landfilling of smelter wastes	Assessed in ENVIRON (2012) Phase 2 Environmental Site Assessment, Dickson Road, Loxford, remediation required
Employment Land Subarea 4	Lot 1 DP589169	Housing (1961), current including outbuilding	Unknown development, asbestos	No
	Lot 16 DP1082569	Housing (1951), housing (current), scrap metal (?) stockpile in back yard (Google Earth)	Asbestos, landfilling	No
	Lot 420 DP755231	Housing and odd stockpiles or vegetation (1978)	Asbestos	No
	Lot 422 DP755231	Housing (1975) demolished after 1987	Asbestos	No
	Lot 429 DP755231	Housing and at least six sheds (1961), housing (1987), demolished (KM source)	Asbestos, unknown development	No
Employment Land Subarea 6	Lot 15 DP1082775 Pt 2	Former hobby farm (1951), demolished (KM source)	Asbestos	No
Employment	Lot 14 DP1082775	Former hobby farm (1951), demolished	Asbestos	No

Table 6.3: Environmental Issues Register for the Buffer Zone

Sub area	Lot and DP	Development	Potential Issues	Previously Assessed?
Land Subarea 8				
Employment Land Subarea 9	Lot 13 DP1082569 (Lot 449 DP755231 – same location)	Housing and development (1975)	Asbestos	No
	Lot 19 DP1082569	Housing, large portion now Hunter Expressway	Asbestos	No
	Lot 20 DP1082569	Housing (1961), likely still current	Asbestos	No
	Lot 22 DP1082569	Housing, unknown infrastructure (1951), different development (1975), current housing	Asbestos, demolition of previous developments	No
	Lot 436 DP755231	Land disturbance (1975)		No
	Lot 437 DP755231	Housing and other development (1975), now demolished	Asbestos	No
	Lot 439 DP755231	Housing, six sheds on property (1961), housing (current)	Asbestos	No
	Lot 447 DP755231	Housing (1975), demolished, scattered debris (Google Earth)	Asbestos	No
	Lot 448 DP755231	Housing (1975), demolished	Asbestos	No
Employment Land Subarea 10	Lot 2 DP502196	Housing (1975) larger disturbed/ developed area (1951), housing, storage of materials and race track (current)	Unknown development, asbestos	No
	Lot 450 DP755321	Cricket pitch (current)		No
	Lot 451 DP755321	Housing (1961) (current)	Asbestos	No
	Lot 453 DP755231	Sheds (1975)Housing and disturbed land (current)	Asbestos, unknown development	No
	Lot 454 DP755231	Housing (1987)(current)		No
	Lot 456 DP755231	Disturbed land (Google Earth)	Waste dumping	No
	Lot 536 DP755231	Housing (1975),housing and other	Unknown development, asbestos	No

Table 6.3: Environmental Issues Register for the Buffer Zone

Sub area	Lot and DP	Development	Potential Issues	Previously Assessed?
		infrastructure (current)		
	Lot 682 DP755231	Housing (between 1975 and 1987) (current)	Potential asbestos	No
Employment Land Subarea 11	Lot 3 DP233125	Farm buildings (current, unsure of age)	Potential asbestos	No
Employment Land Subarea 12	Lot 10 DP1082569	Unknown development (1951) housing (1975), housing (current)	Unknown development, asbestos	No
	Lot 11 DP1082569	Housing (current) housing (1975), other development (1951)	Unknown development, asbestos	No
	Lot 12 DP1082569	Unknown development (1951) housing (1975), housing (current)	Unknown development, asbestos	No
Employment Land Subarea 13	Lot 458 DP755231	Two poultry sheds (1975), two poultry sheds different locations (current)	Asbestos, poultry waste	No
	Lot 459 DP755231	Housing(1961) (current)	Asbestos	No
	Lot 460 DP755231	Two poultry sheds (1975) now removed, housing (current)	Asbestos	No
	Lot 461 DP755231	Housing (1961) (current)	Asbestos	No
	Lot 462 DP755231	Housing (1961) (current)	Asbestos	No
	Lot 463 DP755231	Two poultry sheds (1975) now removed, housing (current)	Asbestos	No
Employment Land Subarea 14	Lot 10 DP553542	Housing (1975 and current), parked cars (Google Earth)	Asbestos, waste disposal?	No
Residential Parcel 1	Lot 7 DP456946 Pt 2	Glen Main colliery	Mine subsidence?	Currently being assessed.
	Lot 5 DP456946	Glen Main colliery, illegal dumping	Mine subsidence, illegal waste dumping	Currently being assessed.
	Lot 8 DP456946	Glen Main colliery	Mine subsidence	Currently being assessed.
	Lot 55 DP975994	Glen Main colliery, filled subsidence void (KM	Mine subsidence, land filling	Currently being assessed.

Table 6.3: Environmental Issues Register for the Buffer Zone

Sub area	Lot and DP	Development	Potential Issues	Previously Assessed?
		source)		
	Lot 69 DP975994	Glen Main colliery	Mine subsidence	Currently being assessed.
	Lot 70 DP975994	Glen Main colliery	Mine subsidence	Currently being assessed.
Residential Parcel 2	Lot 10 DP456946 Pt 1	Small farm buildings and fencing (current, unsure of age)	Potential asbestos	No
	Lot 11 DP456946	Two chicken sheds (current), known to have been relocated from SE of Buffer Zone (KM source)	Asbestos, poultry waste	No
Ecological Land 1	Lot 1 DP73597 Pt 1	Farm buildings (1975) (current)	Asbestos	No
Ecological Land 2	Lot 1 DP166625	Buried car bodies (KM source)	Dumped waste	No

7 Conclusions

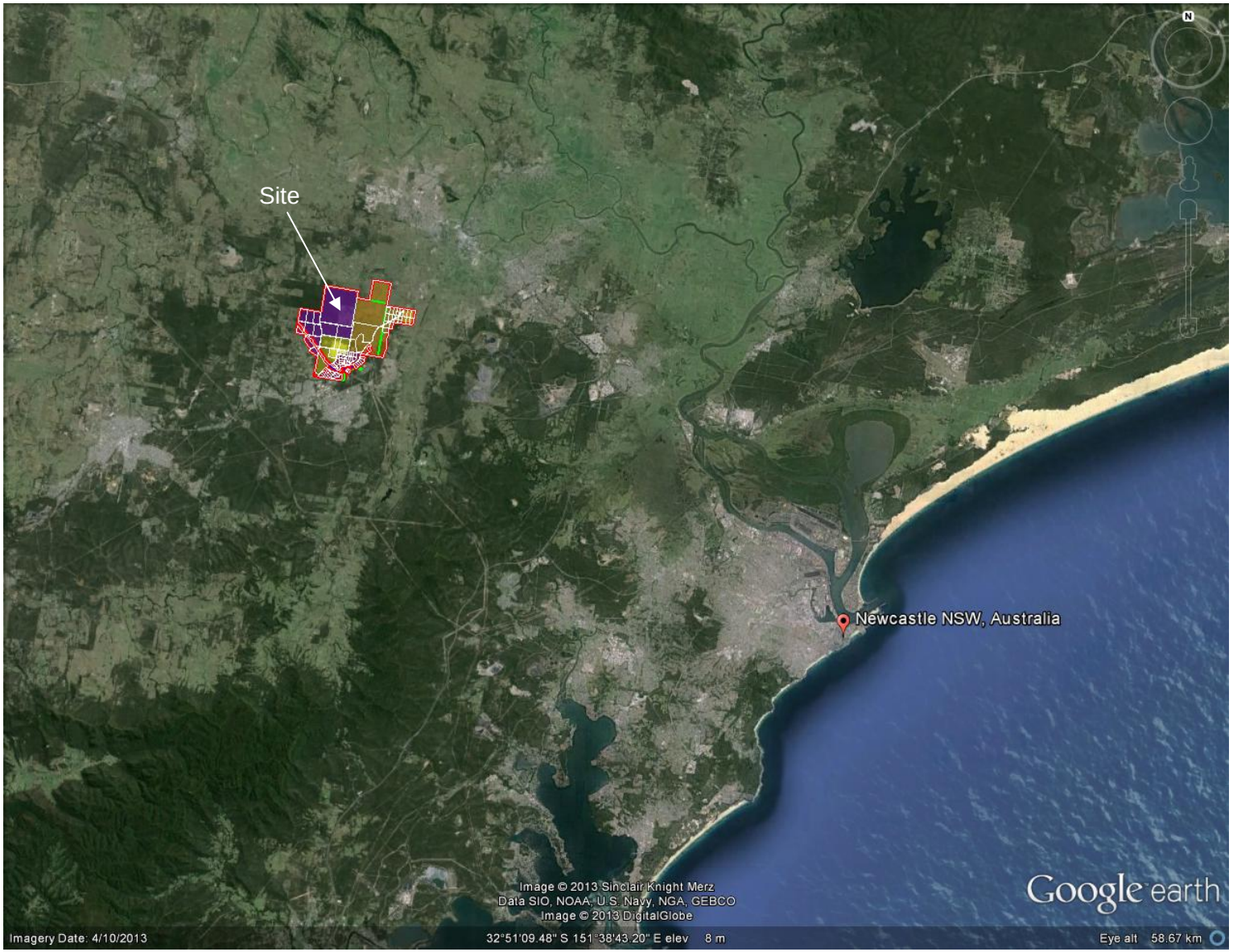
The Hydro Kurri Kurri Aluminium Smelter was built on previously undeveloped agricultural land in 1969 by Alcan Australia Limited. The site includes a 60ha Smelter site and 2,500ha of land surrounding the Smelter. The majority of this land is a Buffer Zone for the Smelter. The remainder is land owned by Hydro outside the Buffer Zone.

The smelter operations include Pot Lines 1, 2 and 3, the Cast House, the Carbon Plant and ancillary operations including a transformer yard and substation, stormwater storage ponds, the Alcan Mound, SPL storage sheds and other waste storage areas, a maintenance compounds, diesel refuelling area, offices, security gate house, canteen, two playing fields and a gym. The smelter ceased operations in September 2012 and is currently under care and maintenance.

Hydro owns 2,500ha of land surrounding the smelter site, with four areas with distinct landuses - the north eastern area comprises low lying swampy land and is used for cattle grazing and poultry farming; the north western area comprises undeveloped bush land; the south eastern area comprises low density rural residential properties, many of which include housing and former small scale poultry sheds comprising ACM building materials; and the south western area comprises generally undeveloped land, with three former small hobby farms.

The operations on the site and in the surrounding Hydro owned lands have potentially resulted in impacts to soil and water. ENVIRON has previously completed a number of investigations at the site that have identified and investigated potential areas of concern. Areas of potential concern identified previously and as part of this in-depth historical review have been listed in an Environmental Issues Register for Hydro owned lands (Table 6.2) and (Table 6.3). This Environmental Issues Register is intended to be a live document that will be used document the issue identification and close out process and also to record new issues should they arise.

Figures



N

HYDRO AUSTRALIA PHASE 1 ESA

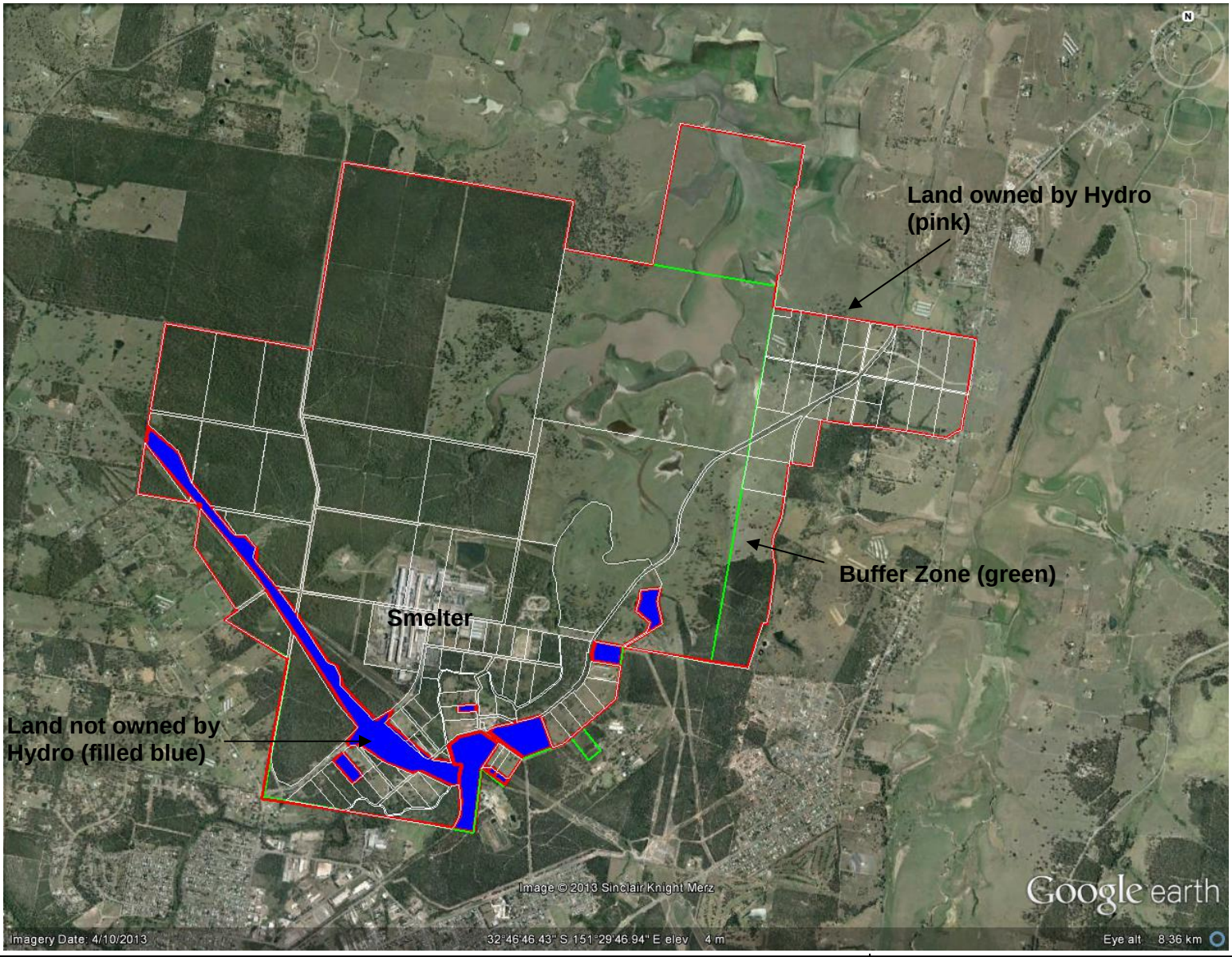
SITE LOCATION PLAN

ENVIRON

JOB NO: AS130336

DATE: 20 August 2013

FIGURE 1



N

HYDRO AUSTRALIA PHASE 1 ESA

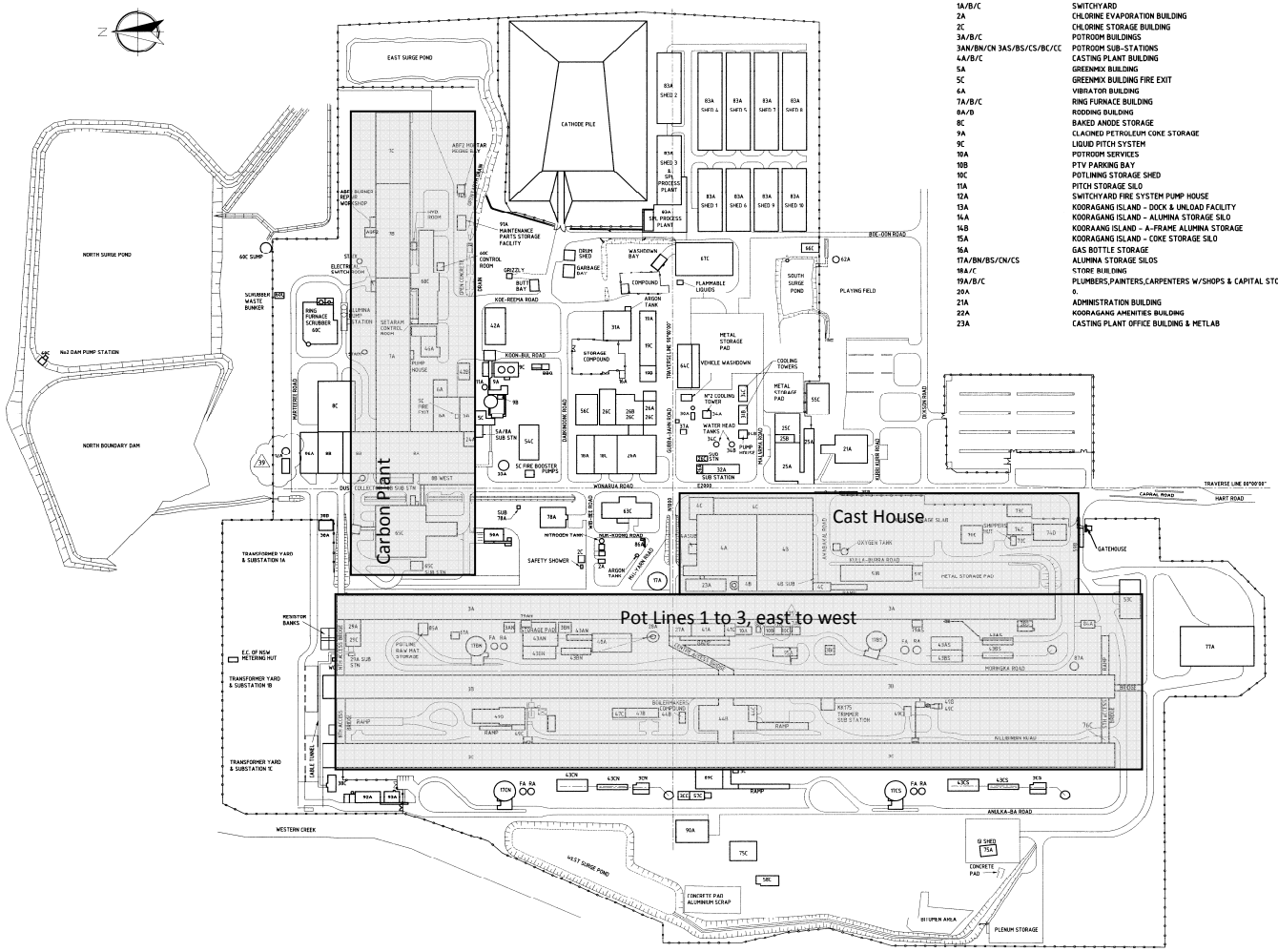
SITE PLAN

ENVIRON

JOB NO: AS130336

DATE: 20 August 2013

FIGURE 2



LEGEND

1A/B/C	SWITCHYARD
2A	CHLORINE EVAPORATION BUILDING
2C	CHLORINE STORAGE BUILDING
3A/B/C	POTROOM BUILDINGS
3AN/BN/CN 3AS/BS/CS/BC/CC	POTROOM SUB-STATIONS
4A/B/C	CASTING PLANT BUILDING
5A	GREENMIX BUILDING
5C	GREENMIX BUILDING FIRE EXIT
6A	VIBRATOR BUILDING
7A/B/C	RING FURNACE BUILDING
8A/B	RODDING BUILDING
8C	BAKED ANODE STORAGE
9A	CLACINED PETROLEUM COKE STORAGE
9C	LIQUID PITCH SYSTEM
10A	POTROOM SERVICES
10B	PTV PARKING BAY
10C	POTLINING STORAGE SHED
11A	PITCH STORAGE SILO
12A	SWITCHYARD FIRE SYSTEM PUMP HOUSE
13A	KOORAGANG ISLAND - DOCK & UNLOAD FACILITY
14A	KOORAGANG ISLAND - ALUMINA STORAGE SILO
14B	KOORAANG ISLAND - A-FRAME ALUMINA STORAGE
15A	KOORAGANG ISLAND - COKE STORAGE SILO
16A	GAS BOTTLE STORAGE
17A/BN/BS/CN/CS	ALUMINA STORAGE SILOS
18A/C	STORE BUILDING
19A/B/C	PLUMBERS,PAINTERS,CARPENTERS W/SHOPS & CAPITAL STORE
20A	0.
21A	ADMINISTRATION BUILDING
22A	KOORAGANG AMENITIES BUILDING
23A	CASTING PLANT OFFICE BUILDING & METLAB
24A	CARBON PLANT OFFICE BUILDING
25A/B/C	GATEHOUSE,MEDICAL CENTRE,PERSONNEL & BATHHOUSE
26A/B/C	ENG. BLDG/APPRENTICE W/SHOP & MAINT W/SHOP,BOILERMAKERS SHOP
27A	POTROOM SERVICES WORKSHOP
28A	MAIN STACK & DUCTWORK
29A/C	POTROOM ELECTRICAL CONTROL BUILDINGS - SUBSTATION
29B	SWITCHYARD SWITCHROOM
30A	FUEL OIL SYSTEM
31A	DROSS STORAGE BUILDING
32A	COMPRESSOR HOUSE
33A	WATER STORAGE AND PUMPHOUSE
34A/B/C	COOLING TOWERS AND PUMPHOUSE
35B	WEIGHBRIDGE
36A	SWITCHYARD WORKSHOP - DEMOLISHED 2009
37A	SEWERAGE PUMPHOUSE
38A/B/C	11KV SWITCHROOMS
39A	SWITCHYARD COMPRESSOR ROOM - DEMOLISHED 2009
40A	CATHODE RODDING BUILDING
41A/B/C	POTROOM OFFICE BUILDING
42A/B	RODDING MIX STORAGE BUILDING
43A/AS/BN/BS/CN/CS	DRY SCRUBBER PLANTS
44B/C	PTA MAINTENANCE BUILDING & OFFICES
45A	SWITCHYARD STOREROOM - DEMOLISHED 2009
46A	CARBON PLANT WORKSHOP & OFFICE
47B/C	POTROOM LUNCHROOM & TOILET BLOCK
49A/C	RATH CRUSHING PLANT,CRUST FEED RATH DUMP
50A	SWITCHYARD UPGRADE PROJECT OFFICE
51B/C	CASTING PLANT SERVICES BUILDING
53C	POT REBUILD WORKSHOP
54C	CARBON PLANT AMENITIES & OFFICE BUILDING
55C	PERSONNEL TRAINING CENTRE
56C	MAINTENANCE OFFICE BUILDING & INSTRUMENT FITTERS WORKSHOP
57C	COMPRESSOR HOUSE - WEST
58C	REFRACTORY STORAGE
59B	WEIGHBRIDGE AND GATEHOUSE
60C	RING FURNACE SCRUBBER
61A	DRY SCRUBBER LUNCHROOM
62A	METEOROLOGICAL TOWER
63C	EOHS BUILDING
64C	MOBILE VEHICLE WORKSHOP
65C	BUTT CLEANING BUILDING - SUBSTATION
66C	NATURAL GAS METER STATION
67C	CATHODE DISPOSAL BUILDING
68C	GREEN & BAKED ANODE STORAGE BUILDING - SUBSTATION
70C	TRUCK LOADING SHELTER / SHIPPERS HUT
72A	SWITCHYARD AMENITIES BUILDING - DEMOLISHED 2009
73C	CASTING MAINTENANCE STORAGE SHED
74C	CASTING ALLOY STORAGE SHED
74D	CASTING ALLOY STORAGE SHED
75A	SLAB REPAIR SHED
75C	POTLINING BRICK STORAGE
76C	TIP CLEANING STATION
77A	POT REBUILD
78A	COMPUTER CENTRE
79AN	NORTH EQUIPMENT ROOM
79AS	SOUTH EQUIPMENT ROOM
81A	POTLINING CENTRE - NOT INSTALLED
82A	DELINING ROOM - NOT INSTALLED
83A	SPL STORAGE & PROCESS PLANT
84A	BROCHOT RAMMING MACHINE STORAGE BLDG
85A	POTLINE RAW MATERIAL STORAGE
86A	LPG GAS BOTTLE FILL STATION
87A	ELECTROLYTE TRUCK LOADING STATION
88A	POT SERVICES STORAGE SHED
89C	CRUCIBLE CLEANING FACILITY
90A	BULK BAG STORAGE FACILITY
91A	MAINTENANCE SPARES STORAGE FACILITY
92A	SWITCHYARD STORAGE/WORKSHOP
93A	SWITCHYARD OFFICE BUILDINGS
94A	(FUTURE) REFRACTORIES AMENITIES & OFFICE BUILDING
94B	(FUTURE) MORTAR MIXING BAY T.B.C (HOLD)
95A	VEHICLE WASHDOWN & PARKING STORAGE
96A	ANODE STORAGE BUILDING
97A	BATTERY EXCHANGE BAY

HYDRO AUSTRALIA PHASE 1 ESA

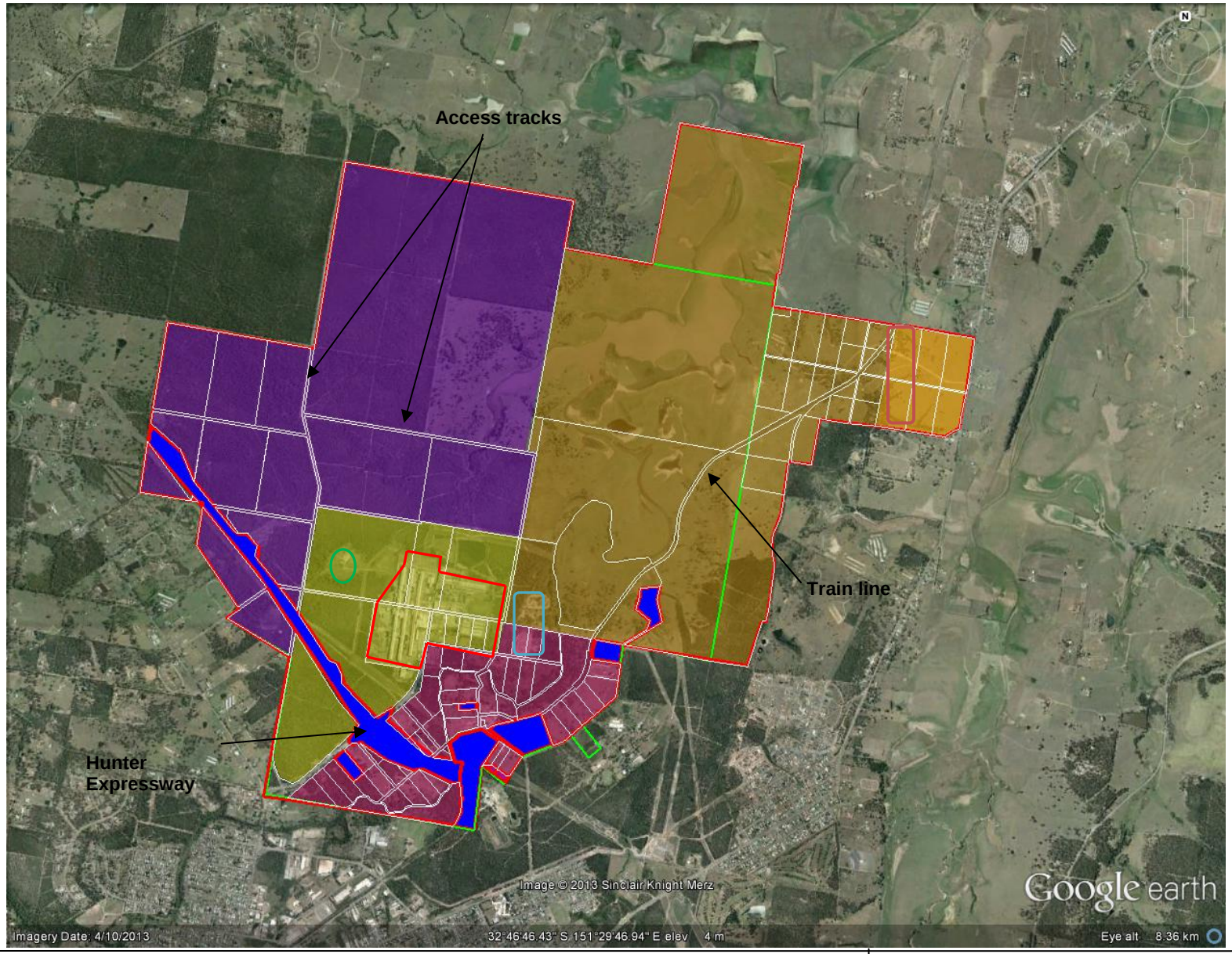
SMELTER LAYOUT

ENVIRON

JOB NO: AS130336

DATE: 7 August 2013

FIGURE 3



Approximate Location of Smelter

Approximate Location of Buffer

Residential Housing Leased to Tenants

Kurri Kurri Junior Motorcycle Club

Wangara

Former Glen Main Colliery (approximate)

Clay Borrow Pit

N

HYDRO AUSTRALIA PHASE 1 ESA

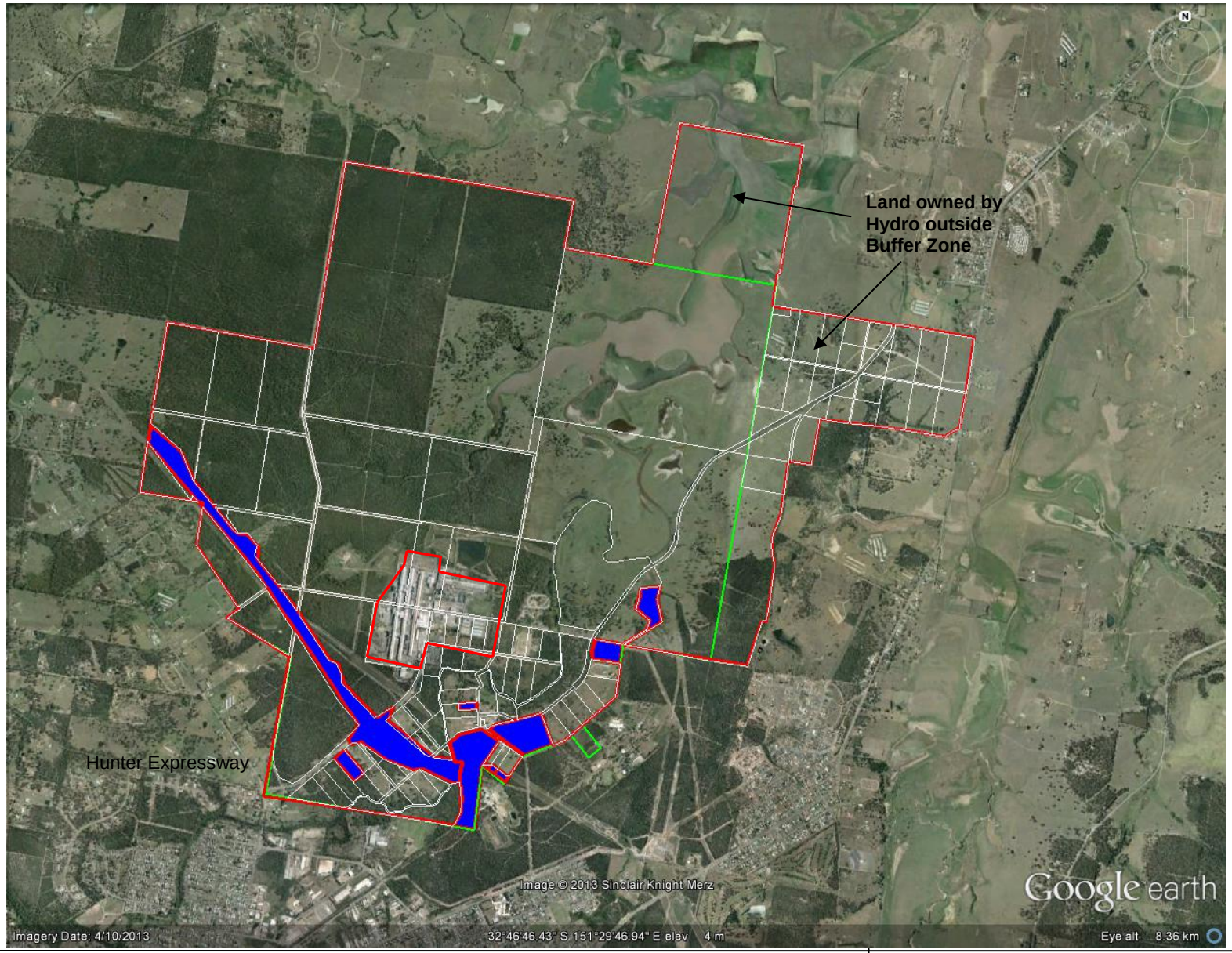
BUFFER ZONE LAYOUT

ENVIRON

JOB NO: AS130336

DATE: 20 August 2013

FIGURE 4



Approximate Location of Smelter

Approximate Location of Buffer

Land not owned by Hydro

N

HYDRO AUSTRALIA PHASE 1 ESA

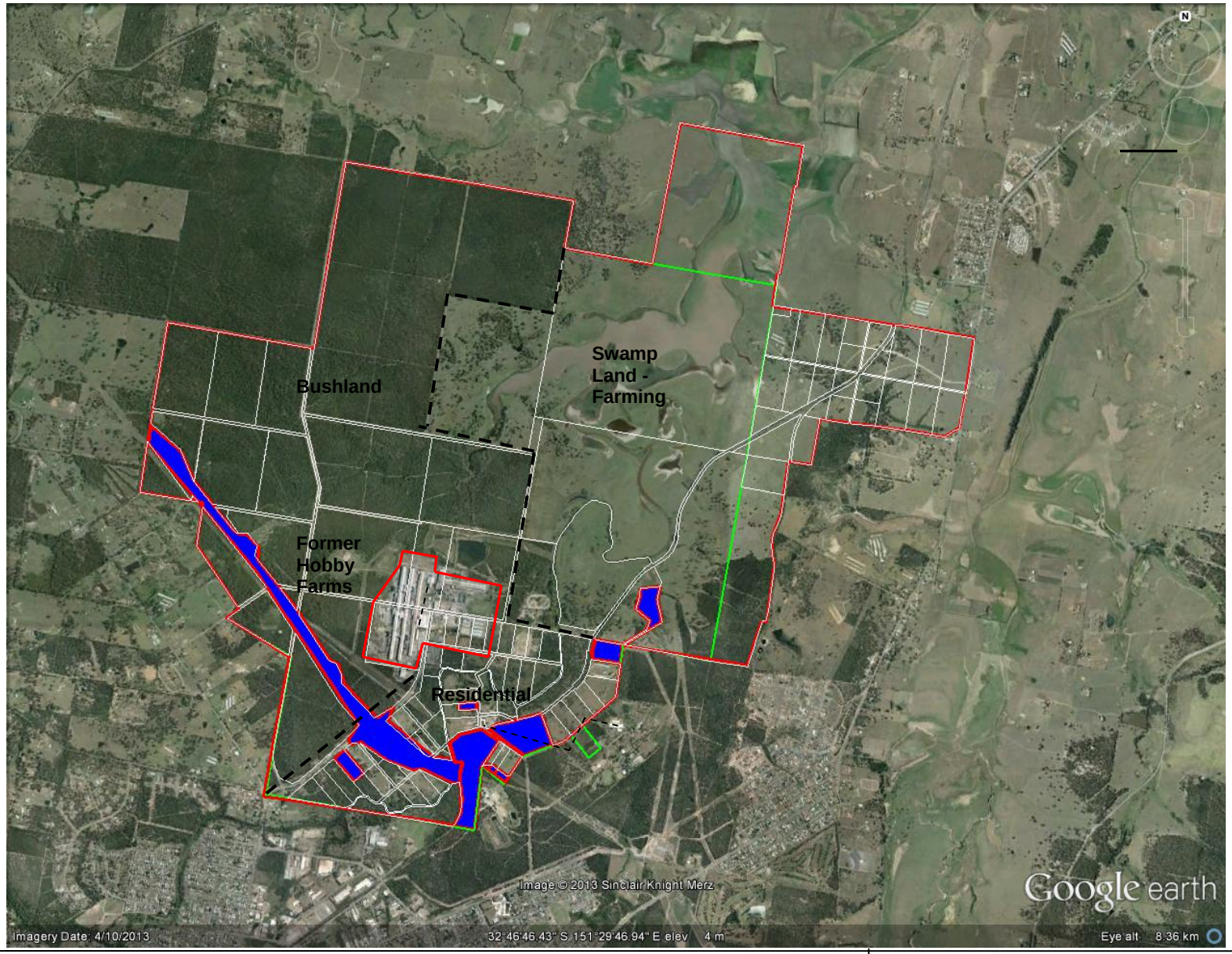
LAND OWNED BY HYDRO OUTSIDE THE BUFFER ZONE

ENVIRON

JOB NO: AS130336

DATE: 20 August 2013

FIGURE 5



Approximate Location of Smelter

Approximate Location of Buffer Zone

Hydro Owned Land

Land not owned by Hydro

N

HYDRO AUSTRALIA PHASE 1 ESA

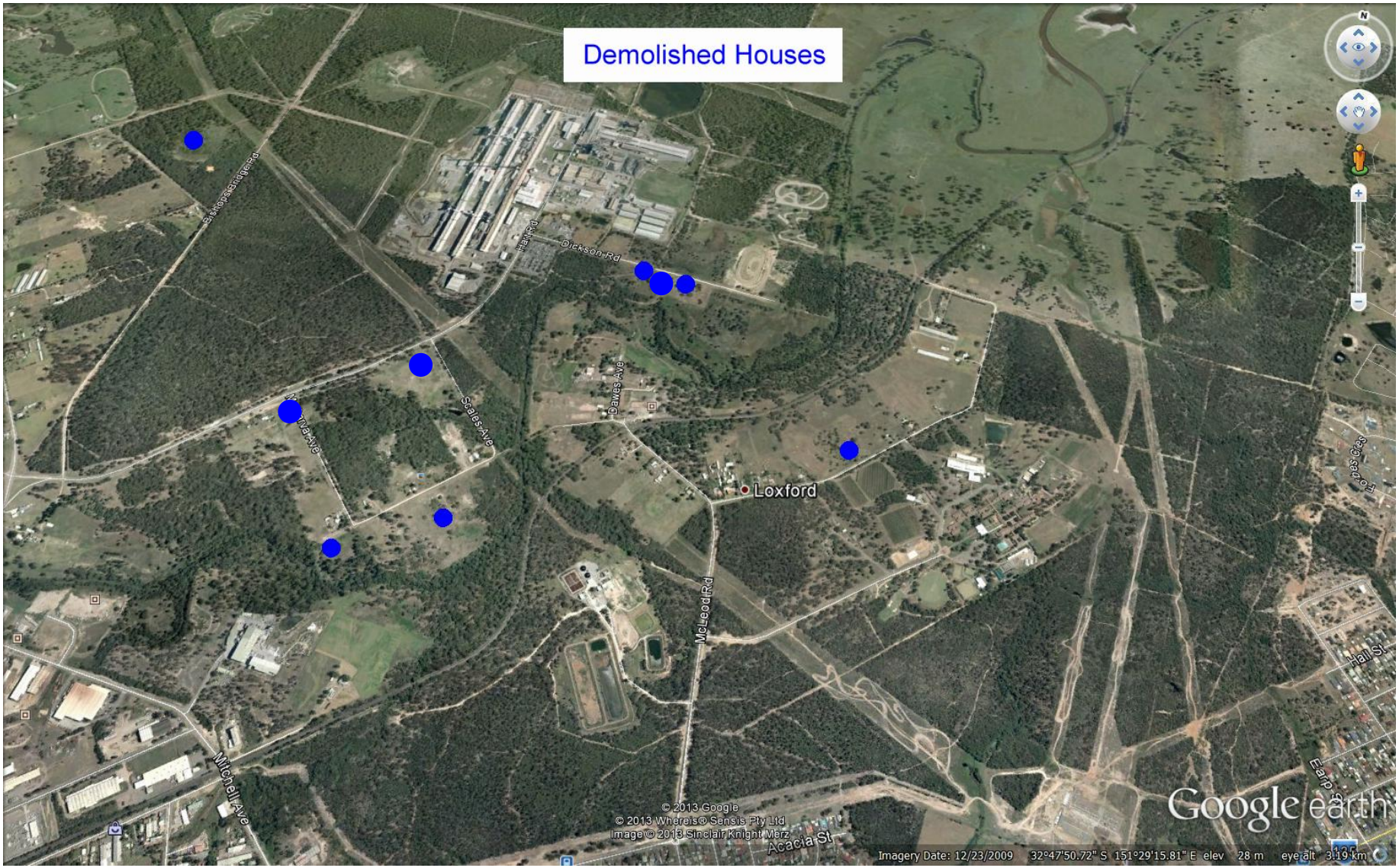
BUFFER ZONE LANDUSE

ENVIRON

JOB NO: AS130336

DATE: 20 August 2013

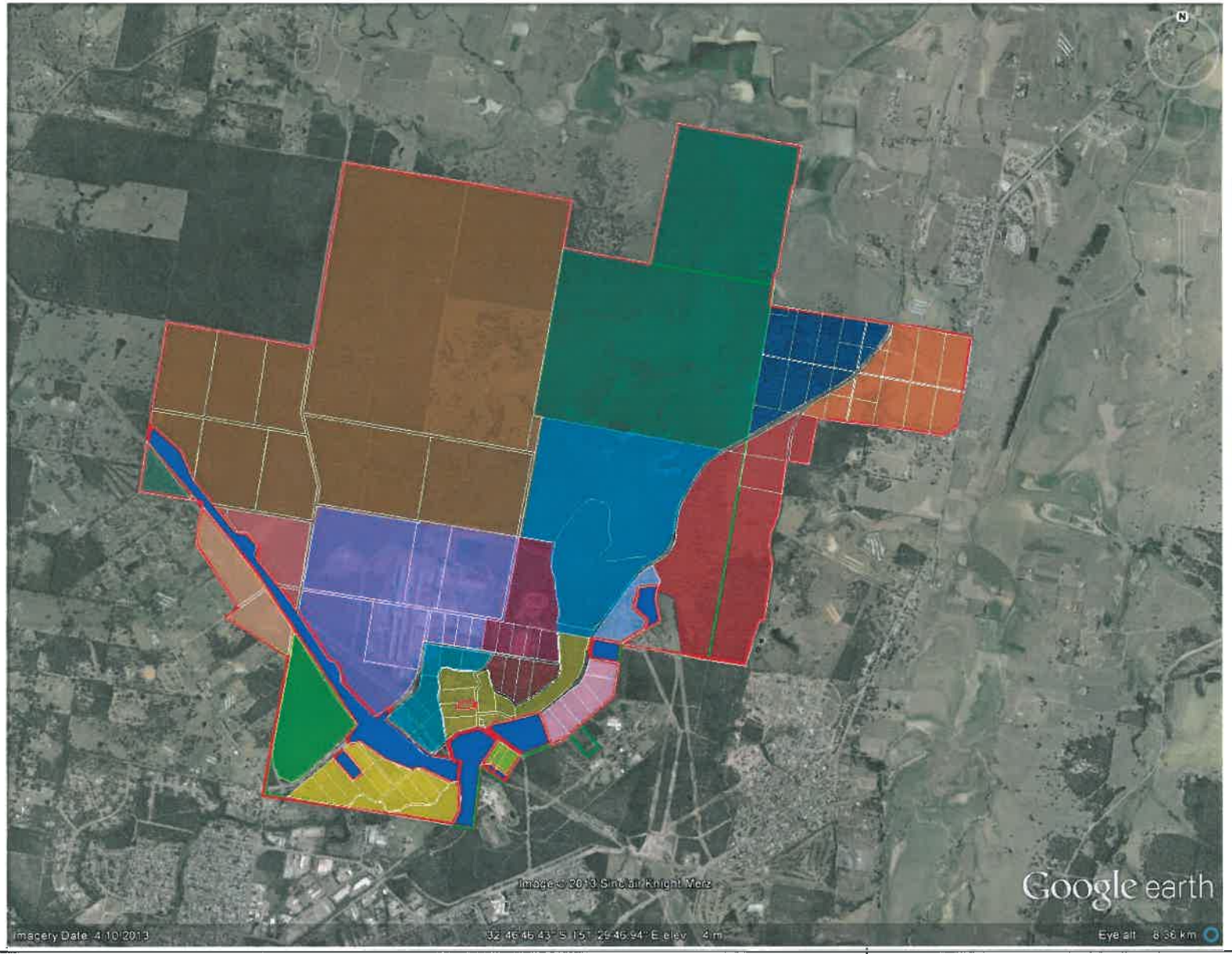
FIGURE 6



N

HYDRO AUSTRALIA PHASE 1 ESA	LOCATION OF DEMOLISHED HOUSES
ENVIRON	JOB NO: AS130336 DATE: 7 August 2013 FIGURE 7

HYDRO AUSTRALIA PHASE 1 ESA	LOCATION OF GLEN MAIN COLLIERY
ENVIRON	JOB NO: AS130336 DATE: 7 August 2013 FIGURE 8



HYDRO AUSTRALIA PHASE 1 ESA	CONTAMINATED LAND ASSESSMENT AREAS

ENVIRON	JOB NO: AS130336	DATE: 20 August 2013	FIGURE 9

1	Alcan Mound
2	Carbon Plant
3	Anode Waste Pile
4	East Surge Pond and associated drainage
5	West Surge Pond
6	Diesel Spray Area
7	Switch yard
8	Most Buildings (Asbestos/ SMF)
9	Diesel Refuelling Area
10	Washdown Bay
11	Flammable Liquids Store
12	Pot Lines

N

HYDRO AUSTRALIA PHASE 1 ESA

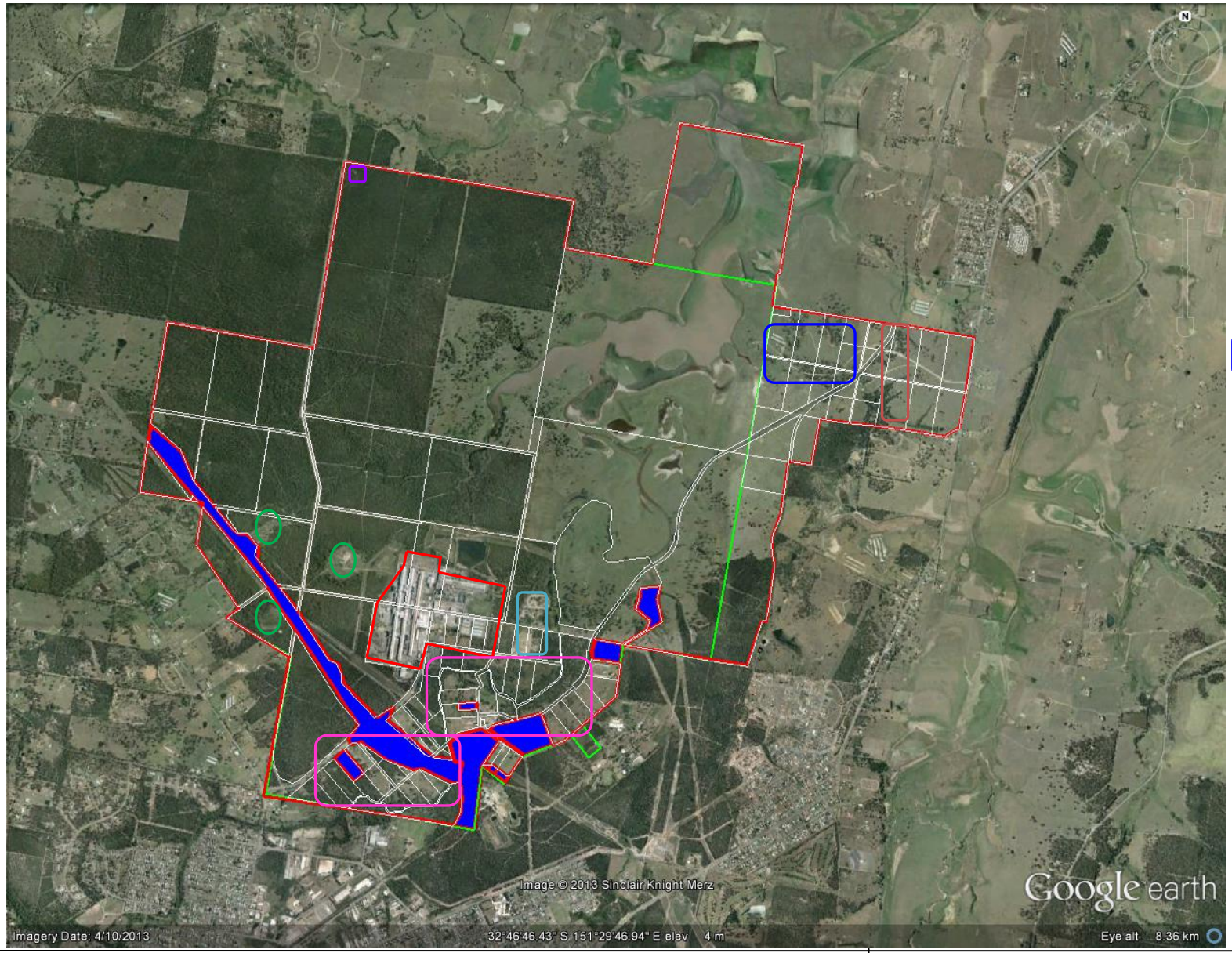
LOCATION OF ENVIRONMENTAL ISSUES AT SMELTER

ENVIRON

JOB NO: AS130336

DATE: 7 August 2013

FIGURE 10



Land owned by Hydro

Approximate Location of Smelter

Approximate Location of Buffer Zone

Kurri Kurri Junior Motorcycle Club

Mine subsidence and illegal dumping

Farm buildings and chicken sheds

Former hobby farms

Housing and other developments, dumped wastes

Buried car bodies

N

HYDRO AUSTRALIA PHASE 1 ESA

LOCATION OF ENVIRONMENTAL ISSUES IN BUFFER ZONE

ENVIRON

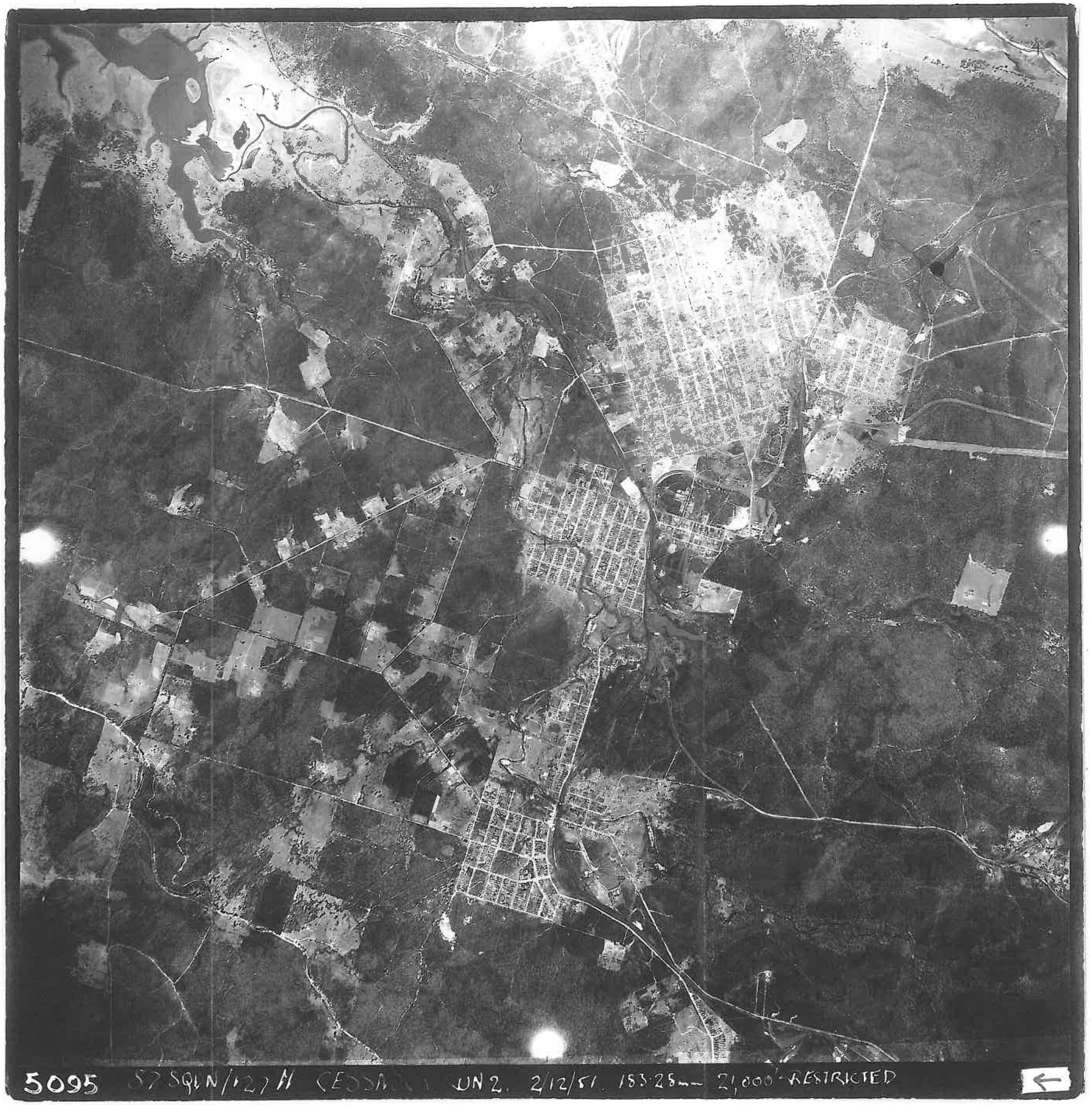
JOB NO: AS130336

DATE: 20 August 2013

FIGURE 11

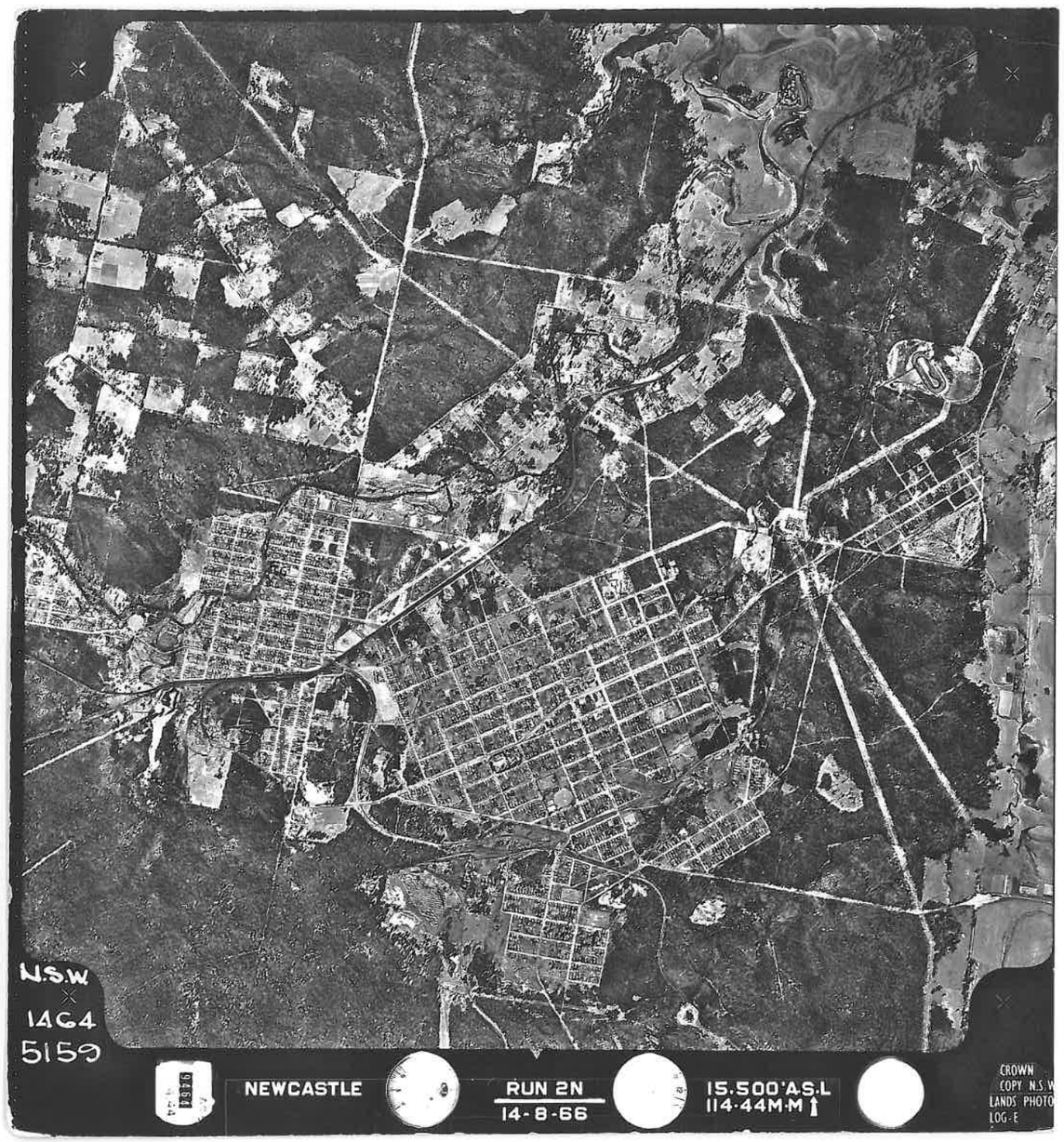
Appendix A

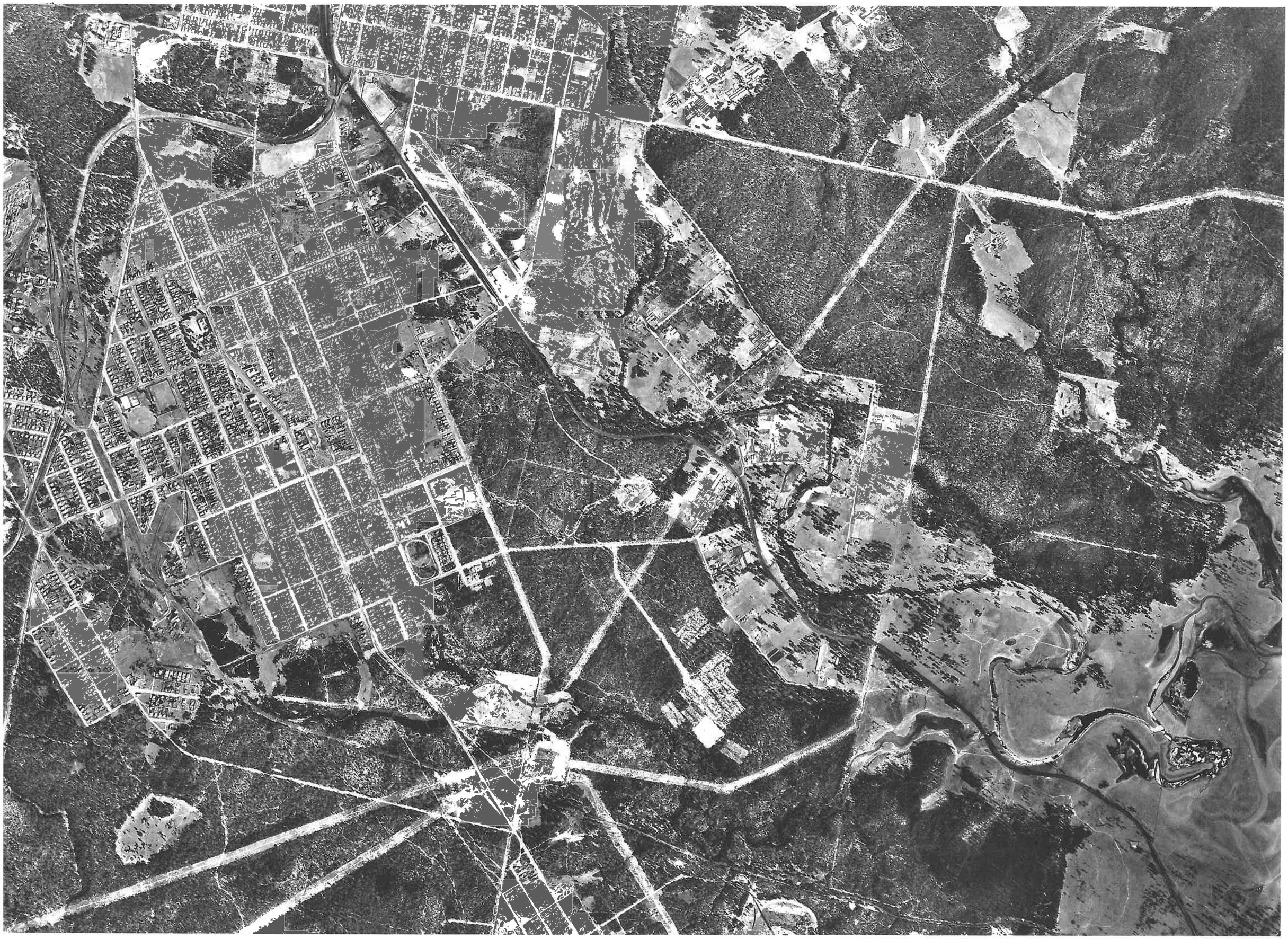
Historical Aerial Photographs


5095
2/12/51.
21,000'
RESTRICTED

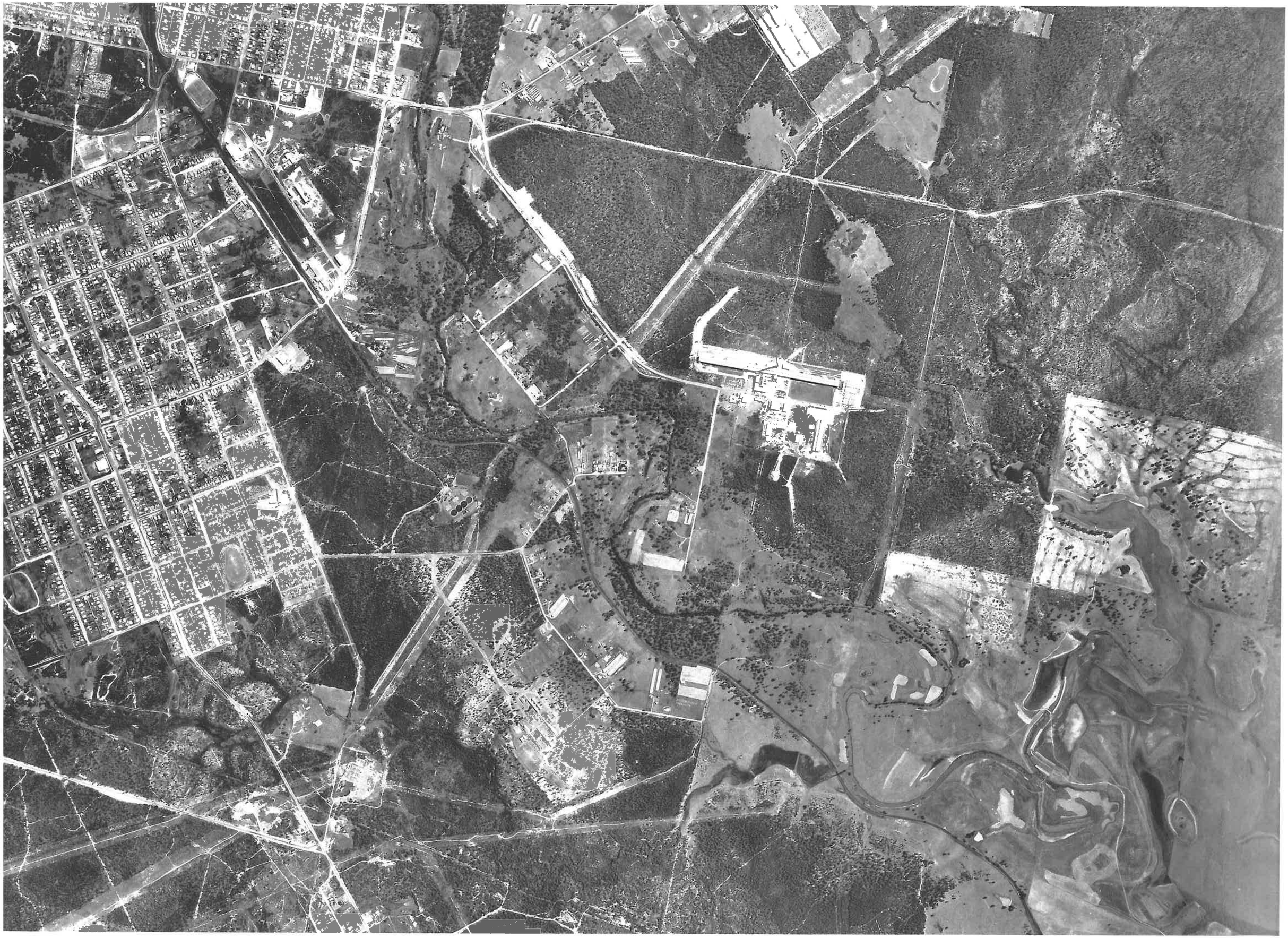

N.S.W.
231
5151
CESSNOCK
RUN 1C
MAR.'61
23.000'A.S.L.
114.44M.M.
CROWN
COPY N.S.W.
LANDS PHOTO
3RD COPY


N.S.W
1464
5158
NEWCASTLE
RUN IN
14-8-66
15.500'A.S.L
114·44M·M
2ND COPY
CROWN
COPY N.S.W
LANDS PHOTO
NSW 1464

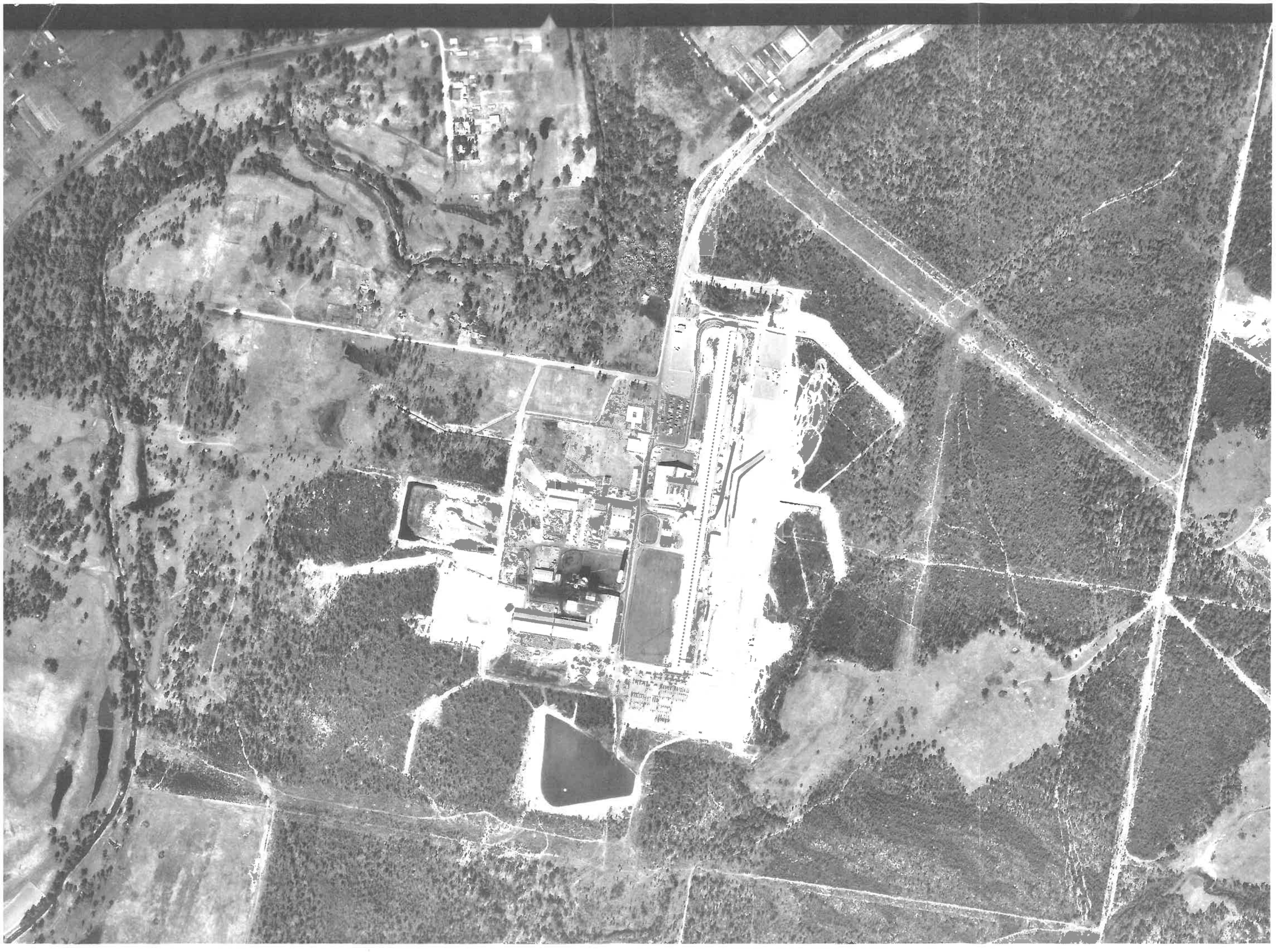

N.S.W
1464
5159
NEWCASTLE
RUN 2N
14-8-66
15.500'A.S.L
114·44M·M
CROWN
COPY N.S.W
LANDS PHOTO
LOG-E



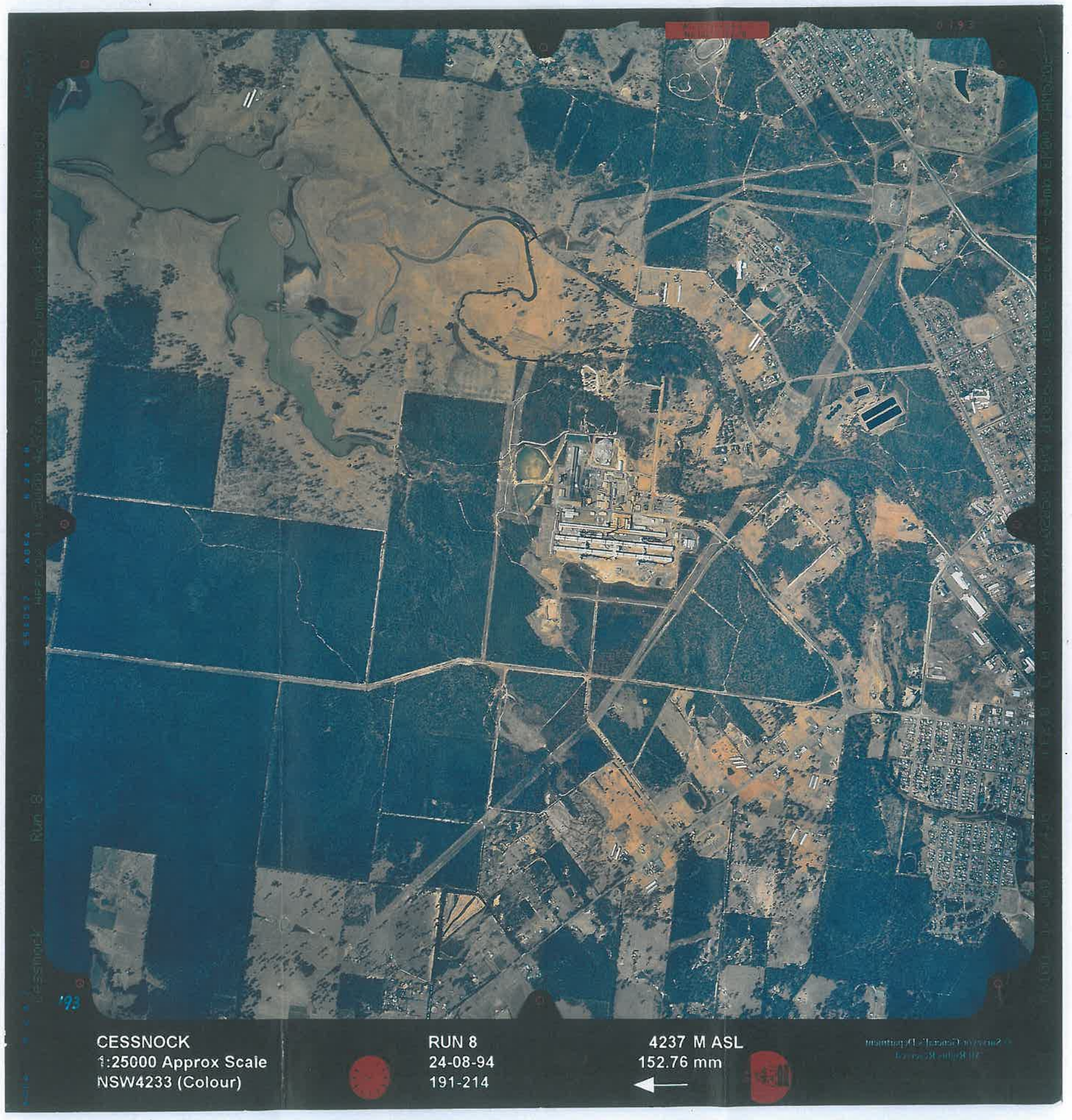

NSW
2299
100
NEWCASTLE
Run 5
1.4.75
6401ft. ASL
151.45mm
CROWN
COPY N S W
LANDS PHOTO
LOG-E



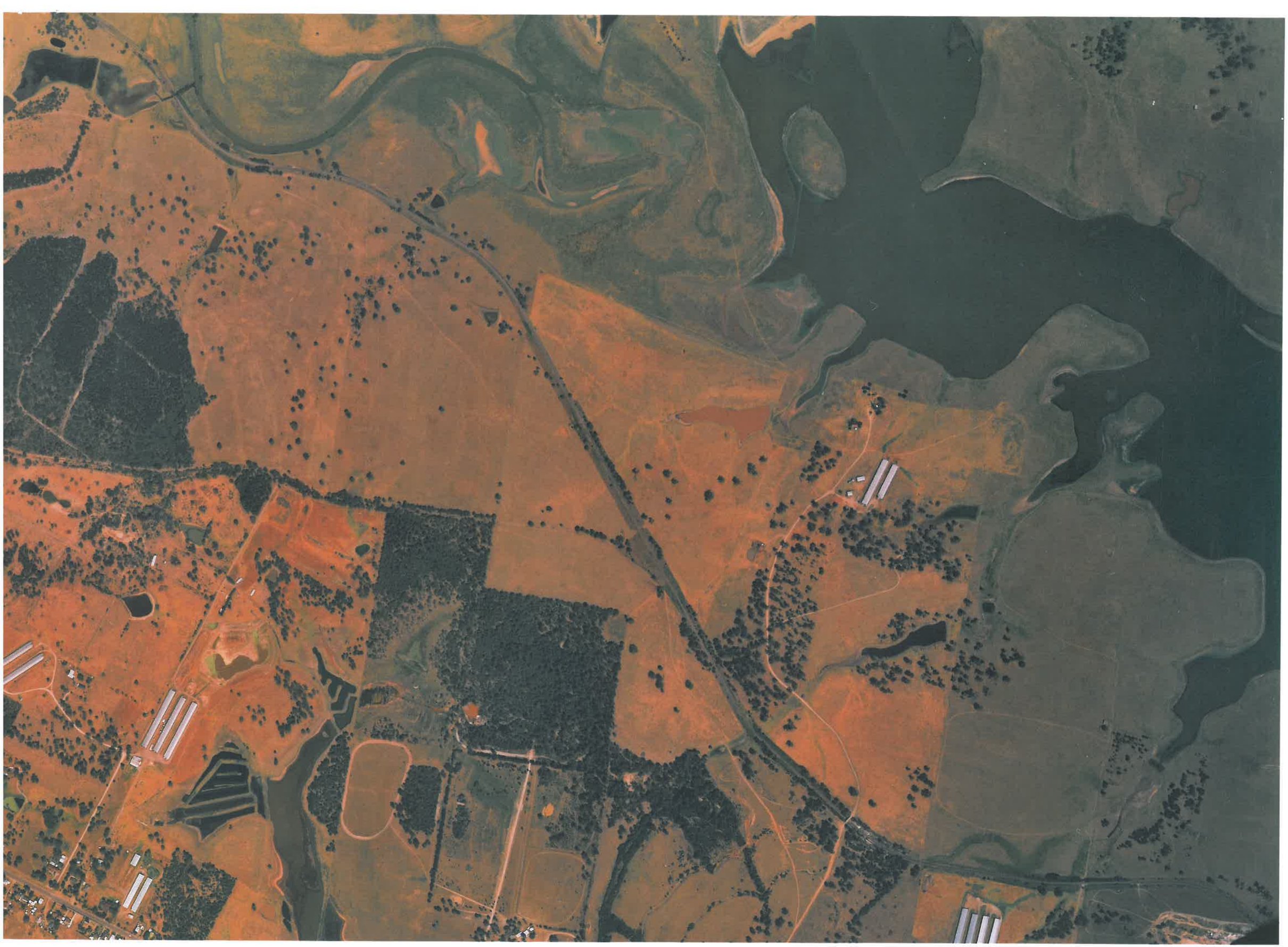

UAg 1025 151.45
NSW 2711 58
NEWCASTLE I.S.G. (CESSNOCK)
1:16 000 (MISC. 967)
NSW 2711
RUN 1
3.5.78
2560m ASL
151.45mm
IST COPY
©CROWN COPY N.S.W. LANDS PHOTO




UAGII 3057 15340
4 9
NSW
3576
184
NEWCASTLE 1987
1:16000 COLOUR
NSW3576 (M1773)
RUN 4W
28.5.87
2713 M ASL
153.10MM
CROWN
COPYRIGHT
LANDS PHOTO


CESSNOCK
1:25000 Approx Scale
NSW4233 (Colour)
RUN 8
24-08-94
191-214
4237 M ASL
152.76 mm


0028
NEWCASTLE
1:25000 Approx. Scale
NSW4535 (M2227)
RUN 8
03-01-01
07-30
152.76 mm
© Land and Property Information




NEWCASTLE
1:25000 Approx. Scale
NSW4535 (M2227)
RUN 8
03-01-01
07-30
152.76 mm
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KURRI
1:16000 Approx. Scale
NSW4963 (M2530)
RUN 9
25-05-06
164-171
152.76 mm
© Department of Lands
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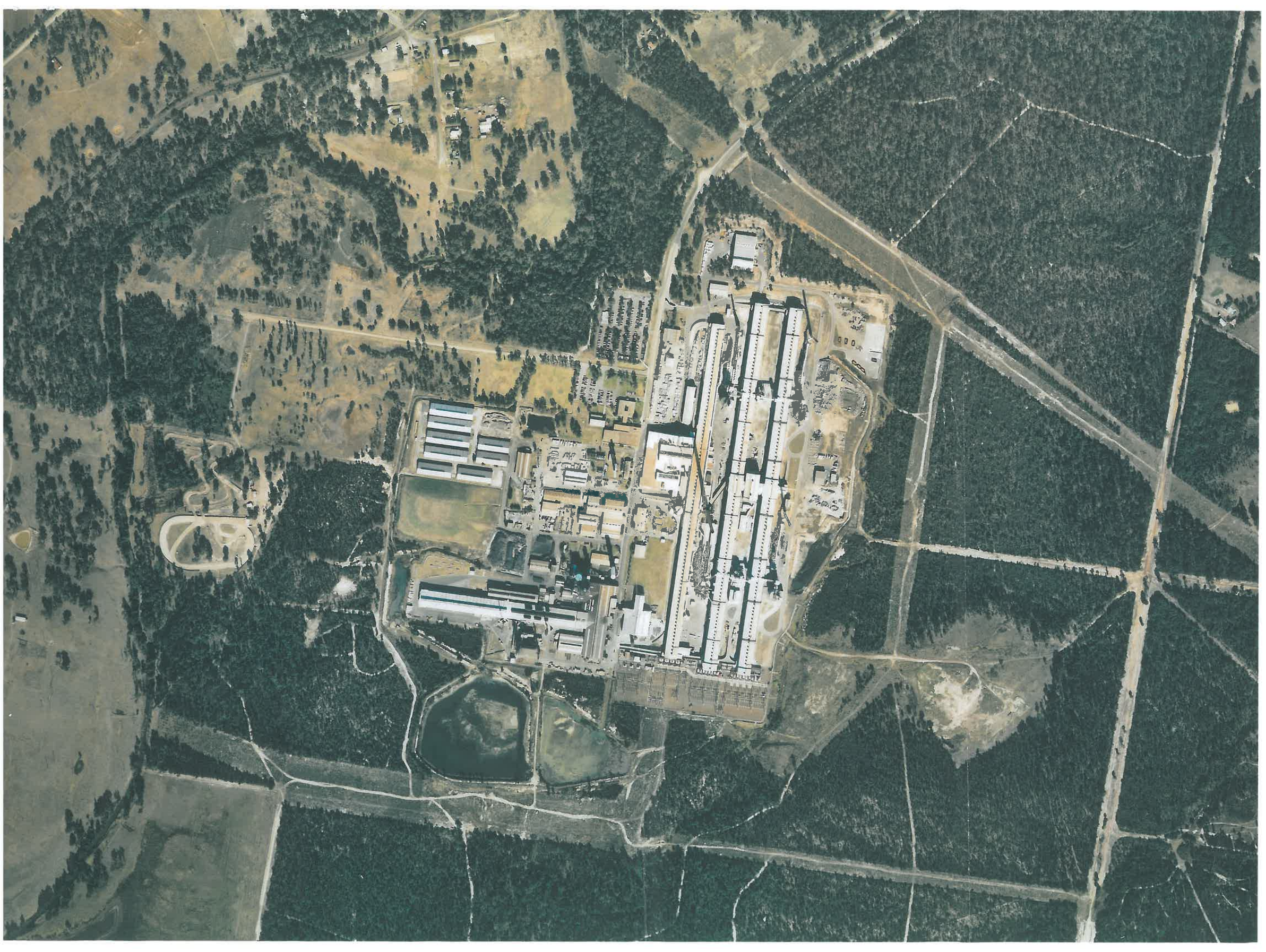
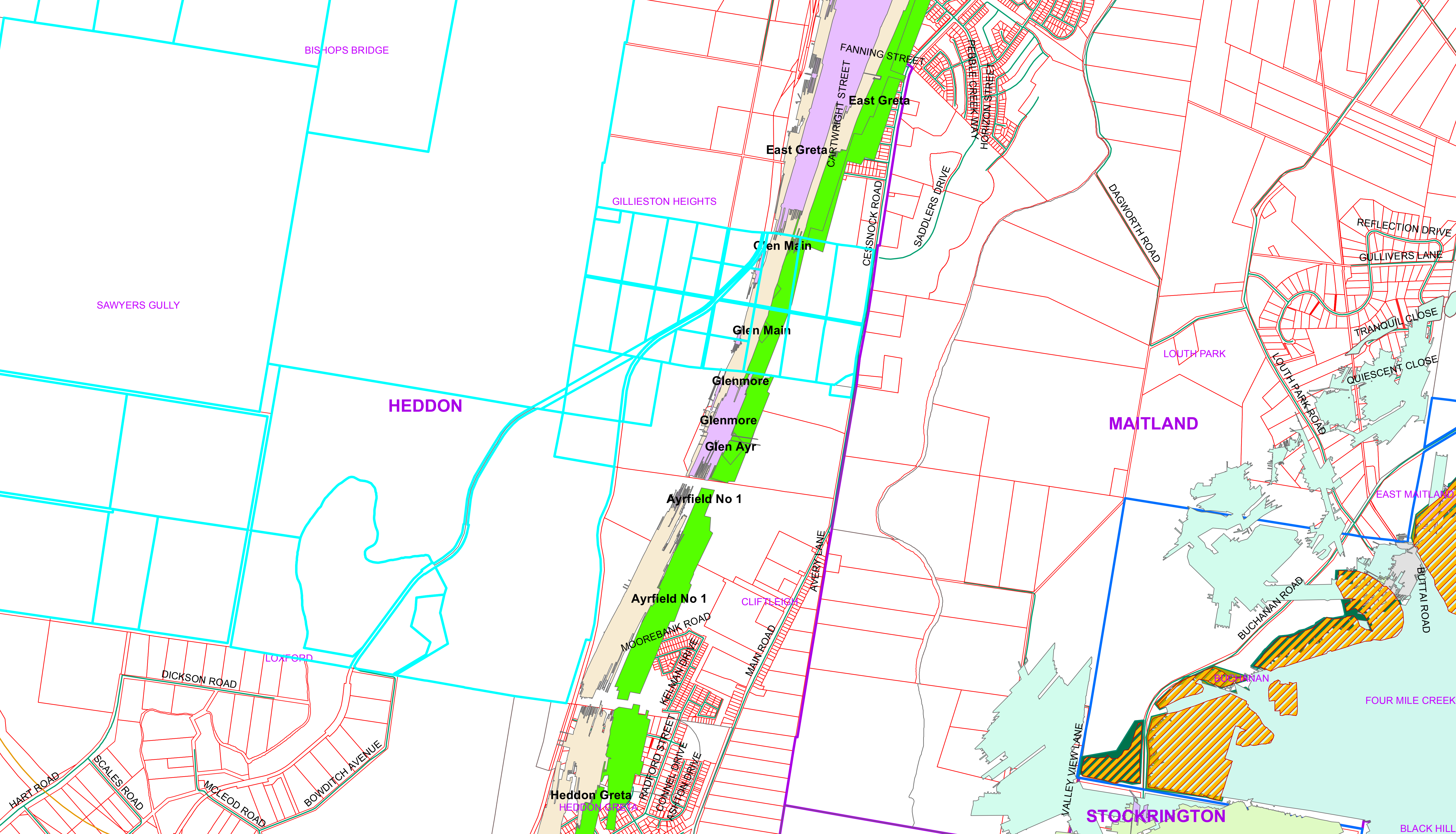
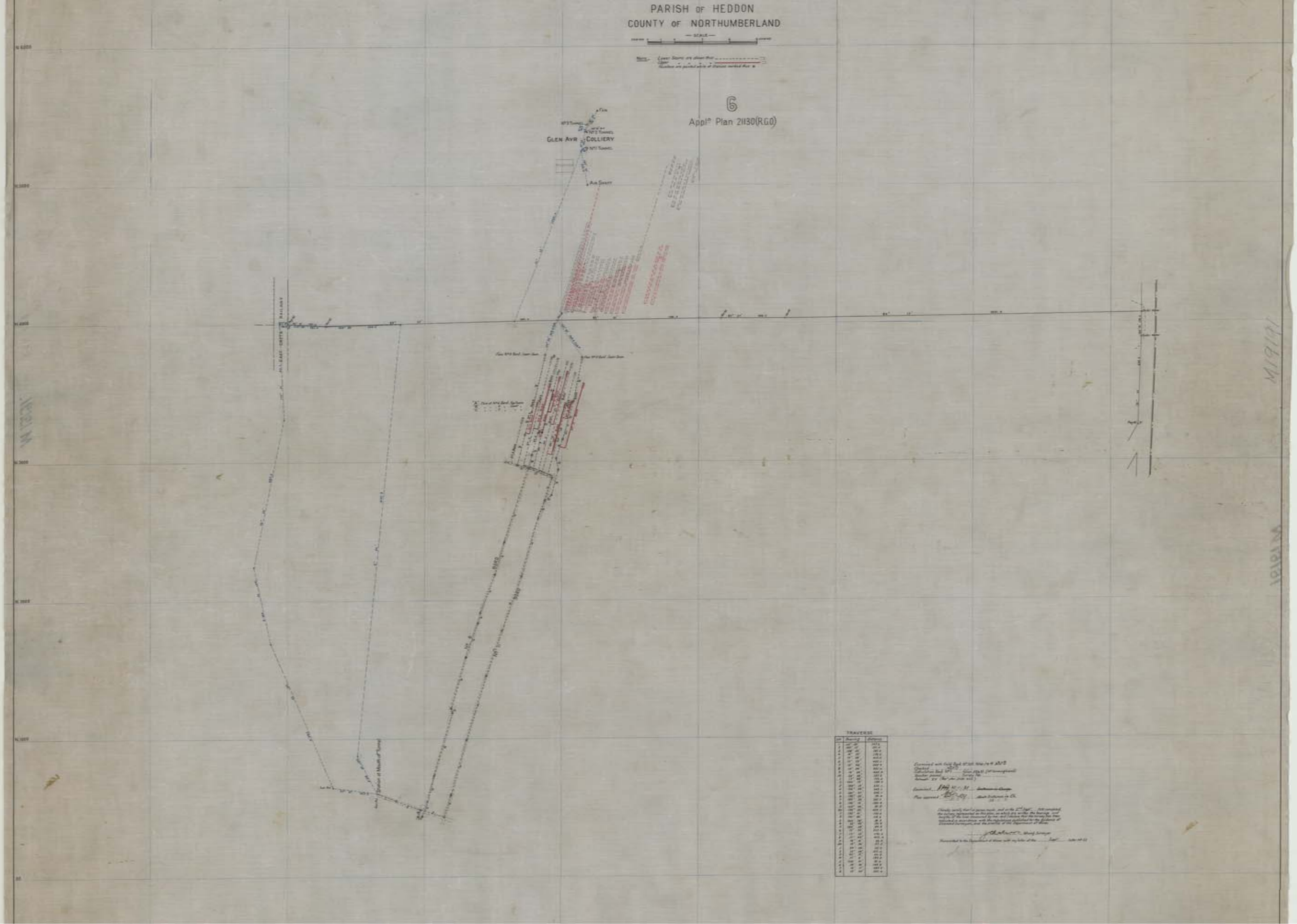


Appendix B

Mine Subsidence Board Information


BISHOPS BRIDGE
FANNING STREET
CARTWRIGHT STREET
East Greta
East Greta
PEBBLE CREEK WAY
HORIZON STREET
SADDLERS DRIVE
CESSNOCK ROAD
DAGWORTH ROAD
GILLIESTON HEIGHTS
Glen Main
REFLECTION DRIVE
GULLIVERS LANE
SAWYERS GULLY
Glen Main
TRANQUIL CLOSE
LOUTH PARK
Glenmore
QUIESCENT CLOSE
LOUTH PARK ROAD
HEDDON
Glenmore
MAITLAND
Glen Ayr
EAST MAITLAND
Ayrfield No 1
AVERY LANE
BUTTAI ROAD
Ayrfield No 1
CLIFTLEIGH
BUCHANAN ROAD
MOOREBANK ROAD
LOXFORD
MAIN ROAD
KELMAN DRIVE
DICKSON ROAD
BUCHANAN
FOUR MILE CREEK
RADFORD STREET
BOWDITCH AVENUE
SCALES ROAD
HART ROAD
MCLEOD ROAD
CONNELL DRIVE
ASHTON DRIVE
VALLEY VIEW LANE
Heddon Greta
HEDDON GRETA
STOCKRINGTON
BLACK HILL


PARISH OF HEDDON
COUNTY OF NORTHUMBERLAND
6
Appl^n Plan 21130(R.G.O)
GLEN AYR COLLIERY
Nº 2 TUNNEL
Nº 1 TUNNEL
AIR SHAFT
TRAVERSE
M19191

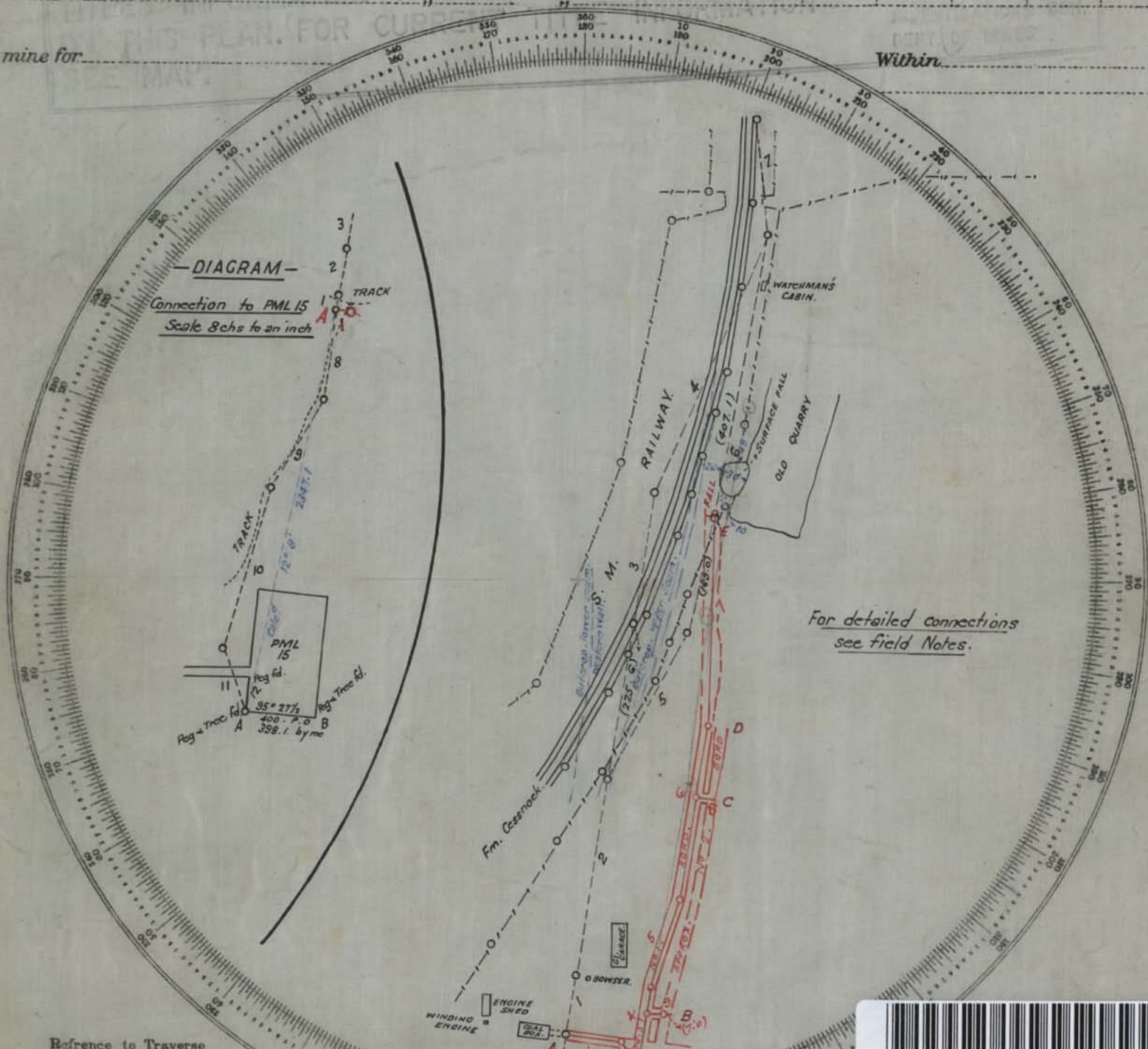
Regn. No. of Papers 38/10851 MS

PLAN OF PORTION OF GLEN MAIN COLLIERY WORKINGS

Parish of Heddon — County of Northumberland

	Refused	Voided	Forfeited	Lease No.	Cancelled
L. Appn. No. ...... at ...... possn. ...... by					
Do. ...... " ...... " ...... "					
Do. ...... " ...... " ...... "					
Do. ...... " ...... "					
Do. ...... " ...... "					
Do. ...... " ...... "					

To mine for ...... Within ......



Refrence to Traverse

Nº	Bearing	Distance
1	96° 59½	79.7
2	147 45½	19.3
3	145 48½	23.2
4	8 34	114.5
5	17 47	134.6
6	8 25	250.9
7	1 0	305 to Fall.
8	102 53	26.0
9	90 28	29.0

Surface Traverse.

1	9 36	86.5
2	8 34	285.0
3	8 34	412.9
4	202 18	397.0
5	28 14½	236.6
6	10 0	576.1
7	354 42	167.6
8	8 23½	518.9
9	30 41½	576.4
10	15 21	954.2
11	340 37	387.4
12	5 27	195.7
	5 27½	195.6 P.O.

Reference to Corners

Corner	Bearing	From	Links	Nº on Tree
A	213° 26'	Iron bark	51.5	↑ PML 15
B.	88 37	Stump.	25.8	↑ PML 15

Examined with Field Notes W.J.B.

Checked and Charted W.J.B.

Calculation Sh. No. 1425 Folio ......

Voucher passed 17. 11. 38. Survey Fee £ 29.12.10

Do. ... do. ...... per cent. on Fee £ ......

Do. ... do. ......

Survey Fee lodged by Applicant £ 29.12.10

Examined W.J.B. Plan approved ... 17.11.38

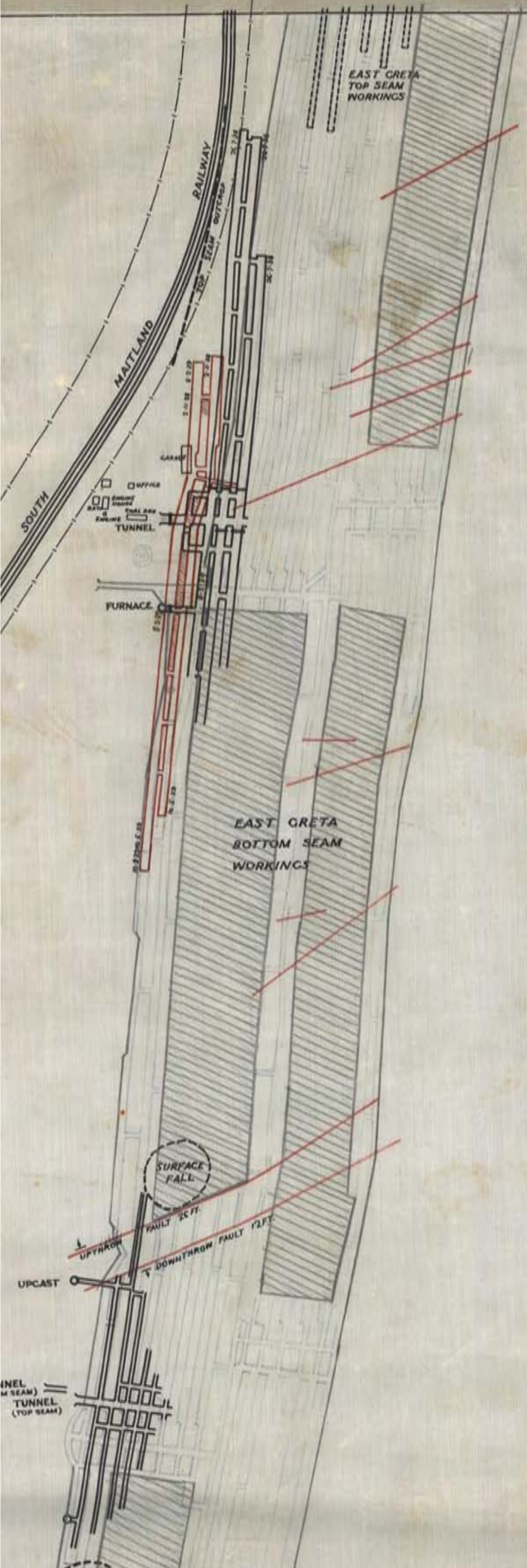
I A. J. Trier of Sydney a surveyor registered under the Surveyors Act, 1929, do hereby solemnly and sincerely declare that the survey represented in this plan has been made by me in accordance with the Survey Practice Regulations, 1933, and the special requirements of the Department of Mines, and was completed on the 15th August 1938.

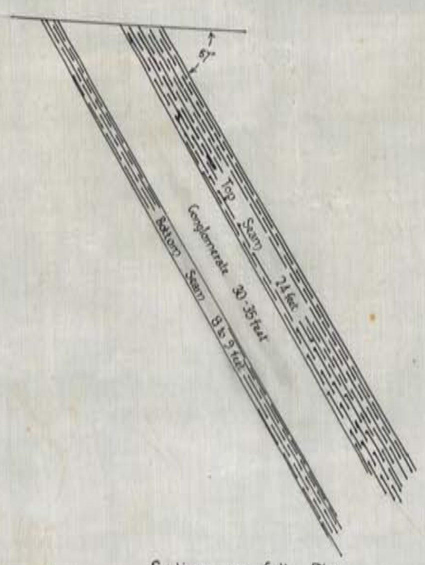
And I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the Oaths Act, 1900.

A. J. Trier ... Mining Surveyor, Surveyor Registered under the Surveyors Act, 1929.

Scale 2 Chains to an Inch

Applicants' pegs shown thus ◎





Section on full Dip

DATE	SURVEYOR	DATE	SURVEYOR
2-11-38	F.Noel White		
8-2-39	F.Noel White		
10-5-39	F.Noel White		
10-8-39	F.Noel White		

GLEN MAIN COL.

SCALE 2CH TO 1IN

Top Seam Workings shown Black
Bottom " " " Red