

Singleton bypass

Technical working paper: Contaminated Soils Phase 1 Assessment

Roads and Maritime Services | November 2019

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Prepared by AECOM and Roads and Maritime Services

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Approval and authorisation

Title	Singleton bypass: Technical Working Paper: Contaminated Soils Phase 1 Assessment
Accepted on behalf of NSW Roads and Maritime Services by:	Joel Rosendahl Project Development Manager
Signed:	
Dated:	

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Document status	Date	Prepared by	Reviewed by
Final Rev 0	14-Nov-19	Alison ONeill	Simon Murphy

Executive summary

AECOM was commissioned by Roads and Maritime Services (Roads and Maritime) to undertake a desktop based Phase I Preliminary Site Investigation for planned Singleton Bypass extending from Rixs Creek Lane to Newington Lane.

The objective of this investigation is to identify contamination constraints to the proposed works, and to assess if past or present land uses at the site has the potential to cause contamination that presents a potential risk to human health or the environment during the proposed construction activities.

This assessment has been undertaken by the completion of a desktop study which incorporated a review of public available information and private records. The scope of works completed was based on the 2013 revised (Assessment of Site Contamination) National Environmental Protection Measure (NEPM) and included a review of the following key information sources:

- Council Local Environment Plans (LEP) and land zoning maps
- Historical aerial photographs to assist in establishing the physical patterns of development over time and potentially contaminating land uses
- NSW Environment Protection Authority (EPA) *Contaminated Land Management Act 1997* (CLM) and *Protection of the Environment Operations Act 1997* (POEO) public registers
- Published soil landscape, acid sulfate soil, geology, hydrogeology, hydrology and topographical records.

Based on the findings of our investigation, AECOM identified evidence of potential contamination from various sources within the study area. Locations identified as potentially containing contamination include Market Gardens, pastoral lands, potential for contaminants within the existing New England Highway and associated collector roads, Main Northern Railway Line and existing buildings and historical structures which may contain potential asbestos containing material (ACM). During geotechnical investigations it was observed the northern portion of the study area may contain ACM within fill material and in situ pipeline within the rail corridor.

It was further noted additional potential contamination sources were in close proximity to the proposal area which included car sales and servicing businesses, heavy machinery sales and servicing businesses, a concrete batch plant, mines rescue centre, former gasworks, coal mine and a sewerage treatment plant.

Based on the findings of this assessment and with due regard to the proposed construction works, AECOM recommends that a contaminated lands unexpected finds procedure be developed as part of the construction environmental management plan (CEMP) for the proposal and implemented during the construction phase.

Should the unexpected finds procedures identify contamination which presents a high risk to human or environmental health, a targeted contamination assessment may be required following consultation with Roads and Maritime environmental staff.

To manage the potential to encounter and impact on ACM within the proposal area, an Asbestos Management Plan will be developed and implemented. The plan will include:

- Identification of potential asbestos on site
- Procedures to manage and handle any asbestos
- Mitigation measures if asbestos is encountered during construction
- Procedures for disposal of asbestos in accordance with NSW EPA guidelines, Australian Standards and relevant industry codes of practice.

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Terms and acronyms used in this technical working paper

Term / Acronym	Description
AEC	Areas of Environmental Concern
ACM	Asbestos Containing Material
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASL	Above Sea Level
BaPTEQ	Benzo(a)pyrene Toxic Equivalence Quotient
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CEMP	Construction environmental management plan
CLM	<i>Contaminated Land Management Act 1997</i>
CoPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DCP	Development Control Plan
EIA	Environmental impact assessment
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EP&A Reg	<i>Environmental Planning and Assessment Regulation 2000</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure

Term / Acronym	Description
NES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
OEH	Office of Environment and Heritage
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PFAS	Per and Poly FluoroAlkyl Substances
PoEO	<i>Protection of Environmental Operations Act 1997</i>
RMS	NSW Roads and Maritime Services
Ps	Singleton Coal Measures (Sandstone, shale, mudstone, conglomerate and coal seams)
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SPR	Source-Pathway-Receptor
TRH	Total Recoverable Hydrocarbons

1 Introduction

1.1 Background

Roads and Maritime Services NSW (Roads and Maritime) proposes to build a highway bypass of Singleton (the proposal). Currently the New England Highway passes through Singleton and forms the main road access through the town and to the town centre. More than 25,000 vehicles use the highway through Singleton and across the Hunter River, with around 3750 of these being heavy vehicles. Traffic volumes are predicted to increase as a result of population growth, future land developments in Singleton, and regional freight movement traffic growth. In November 2014, Roads and Maritime started a route options assessment to identify a preferred corridor for the future bypass.

Key features of the proposal include:

- About eight kilometres of new highway (the bypass) with a single lane in each direction
- Connection with the New England Highway at the southern end of the bypass (the southern connection) including a southbound entry ramp and northbound exit ramp
- A 55 metre long bridge over the bypass at the southern connection
- A 1.7 kilometre long bridge over the Main North railway line, the Doughboy Hollow and Hunter River floodplain, Army Camp Road and Putty Road (bridge over the floodplain)
- Connection to Putty Road including a northbound entry ramp and southbound exit ramp (the Putty Road connection)
- A 40 metre long bridge over the entry ramp at the Putty Road connection
- A 100 metre long bridge over Rose Point floodway
- A 205 metre long bridge over the Hunter River
- A 40 metre long bridge over the New England Highway west of the existing Main North railway line overbridge (known as Gowrie Gates)
- Connection with the New England Highway at Gowrie Gates consisting of a southbound entry ramp and northbound exit ramp. The northbound exit ramp would connect to the New England Highway via a new roundabout intersection at Maison Dieu Road
- A 1.7 kilometre northbound climbing lane between Gowrie Gates and the northern connection
- Connection at Magpie Street providing access to the nearby industrial area (the northern connection) consisting of a southbound entry ramp, southbound exit ramp and northbound entry ramp
- A 60 metre long bridge over the bypass at the northern connection.

1.2 Study area

For the purposes of this Contamination Soils Phase 1 Assessment the following investigation areas have been identified:

- Study area - The Phase 1 study area encompasses a wide area defined to commence from the New England Highway at McDougalls Hill in the north to the New England Highway near Newington Lane in the south. Figure 1.1 identifies the study area in blue. The intent of establishing a wider study area for this report is to identify potential sources of contamination which may be found within the proposal area as described below

- Proposal area – within the larger study area is the proposal area which is consistent with the proposal area as defined in the REF. This Phase 1 Contamination Assessment further breaks down the proposal area into the following four sections for the purpose of describing section of the proposal area which may contain contamination. These sections are defined as:
 - Section 1 – Northern extent of proposal area to Water Reservoir: Starts at the intersection of the New England Highway and Rixs Creek Road southward towards McDougalls Hill and Singleton Heights
 - Section 2 – Water Reservoir to Hunter River: Continues through undulating terrain via Maison Dieu Road towards the Hunter River
 - Section 3 – Hunter River in the East to Army Camp Road: Continues from the Hunter River along flat floodplain. The area traverses through market gardens and rural farm paddocks, Putty Road and Army Camp Road
 - Section 4 – East of Army Camp Road to Southern extent of proposal area: Traverses in an east to south-east direction towards the New England Highway via the Main Northern Railway Line, Orchard Lane, Cemetery Lane and Newington Lane.

The overall location of the study and proposal areas are shown in Figure 1-1 and the sections within the proposal area are identified in Figure 1-2.

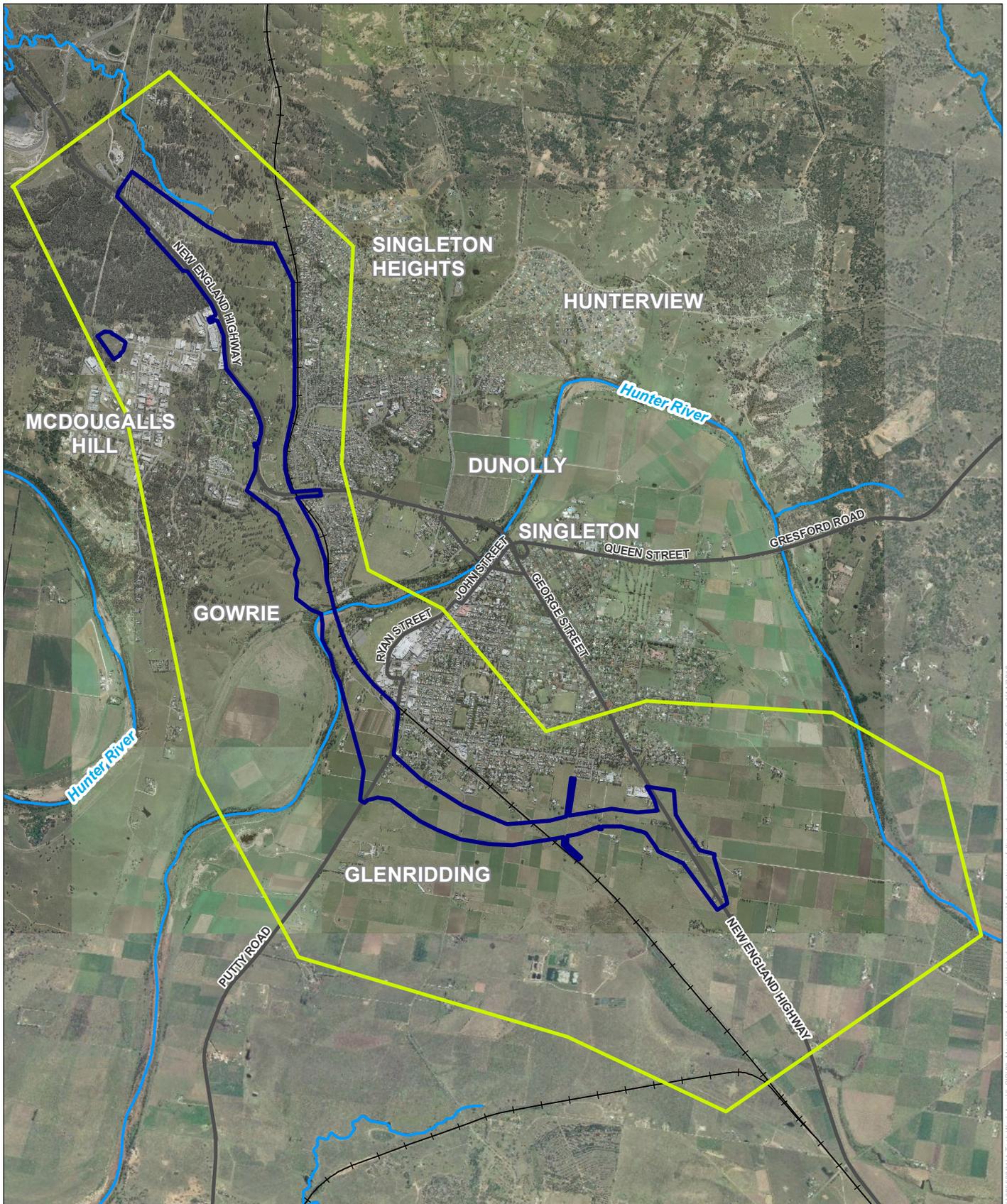


FIG. 1-1 Location of the study area

Legend

Investigation extents

— Proposal area

▭ Study area

Other features

— State roads

— Watercourse

+ Main North railway line



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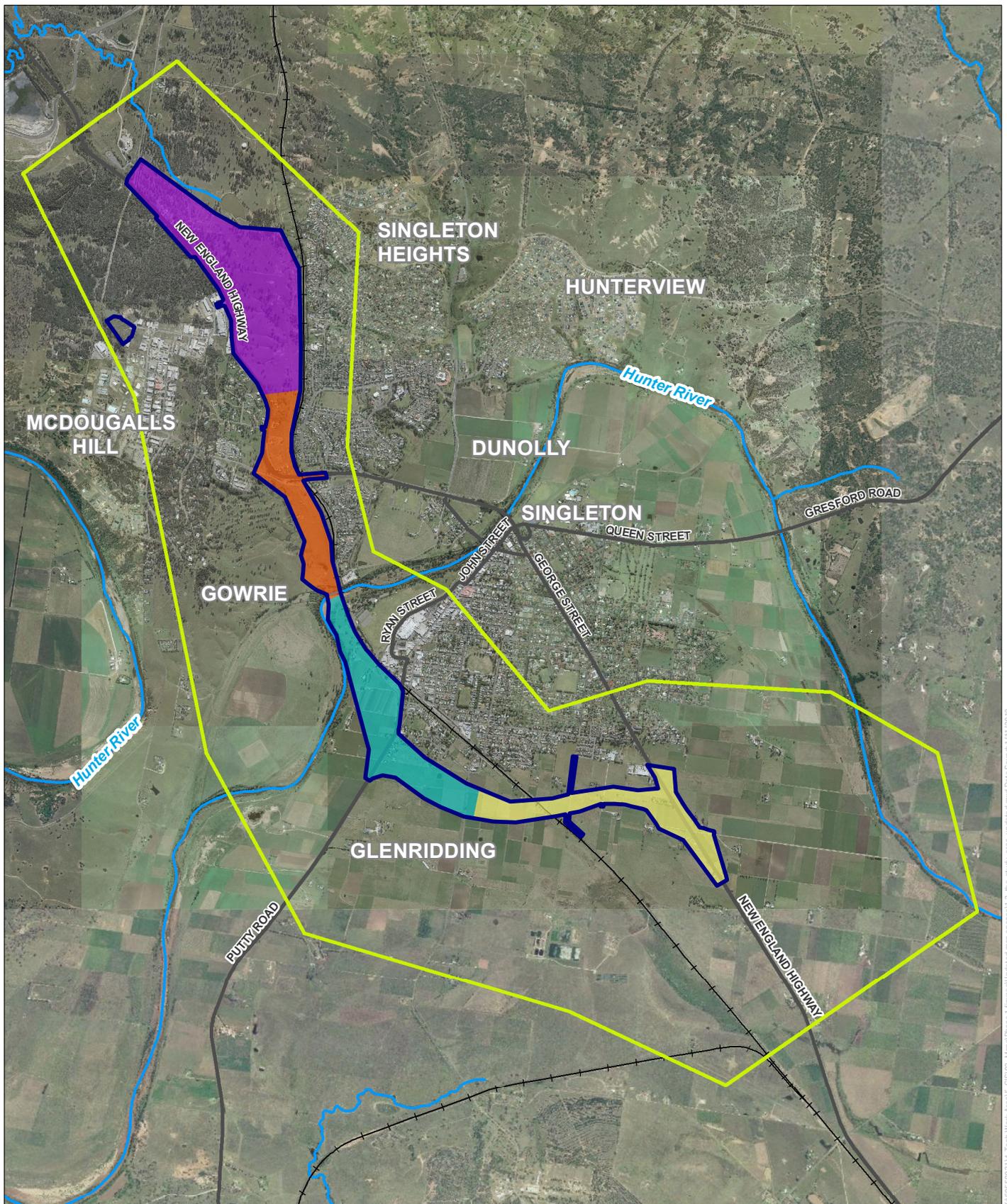


FIG. 1-2 The study area

Legend

Investigation extents

— Proposal area

Assessment sections

Section 1

Section 2

Section 3

Section 4

Study area

Other features

State roads

Watercourse

Main North railway line



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1.3 Purpose of Phase 1 Contamination Assessment

The purpose of a Phase 1 Contamination Assessment (NEPM, 2013) is to identify:

- Potential sources of contamination and determine potential contaminants of concern
- Areas of potential contamination
- Potential human and ecological receptors
- Potential affected media
- Data gaps that may warrant further consideration to meet the proposal scope requirements.

If a thorough preliminary investigation shows a history of non-contaminating activities and there is no other evidence or suspicion of contamination, further investigation is not required.

This Phase 1 Contamination Assessment was prepared to identify potential sources of contamination and potential contaminants of concern at a broad scale approach. The Phase 1 Assessment provides early identification of all hazards associated from potential sources of contamination that may have an influence on the proposal.

If required, a Phase 2 Contamination Assessment would then conduct a risk characterisation and determine, based on scientific evidence (through laboratory analysis), whether the potential sources of contamination and risk receptors may or may not apply to the proposal.

1.4 Objective

The objective of this Contamination Soils Phase 1 Assessment was to conduct a preliminary desktop based assessment of the study area to determine the potential for soil and groundwater contamination within the proposal area which may require management during construction works.

In order to achieve this objective a desktop study was conducted in a manner generally consistent with the National Environment Protection (Assessment of Site Contamination) Measure (2013) (NEPM) to review the site history and relevant information supplied by Roads and Maritime.

The findings determined within this Contamination Soils Phase1 Assessment would establish whether a more detailed investigation is required.

1.5 Disclaimer

This report was prepared without the following information:

- Previous environmental investigation reports
- Land titles information
- Dangerous Goods search
- Council S.149 Certificate/s.

The investigation has been limited to desktop study; no intrusive soil or groundwater sampling has been completed. A site inspection has not been completed by a contaminated land specialist.

2 Methodology

2.1 Scope of Work

In order to achieve the objective (refer to Section 1.4), a desktop study was conducted in a manner generally consistent with the NEPM (2013) to review the study area history and relevant information supplied by Roads and Maritime. This information included current and historical aerial photography.

To partially address the study area history component the following publicly available information was used as reference material:

- NSW Planning Portal
- Singleton Local Environmental Plan (LEP) 2013
- Search on Environment Protection Authority (EPA) NSW website for Contaminated land records within Singleton Local Government Area (LGA)
- Search on EPA NSW website environmental protection licence public register within the immediate and surrounding land use sites
- Search on the Commonwealth EPBC Act Protect Matters Search Tool (Determines whether the study area have matters of national environmental significance or other matters protected by the Environment Protection and Biodiversity Conservation Act 1999)
- BioNet atlas search (for threatened flora and threatened fauna & endangered ecological communities)
- Google Maps for current aerial photography
- SIX viewer for current aerial photography
- Groundwater monitoring bores.

The Stage 2 PACHCI Aboriginal Archaeological Survey Report and Historical Archaeological Assessment were used to assist in helping establish past land uses of the overall study area.

Based on the abovementioned sources of information a preliminary contamination Conceptual Site Model (CSM) has been developed for the potential on-site sources of contamination.

2.2 Relevant Criteria

The Phase 1 Site Contamination Assessment was undertaken with general reference to relevant parts of the following key guidelines and legislation:

- Applicable Development Control Plan (DCPs)
- NEPC, 2013. National Environment Protection (Assessment of Site Contamination) Measure 1999 (the ASC NEPM), National Environment Protection Council, as amended on 16 May 2013
- NSW Department of Environment and Conservation (DEC) 2007. Guidelines for the Assessment and Management of Groundwater Contamination March 2007
- NSW Environment Protection Authority, 1994. Contaminated Sites: Guidelines for Assessing Service Station Sites, as amended August 2003
- NSW OEH, 2011. Guidelines for Consultants Reporting on Contaminated Sites, The State of NSW and Office of Environment and Heritage
- NSW DECC, 2009. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act of 1997, NSW Department of Environment and Climate Change, 2009
- NSW Government, 1997. Contaminated Land Management Act, Act 140 of 1997, NSW Government, Australia.

3 Proposal area Identification

As detailed in Section 1.2 the proposal area has been divided into four sections for the purposes of establishing the potential presence of contamination. Sections one to four of the proposal area are identified from Table 3-1 to Table 3-4 respectively:

Table 3-1 Section 1 Northern extent of proposal area to Water Reservoir

Item	Description
Locality	New England Highway, McDougalls Hill
General	<p>The proposal area starts at the intersection of the New England Highway and Rixs Creek Road. The area then becomes undulated with sheet and gully erosion southward towards McDougalls Hill and Singleton Heights.</p> <p>The proposal area is predominantly rural pastoral lands with sections of abundant to low sparse vegetation. This section includes the former rail embankment and immediately adjoins the current ARTC rail line along its eastern boundary. This section is approximately 2.1 kilometres in length.</p>
Legal Description	Lot 221 DP 1046820, Lot 1 DP 736773, Lot 25 DP 248630, Lot 26 DP 248630, Lot 11 DP 583232, Lots 1, 2 & 3 DP 614110, Lot 1 DP 561939, Lot 1000 DP 1147316.
Local Government Authority	Singleton Council
Previous Land Use Zoning	Unknown
Current Zoning	RU1 Primary Production and SP2 Infrastructure
Current Land Use	Agricultural pastoral land, road and rail infrastructure
Proposed Ongoing Land Use	Road infrastructure
Section Area (Total)	About 106 hectares
Section Location and Layout	Refer to Figure 1.2 and Appendix A.

Table 3-2 Section 2 Water Reservoir to Hunter River

Item	Description
Locality	New England Highway and Maison Dieu Road, Gowrie
General	<p>The proposal area continues through undulating terrain via Maison Dieu Road towards the Hunter River. The proposal area comprises of mostly cleared pasture grasses and rural residential development to Maison Dieu Road. The south-eastern portion of this section aligns to the Main Northern Railway Line.</p> <p>An unnamed creek flows down gradient towards the Hunter River. This section is approximately two kilometres in length.</p>

Item	Description
Legal Description	Lot 2 DP 1063069, Lot 1 DP 1047239, Lot 1 DP 118590, Lot 1 DP 1001760, Lot 1221 DP 599260, Lots 1, 2 & 4 DP 1195454.
Local Government Authority	Singleton Council
Previous Land Use Zoning	Unknown
Current Zoning	RU1 Primary Production, SP2 Infrastructure, R1 General Residential and RE2 Private Recreation.
Current Land Use	Agricultural pastoral land, private recreation, road and rail infrastructure.
Proposed Ongoing Land Use	Road infrastructure
Section Area (Total)	About 46 hectares
Section Location and Layout	Refer to Figure 1-2 and Appendix A.

Table 3-3 Section 3 Hunter River to east of Army Camp Road

Item	Description
Locality	Waterworks Lane and Putty Road, Glenridding
General	<p>The proposal area continues from the Hunter River along flat floodplain. The proposal area traverses through the market gardens and rural farm paddocks, Putty Road and Army Camp Road. Singleton LEP 2013 heritage listed Former Water Pumping Station is located in the northern portion adjacent to the Hunter River and Waterworks Lane.</p> <p>The Main Northern Railway Line is also located along the north-eastern perimeter of the proposal area.</p> <p>This section is approximately 4.6 kilometres in length.</p>
Legal Description	Lots 2 & 3 DP 883810, Lot 5 DP 1153724, Lot 1 DP 1050582, Lot 1 DP 360940, Lots 1 - 5 DP 1159019, Lot 1 DP 999044, Lots 2 & 3 DP 1108792, Lot 1 DP 796721, Lot 31 DP 1108474, Lot 4 DP 82024, Lot 1 DP 196016, Lots 1 & 2 DP 1104241, Lot 2 DP 798801, Lot 1 DP 1100026, Lot 1 DP 1100628, Lot 2 DP 1100628, Lot 11B DP 37001, Lot 11A DP 37001, Lot 12 DP 1108409, Lots 1 & 2 DP 8695, Lot 2 DP 1062689
Local Government Authority	Singleton Council
Previous Land Use Zoning	Unknown
Current Zoning	RU1 Primary Production and SP2 Infrastructure.
Current Land Use	Agricultural market gardens and pastoral use, road and rail infrastructure.

Item	Description
Proposed Ongoing Land Use	Road infrastructure
Section Area (Total)	About 60 hectares
Section Location and Layout	Refer to Figure 1-2 and Appendix A.

Table 3-4 Section 4 East of Army Camp Road to southern extent of proposal area

Item	Description
Locality	Army Camp Road and New England Highway, Glenriding and Whittingham
General	The proposal area traverses in an east to south-east direction towards the New England Highway via the Main Northern Railway Line, Orchard Lane, Cemetery Lane and Newington Lane. The area comprises of rural farm paddocks located on relatively flat flood plains. This section is approximately 2.7 kilometres in length.
Legal Description	Lot 4 DP 1089420, Lot 1 DP 197746, Lot 15 DP 1117570, Lot 152 DP 1154746, Lot 110 DP 1137689, Lot 101 DP 1048703, Lot 4 DP 1139915, Lot 28 DP 1104815, Lot 3 DP 1139915, Lot 2 DP 1139915, Lot 20 1129695, Lot 1 DP 1122748, Lot 1 DP 1139915, Lot 4 DP 36999, Lot 101 DP 1095188, Lot 101 DP 1095188, Lot 111 DP 855355, Lot 1 DP 1130681, Lot 3 DP 1119857
Local Government Authority	Singleton Council
Previous Land Use Zoning	Unknown
Current Zoning	RU1 Primary Production and SP2 Infrastructure
Current Land Use	Agricultural pastoral land and road infrastructure
Proposed Ongoing Land Use	Road infrastructure
Section Area (Total)	About 44 hectares
Section Location and Layout	Refer to Figure 1-2 and Appendix A.

4 Proposal Area and Surrounding Area History

4.1 Local Government Information – Section 149 Certificate

Section 149 Certificates were not available to be reviewed as part of the background investigations undertaken for this report.

It is noted that the proposal area is within four land zoning regions from the Singleton LEP 2013; RU1 Primary Production, SP2 Infrastructure, R1 General Residential and RE2 Private Recreation.

A search on the NSW Planning Portal and Office of Environment and Heritage BioBanking and Native Vegetation Act 2003 Public Register was conducted 2 July 2018 and the following information could be provided:

- The proposal area does not include or comprise critical habitat
- The proposal area is not an environmental conservation area
- The land within the northern portion of the proposal area (located south of Maison Dieu Road to north of the Hunter River), is currently zoned R1 General Residential and RE2 Private Recreation
- The proposal area is not within a mine subsidence district
- The proposal area is restricted by Council and other public authorities because of the likelihood of flooding within the proposal area south of the Hunter River
- The proposal area is not subject to a bio-banking agreement
- The proposal area is not subject to a property vegetation plan.

4.2 Aerial Photographs

The following information summarised in Table 4-1, Table 4-2, Table 4-3 and Table 4-4 was derived from reviewing the aerial photographs for the study area.

Table 4-1 Aerial Photograph Review – Section 1 Northern extent of proposal area to Water Reservoir

Photograph Details	Description
2017 Aerial Photograph	<p>Section 1: The western boundary of Section 1 of the proposal area comprises of the New England Highway. This area is undulating and grassed with scattered rural residential properties within open paddocks. Structures within this area include sheds, fencing and dams. This section has several vehicular access tracks which join onto the New England Highway.</p> <p>There is a mixture of sparse vegetation east of the New England Highway and more abundant vegetation west of the New England Highway. It appears sheet and gully erosion are present in the southern portion of the Section 1.</p> <p>In proximity to Section 1, within the study area: The surrounding portions of the Section 1 can be described as:</p> <ul style="list-style-type: none"> • North: <ul style="list-style-type: none"> - Rixs Creek Mine lease area - New England Highway - Rixs Creek Rest Area which includes a sealed access road loop with sealed parking areas and associated amenities (e.g. shelters) - Maitland Diesel Service maintenance sheds, machinery and heavy vehicles east of the Rix’s Creek rest area - A small dam - Undulated pasture areas - A heavily vegetated section. • North-east: <ul style="list-style-type: none"> - Undulated grassy paddock areas - Several dams and a water tower - A mixture of clumps and sparse vegetation scattered - Vehicular access tracks - Sealed road - Excavations from potential new residential development. • East: <ul style="list-style-type: none"> - Former rail embankment and current rail corridor and infrastructure associated with the Main Northern Railway Line - Undulated pasture sections - Sparse vegetation - Residential development and sealed road within Singleton Heights - Commercial building (Hunter Valley Mines Rescue Station). • West: <ul style="list-style-type: none"> - Vegetated portion with unsealed access track; - Undulated pasture sections - Dams - Commercial buildings within a business development area – Bunnings and service station - Rural residential development - A water reservoir.
Google Maps	<p>Proposal area: Shows the same land use as the 2017 aerial image.</p> <p>Surrounding Section 1: Shows the same land use as the 2017 aerial image.</p>

Table 4-2 Aerial Photograph Review – Section 2 Water Reservoir to Hunter River

Photograph Details	Description
2017 Aerial Photograph	<p>Section 2: The New England Highway is within the western boundary of Section 2 of the proposal area, from the water reservoir to the Hunter River. This area is predominantly undulated terrain comprising of open paddocks with rural residential properties, access tracks, associated shed structures and fencing.</p> <p>Maison Dieu Road heads in an east and west direction within Section 2.</p> <p>The section includes a small creek with riparian vegetation that feeds into the Hunter River and it appears from the aerial image to have creek bank erosion. The Hunter River, comprising riparian vegetation, flows within the southern portion of the proposal area. An associated rail bridge over the river is also evident. The construction compound to the Gowrie Gate Rail Bridge Replacement was temporarily situated in Section 2.</p> <p>Surrounding Section 2 within the study area: The surrounding portions of the Section 2 proposal area can be described as:</p> <ul style="list-style-type: none"> • West <ul style="list-style-type: none"> - Rural residential with sealed roads - Building structures arranged together to be part of Country Acres Caravan Park north of Maison Dieu Road - Commercial buildings and sheds together to be part of the Roads and Maritime Singleton Maintenance Depot - Undulated grassy paddock sections - Dams - A small creek with riparian vegetation that feeds into the Hunter River and it appears from the aerial image to have creek bank erosion - Sparse vegetation.
	<ul style="list-style-type: none"> • East <ul style="list-style-type: none"> - Former rail embankment and current rail corridor infrastructure associated from the Main Northern Railway Line - Combination of undulated and flat grassed sections with sparse vegetation - Recreational areas Alroy Park and Resco Park Football Field - Boral concrete batching plant - Residential and commercial development of Singleton Heights and Darlington - Sealed roads.
Google Maps	<p>Proposal area: Shows the same land use as the 2017 aerial image.</p> <p>Surrounding Section 2: Shows the same land use as the 2017 aerial image.</p>

Table 4-3 Aerial Photograph Review – Section 3 Hunter River to east of Army Camp Road

Photograph Details	Description
2017 Aerial Photograph	<p>Section 3: The Main Northern Railway Line and associated rail corridor including an ARTC maintenance compound is within the north-eastern boundary of Section 3. Putty Road is a sealed road and follows a north-south direction through a middle portion of this section. Army Camp Road is located within the south-eastern portion. Army Camp Road is a sealed road which follows a north-south direction.</p> <p>The Hunter River flows along the west to north-east boundary.</p> <p>The northern portion of Section 3 comprises riparian corridor with scattered vegetation, floodplain and open paddock. Singleton LEP 2013 heritage listed structure 'Former pumping station' is also located within this section of the proposal area, it is located on the end of Waterworks Lane which joins onto Putty Road. Waterworks Road runs in a north-west to south-east direction within the section.</p> <p>Agricultural land use (market gardens, farming sheds, farming machinery and equipment) is also prominent throughout Section 3.</p> <p>Surrounding Section 3 within the study area: The surrounding portions of Section 3 can be described as:</p> <ul style="list-style-type: none"> • West: <ul style="list-style-type: none"> - Hunter River with riparian vegetation - Flat and clear grassed areas - Farming properties with including sheds. • East: <ul style="list-style-type: none"> - The recreational area Rose Point Park, comprising of asphalt courts, buildings, sealed road access, cleared grass areas with clumped vegetation located adjacent to the Main Northern Railway Line - Singleton Railway Station (also Singleton LEP 2013 heritage listed structure).
	<ul style="list-style-type: none"> - Main Northern Railway Line and associated infrastructure. - Commercial and office businesses of Singleton - Rural residential properties of Singleton with surrounding clumped vegetation and recreational areas - Sealed roads - Flat and clear grassed areas - Agricultural land uses and a dam. • South <ul style="list-style-type: none"> - Agricultural land use (pastoral use, farming sheds, farming machinery and equipment) - Flat and clear grassed areas - Sealed Putty Road.
Google Maps	<p>Proposal area: Shows the same land use as the 2017 aerial image.</p> <p>Surrounding Section 3: Shows the same land use as the 2017 aerial image.</p>

Table 4-4 Aerial Photograph Review – Section 4 east of Army Camp Road to Southern extent of proposal area

Photograph Details	Description
2017 Aerial Photograph	<p>Section 4: This section of the proposal area is predominantly agricultural land use comprising flat floodplain and open grassed paddocks. The Main Northern Railway Line follows the western portion of the section in a north to south direction.</p> <p>An overhead power line easement is located in the northern portion of this section known as Orchard Lane.</p> <p>The New England Highway is located in the eastern portion of the Section 4 travelling along a north – south direction. A clump of vegetation is immediately west of the highway bordering pasture. Two unsealed access roads are located in the northern and eastern portions of this section.</p> <p>Surrounding Section 4 within the study area: The surrounding portions of the Section 4 can be described as:</p> <ul style="list-style-type: none"> • North: <ul style="list-style-type: none"> - Main Northern Railway Line and associated infrastructure - Flat open pasture - Township of Singleton with sealed roads - Australian Christian College Singleton - Lancaster Motor Group - New England Highway - Scattered vegetation - Unsealed access road connecting to Waddells Lane. • East: <ul style="list-style-type: none"> - Flat open pasture - Rural residential properties - Unsealed access roads. • South: <ul style="list-style-type: none"> - Main Northern Railway Line and associated infrastructure - Flat open pasture - Rural residential properties - Swamp area and associated drainage line, south of the railway line - Unsealed and sealed access roads - Clumped areas of vegetation - Singleton Sewerage Treatment Plant - Solar panels south of Sewerage Treatment Plant.
Google Maps	<p>Proposal area: Shows the same land use as the 2017 aerial image.</p> <p>Surrounding Section 4: Shows the same land use as the 2017 aerial image.</p>

4.3 Historical Photographs

The following information summarised in Table 4-5 – Table 4-8 was derived from reviewing the aerial photography in Appendix B for the proposal area and the study area.

Table 4-5 Aerial Photograph Review – Section 1 northern extent of proposal area to Water Reservoir

Photograph Date	Description
2009	<p>Within Section 1 of the proposal area:</p> <ul style="list-style-type: none"> Minimal variation from 2017 aerial photography. Additional building structures are present in the northern portion of the section. <p>In proximity to Section 1:</p> <ul style="list-style-type: none"> Vacant parcels of land occur outside the Section 1 in the south-west. The 2017 aerial photography indicated commercial business development in this area.
2004	<p>Within Section 1 of the proposal area:</p> <ul style="list-style-type: none"> No variation from aerial 2009 photography. <p>In proximity to Section 1:</p> <ul style="list-style-type: none"> Additional vacant parcels of land occur outside Section 1 further south-west.
1994	<p>Within Section 1 of the proposal area:</p> <ul style="list-style-type: none"> No variation from 2004 aerial photography of Section 1. <p>In proximity to Section 1:</p> <ul style="list-style-type: none"> Commercial precinct located outside of this section in the south-west portion is virtually non-existent apart from partially sealed road Northern portion outside Section 1 is an unsealed loop road which would become a Rix's Creek rest area.
1984	<p>Within Section 1 of the proposal area:</p> <ul style="list-style-type: none"> Extensive fill embankment is evident in the south-east portion. Gully erosion appears to be present. <p>In proximity to Section 1:</p> <ul style="list-style-type: none"> Excavated cleared area visible to the north beside the New England Highway which will eventuate into a Rix's Creek rest area Disturbance from excavation is evident to the east. This will eventuate into the residential development of Singleton Heights Gully erosion appears to be present in the north-east.

Photograph Date	Description
1975	<p>Within Section 1 of the proposal area:</p> <ul style="list-style-type: none"> • Previous additional building structures in northern portion of Section 1 not present. Only one dwelling • The previously mentioned gully eroded section in southern portion not as distinctive as 1984 photography. <p>In proximity to Section 1:</p> <ul style="list-style-type: none"> • The commencement of disturbance for residential development in the south- east • Primarily agricultural pastoral land with vegetation to the west.
1963	<p>Both within and in proximity to Section 1 of the proposal area is primarily agricultural pastoral land with scattered vegetation. There appears to be gully erosion present within Section 1 of the proposal area with more gully erosion outside Section 1 to the north-east.</p>

Table 4-6 Aerial Photograph Review – Section 2 Water Reservoir to Hunter River

Photograph Date	Description
2009	<p>Within Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • Minimal variation to 2017 aerial photography apart from three additional building structures north of the New England Highway in the middle portion. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • No changes from 2017 aerial photography.
2004	<p>Within Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • No changes from 2009 aerial photography. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • No changes from 2009 aerial photography.
1994	<p>Within Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • Three building structures north of the New England Highway are not present in comparison to 2004 aerial photography. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • Additional rural residential properties not present in the north-west portion • Minimal vegetation present along banks of the Hunter River.
1984	<p>Within Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • The tributary in the southern portion that flows into the Hunter River appears to be more inundated in comparison to later photography. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • Rural pastoral land present in the north-west portion • Some stockpiled building material is also present in the north-west portion • Additional storage structures on the Roads and Maritime

Photograph Date	Description
	<p>Singleton Maintenance depot located to the west are not present. There is a defined unsealed road</p> <ul style="list-style-type: none"> • A couple of rural residential properties in the south-western most extent of the photography are also not present • Minimal vegetation present along banks of the Hunter River.
1975	<p>Within the Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • No changes from 1984 photography. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • Caravan park not present north of Maison Dieu Road • Rural residential development of Singleton Heights in the north-east is not present. Construction disturbance evident from excavations and unsealed roads • No residential development is present within the Darlington area immediately to the east.
1963	<p>Within the Section 2 of the proposal area:</p> <ul style="list-style-type: none"> • No visible structures are evident apart from the roads and the Main Northern Railway Line • Section 2 appears to be predominantly agricultural pastoral land use • The Hunter River has limited vegetation along the banks and it appears to have been susceptible to bank erosion. <p>In proximity to Section 2:</p> <ul style="list-style-type: none"> • Small portions of the east of Section 2 comprise of commencement of rural residential development in future Singleton Heights and Darlington • Surface preparation underway for Concrete Batch Plant • Roads and Maritime Singleton Maintenance Depot is not present • The Hunter River has limited vegetation along the banks and it appears to have been susceptible to bank erosion.

Table 4-7 Aerial Photograph Review – Section 3 Hunter River to East of Army Camp Road

Photograph Date	Description
2009	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • Tillage of soil is evident in the section north of Putty Road • Additional storage structures are present in the rail corridor. <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • No changes from 2017 aerial photography.
2004	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • Lower intensity agricultural practices are evident in proximity to the pump station <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • No changes from 2009 aerial photography.

Photograph Date	Description
1994	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • Storage structures are present in the area south of the rail corridor. • Rail corridor infrastructure beside railway line not as extensive as 2004 photography. <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • Rose Point Park not as established as 2004 photography • Commercial business area north of the Main Northern Railway Line not present • Hunter River is not as vegetated along the banks with bank erosion.
1984	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • Rail corridor infrastructure beside railway not present • Market Gardens west of Putty Road are yet to be established. <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • The commercial area is being established north of the rail corridor, with unsealed roads and the construction of a large building evident • Rose Point Park not established • Bank erosion along the Hunter River is present with minimal vegetation.
1975	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • No Market Garden activity is present • Bank erosion along the Hunter River. <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • Rose Point Park is agricultural pastoral land use at this stage • Bank erosion along the Hunter River with minimal vegetation.
1963	<p>Within Section 3 of the proposal area:</p> <ul style="list-style-type: none"> • Some agricultural rural residential buildings are yet to be established • Primarily cleared agricultural pasture • Some of the Former Pumping Station buildings are yet to be constructed. <p>In proximity to Section 3:</p> <ul style="list-style-type: none"> • No variation from 1975 aerial photography.

Table 4-8 Aerial Photograph Review – Section 4 East of Army Camp Road to Southern extent of proposal area

Photograph Date	Description
2009	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> No changes from 2017 aerial photography. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> Building and hardstand area extension of Lancaster Motor Group (located west of New England Highway) yet to be established.
2004	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> No changes from 2009 aerial photography. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> Lancaster Motor Group not constructed.
1994	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> No changes from 2004 aerial photography. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> No solar panels south-east of Singleton Sewerage Treatment Plant.
1984	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> More defined unsealed access road to rural residential properties along eastern portion which connect to the New England Highway. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> Rural residential properties along the southern fringe of Singleton (north of Section 4) are yet to be established Australian Christian College Singleton yet to be constructed Singleton Sewerage Treatment Plant is not as extensive to the west and north as 1994 aerial photography.
1975	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> A more defined unsealed access road to rural residential properties is present located along the eastern portion which connects to the New England Highway. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> Rural residential development not yet established along south-eastern fringe of Singleton (north of Section 4).
1963	<p>Within Section 4 of the proposal area:</p> <ul style="list-style-type: none"> No changes from 1975 aerial photography. <p>In proximity to Section 4:</p> <ul style="list-style-type: none"> Further rural residential development not established in the north-eastern fringe of Singleton (north of Section 4) No infrastructure present at the future Singleton Sewerage Treatment Plant.

4.4 Certificates of Title

Certificates of title were not reviewed as part of this report.

4.5 NSW EPA Records

4.5.1 Contaminated Sites Register

A search of the list of NSW contaminated sites notified to the NSW EPA was undertaken. Current from 29 June 2018, the search identified one record located within the study area:

Site 1: Singleton Gasworks

Proximity to proposal area: 330 metres north east

Address: 55-57 John Street, Singleton

Notice Number: 21068

Status: Current.

Nature of Contamination: Soil on the site is contaminated with polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylenes (BTEX) and cyanide in concentrations that exceed health-based investigation levels for industrial land use. Coal tar is also present in the soil.

Groundwater at the site is also contaminated with petroleum hydrocarbons, PAHs, phenol and ammonia at concentrations exceeding the trigger values for 95% of freshwater ecosystems in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC and ARMCANZ, 2000. Contaminated groundwater has the potential to migrate off-site and have an impact on the Hunter River and the users of the river and regional groundwater.

4.5.2 POEO environment protection license register

A search of the NSW Protection of Environment Operations Act 1997 (POEO Act) environment protection register was conducted 29 June 2018. The search did not show any POEO licences located within the study area.

A search of the study area showed that the only licenced premises in the study area is the Singleton Sewerage Treatment Plant which is discussed further in this report. It is noted that the Rix's Creek Open Cut Coal Mine adjoins the study area to the immediate north. The actual scheduled activity of mining for coal by open cut extraction is located further to the north and is unlikely to have any interaction with the proposal, therefore no further consideration of the coal mine is considered necessary.

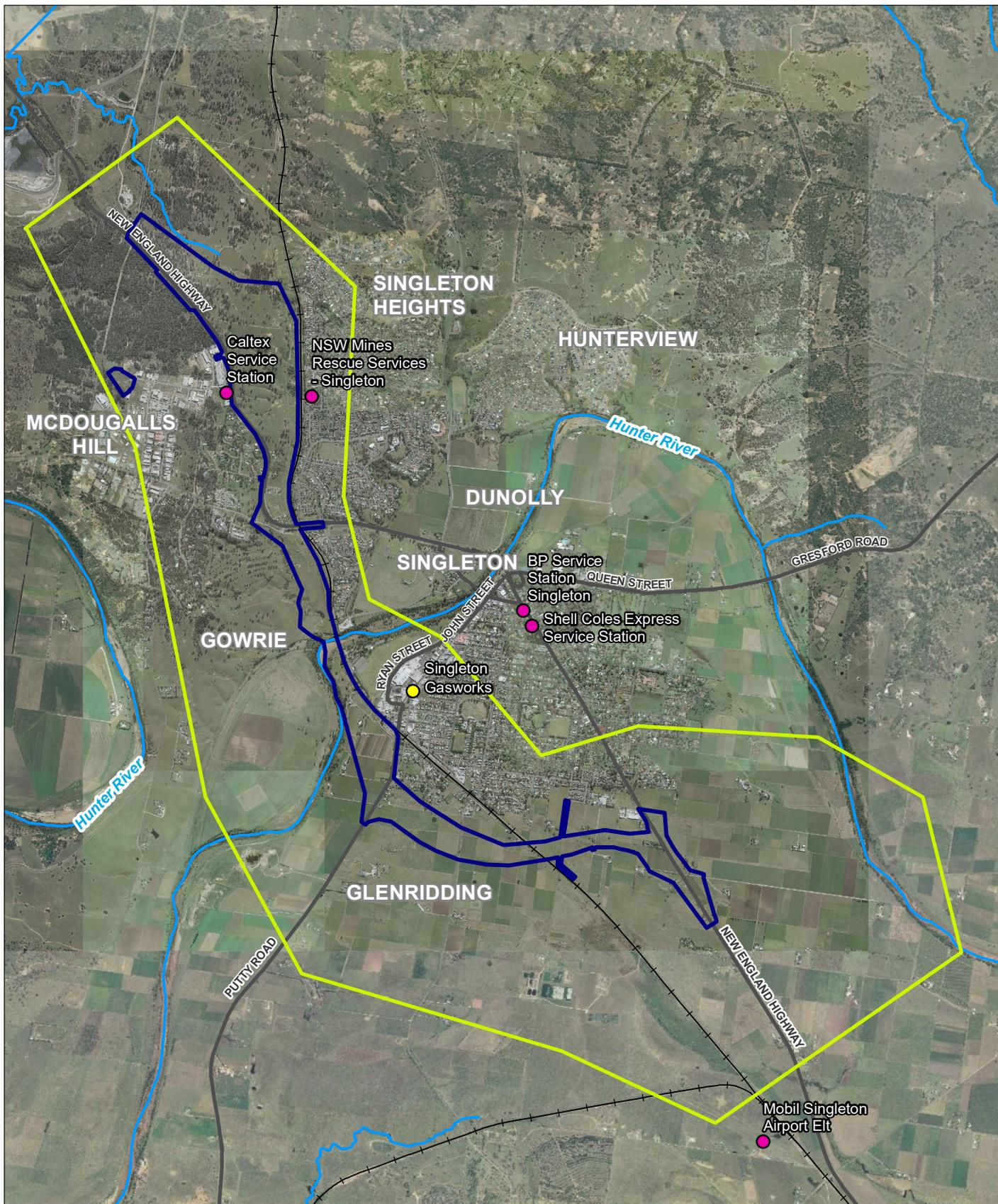


FIG. 4.1 Contaminated sites

Legend

Investigation extents

- Proposal area
- Study area

Contaminated sites

- Contaminated land record site
- Site notified to the EPA

Other features

- State roads
- Watercourse
- + Main North railway line



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4.6 NSW WorkCover Dangerous Goods Search

A NSW WorkCover Dangerous Goods Search was not reviewed as part of this report.

4.7 Summary of Historical Information

Based on the available information the following was observed:

- The study area is predominantly agricultural land use with a combination of pastoral open paddock and market gardens
- The Main Northern Railway Line and New England Highway occurred prior to earliest historical imagery (pre 1963)
- The commercial industrial area of McDougalls Hill did not exist until the 2000s
- Rural residential development began to occur in Singleton Heights during the 1980s
- Commercial development within the northern portion of Singleton did not occur until the 1990s
- The proposal area is not located within an environmental conservation area
- Technical working paper: Historical Archaeological Assessment Report identified Historical heritage items within the proposal area
- The proposal area is not within a mine subsidence district
- The proposal area is restricted by Council and other public authorities because of the likelihood of flooding within the proposal area south of the Hunter River
- The proposal area is not subject to a bio-banking agreement
- The proposal area is not subject to a property vegetation plan
- The Former Singleton Gasworks (EPA Listed site) identified that groundwater is contaminated with petroleum hydrocarbons, PAHs, phenol and ammonia at concentrations exceeding the trigger values for 95% of freshwater ecosystems in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC and ARMCANZ, 2000. Contaminated groundwater has the potential to migrate off-site and have an impact on the Hunter River and the users of the river and regional groundwater
- A search of the Protection of Environment Operations Act 1997 environment protection register did not show any POEO licences located within the proposal area.

5 Site Condition and Surrounding Environment

5.1 Overview

Information provided within the following sections was obtained from the desktop study presented in Section 4.1 to Section 4.7.

5.2 Current and Proposed Land Use

The current land use within the study area includes road, rail, residential, commercial, industrial, wastewater infrastructure and renewable energy infrastructure and agricultural land with rural residential properties. The land use for the proposal would be for the purposes of a road reserve and are likely to be zoned as SP2 Infrastructure – Classified Road subject to a future amendment of the Singleton LEP 2013.

5.3 Site and Surrounding Area Description

As previously mentioned the majority of the site is predominantly agricultural land use. Market Gardens are also located within Section 3 of the proposal area. Agricultural land use including market gardens indicates the potential presence of Organochlorine Pesticides, Herbicides and Polychlorinated biphenyls (PCBs). These contaminants may have been used by past agricultural practices for the purposes of herbicides or insecticide's as part of historical farm management.

In proximity to the study area residential and commercial development occurs within the surrounding suburbs Singleton Heights, Darlington, Gowrie, Maison Dieu and McDougalls Hill.

5.4 Surrounding Land Use

The land uses surrounding the study area can be described as follows:

- North: Rixs Creek Mine which is an operating open cut coal mine that is north of the proposal area
- South: Agricultural (cropping and grazing) activities and the Singleton Military Area
- East: The urban and residential areas of Singleton and Singleton Heights and agricultural land uses in Darlington and Dunolly
- West: Agricultural properties, rural residential townships of Gowrie, McDougalls Hill and Maison Dieu
- The Hunter River traverses the study area in a west to north easterly direction between Singleton and Darlington.

5.5 Topography and Drainage

Information obtained in the Singleton 1:250,000 topographic map (Land and Property Information, 2002) shows that the study area is at an elevation ranging from 40 metres Above Sea Level (ASL) to 100 metres ASL. Predominantly the town of Singleton and the study area south of the town are relatively low lying at approximately 40 metres ASL. Moving northward across the river and towards McDougalls Hill a rising gradient would be encountered that reaches 100 metres ASL on the far northern section of the study area.

5.6 Surface Water and Flood Potential

As previously mentioned the Hunter River flows in a north easterly direction between Singleton and Darlington. North of the Hunter River, surface waters are expected to flow down gradient. While south of the river, water would be expected to flow cross gradient.

The Singleton 1:250,000 topographic map identified an unnamed swamp in the southern portion of the study area. The swamp is west of the railway line with its extent from Singleton Sewerage Treatment Plant and the township of Whittingham.

The study area is also within the flood planning area defined under the Singleton LEP 2013. This is confined to the area south of the Hunter River to the southern extent of the study area.

5.7 Regional Meteorology

Bureau of Meteorology has identified the closest weather station as Singleton Sewerage Treatment Plant (ID: 061397), located approximately one kilometre south of the proposal area. The region experiences hot summers and cold winters, the average maximum temperature in summer (January) is 31.9 degrees Celsius (°C) and the average minimum temperature in winter (August) of 4.1 degrees Celsius (°C). The regional area experiences an annual rainfall of 659 millimetres. On average February experiences the highest rainfall (85.6 millimetres), while in the lowest rainfall occurs in July (25.4 millimetres).

5.8 Geology

The proposal spans over a large distance, therefore being underlain by a few different rock types. According to (Rasmus P.L et al., 1969), the proposal area is underlain by a series of faulted folded sedimentary deposits of the Permian age, generally assigned to the Maitland Group.

The Maitland Group consists of the following identified geological units (in descending geological age):

- Qa – (Quaternary) Gravel, sand, silt clay
- Pmm - Mulbring Sandstone – siltstone and sandstone
- Pmms - Muree Sandstone – sandstone and conglomerate
- Pmb - Branxton Formation – mudstone, sandstone and conglomerate.

To the north-west the Singleton Coal Measures (Ps) overlies the Maitland Group and comprises sandstone, shale, mudstone, conglomerate and coal seams, the latter of which has been historically mined.

The Quaternary rock is associated with the southern section of the study area near the Hunter River that traverses through Singleton. The soils in this area are part of the Hunter Soil Landscape are generally fertile alluvial soils, brown clays, black earths and red podzolic (eSPADE v2, 2017a). The fertile alluvial soils are well suited to cropping and grazing and supports the agricultural activities in the area (DPI, 2013). The northern section of the bypass that intercepts McDougalls Hill is associated with the Sedgefield Soil Landscape and is characterised by yellow soloths, black soloths and yellow solodic soils (eSPADE v2, 2017b).

5.9 Acid Sulfate Soils

A search conducted 4 July 2018, through the NSW Planning Portal website indicated the study area did not contain known acid sulfate soils.

5.10 Hydrogeology

A search was conducted 4 July 2018, through the Water NSW website. The dataset identified up to 55 registered groundwater bores were located within the study area, with thirteen of these bores located within the proposal area. These groundwater bores provided following characteristics:

- One or more recorded purpose of irrigation, domestic, stock, test, monitoring or municipal use
- Final installed depths of groundwater bores were between 4.10 metres to 20.40 metres
- Standing water levels of the groundwater bores within the ranges of 7.30 metres to 14.60 metres.

The information indicates an aquifer is present within and around the proposal area boundaries. A more detailed explanation of the aquifer and groundwater condition in the proposal area is provided in Section 3.4 of the Singleton bypass Surface and Groundwater Technical working paper (AECOM, 2019) Available information on these monitoring wells is provided in Appendix B.

5.11 Per and Poly Fluoro Alkyl Substances

The EPA is investigating the Singleton Heights Mines Rescue Services (within the study area) and Singleton Military Area (around 500 metres outside of the southern section of the study area) for potential per- and poly-fluoroalkyl substances (PFAS) contamination. The EPA is collecting samples of soils and/or water for analysis for PFAS and reviewing exposure pathways that may increase people's contact with the chemicals, such as bore and surface water usage.

The Department of Defence has undertaken an investigation into the potential presence of PFAS at Singleton Military Area (publicly available on the EPA website). A number of unregistered bores were sampled, including two bores in the southern section of the study area. PFAS concentrations in the two bores were below the NEPM drinking water and recreational use guidelines. Refer to Singleton bypass Surface and groundwater assessment (AECOM, 2019) for further information.

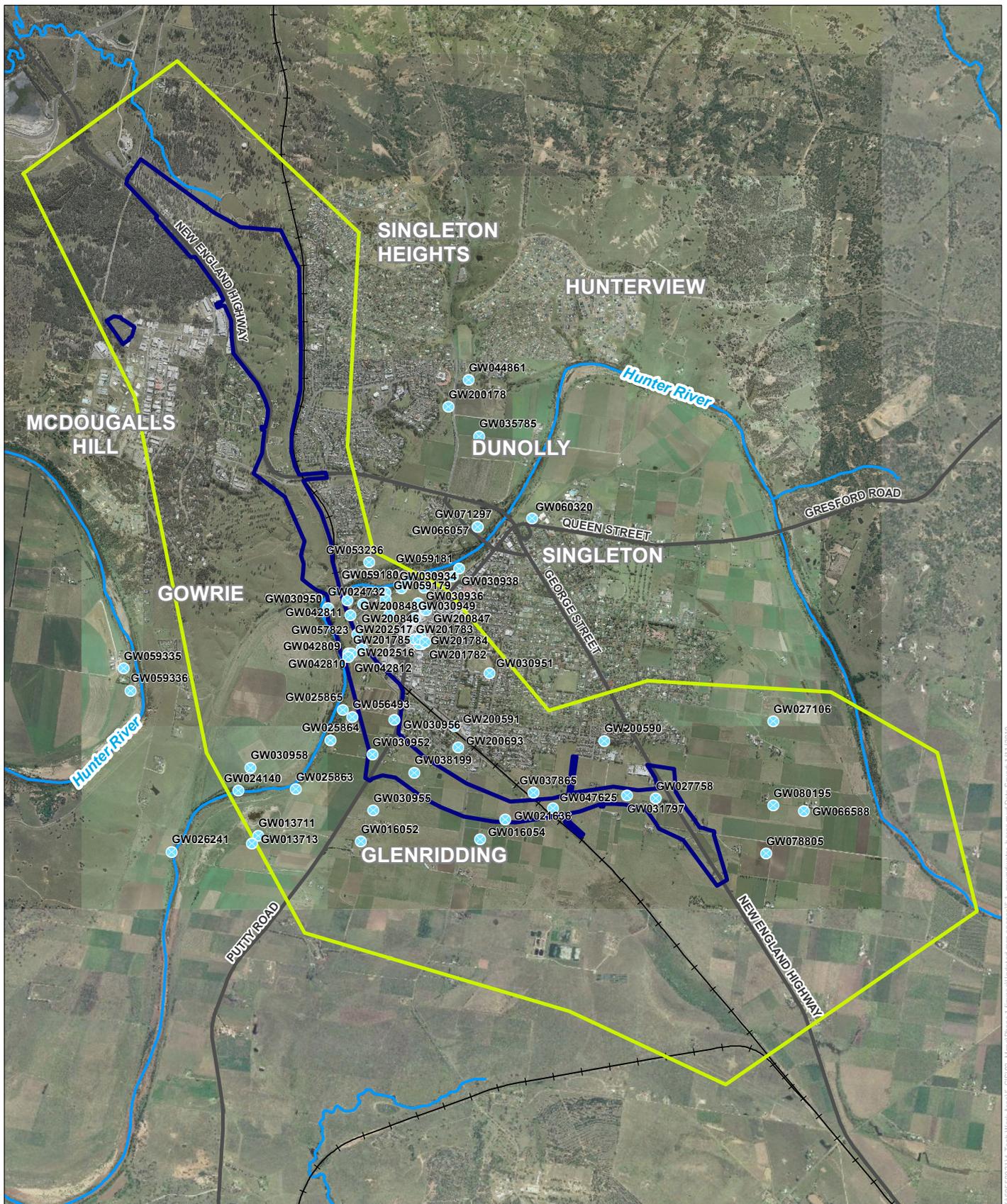


FIG. 5.1 Groundwater bores

Legend

Investigation extents

— Proposal area

▭ Study area

Points of interest

• Groundwater bores

Other features

— State roads

— Watercourse

— Main North railway line



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6 Preliminary Conceptual Site Model

6.1 General

A Conceptual Site Model (CSM) is a site specific qualitative description of the source(s) of contamination, the pathway(s) by which contaminants may migrate through the environmental media, and the populations (human or ecological) that may potentially be exposed. This relationship is commonly known as Source-Pathway-Receptor (SPR) linkage. Where one or more elements of the SPR linkage are missing, the exposure pathway is considered to be incomplete and no further assessment is required. Equally, where a complete pollution linkage is identified for a particular source of contamination, further assessment of actual or potential risk is required to understand the need for remediation or management of unacceptable concentrations of contamination.

6.2 Preliminary Contamination Conceptual Site Model

The preliminary contamination CSM for the proposal area has been considered in its current and proposed ongoing agricultural and public infrastructure use. The surrounding study area was also considered to potentially factor in existing commercial/ industrial uses which may have direct or indirect effects to the proposal area. The preliminary contamination CSM is presented below.

6.2.1 Potential Sources of Contamination

The following potential areas of environmental concern (AEC) for the Study area were identified as:

- Rix's Creek Mine (multiple Lots & DPs) to the north of the proposal area
- Heavy machinery and equipment maintenance businesses potentially storing fuels and chemicals adjacent to the proposal area in the north and west (Maitland Diesel Service – Singleton Branch: Lot 10 DP 1187455 and Complete Parts and Equipment Solutions: Lots 3001 & 3002 DP 1220756)
- Motor vehicle servicing and sales businesses adjacent to the proposal area (in the north west and south east) potentially storing fuels and chemicals, (Singleton Toyota: Lot 148 DP1124114 and Lancaster Motor Group: Lot 3 DP 119857)
- New England Highway and additional collector roads which connect throughout the study area
- Caltex Service Station (Lots 1 & 2 DP 1123389) adjacent to the proposal area in the north west storing fuel
- Main Northern Railway Line which traverses the southern portion and the eastern boundary of the Study area
- Fill comprising potential asbestos containing material and a water main lined with potential asbestos, within the rail corridor in the north-east portion of the Study area
- Mines Rescue Station in the north-east in proximity to Section 2 of the proposal area (Lot 501 DP 261606)
- Concrete batch plant adjacent to the proposal area in the east boundary (Lot 461 DP 1183023)
- NSW EPA Contaminated site former Singleton Gasworks which has been identified as a site declared for remediation located east of proposal area near Section 3. Contaminated groundwater with petroleum hydrocarbons, PAHs, phenol and ammonia has the potential to migrate within the study area (Lot 1 DP 81369 and Lot 1 DP 90228).
- Roads and Maritime Singleton Maintenance Depot west of the proposal area which stores fuels and chemicals and may potentially store waste spoil (Lot 121 DP 568985)
- Market Gardens within the proposal area, north of Putty Road, which may potentially store chemicals and fuels (from machinery refuelling and maintenance) (Lot 1 DP 999044, Lots 2 & 3 DP 1108792, Lot 31 DP 1108474, Lot 4 DP 82024, Lots 1, 2 & 3 DP 1108912, Lot 11A DP DP3700, Lot 1 DP 8695)

- Excess nutrient and microbial loading in the subsurface environment from evaporation ponds within Singleton Sewerage Treatment Plant located south of the proposal area (Lot 1 DP430134, Lot 2 DP547967, Lot 2 DP 430134, Lot 22 DP 733353, Lot 3 DP746156 and Lot 2 DP 1207737)
- Historical storage and use of unknown chemicals/fuels in the operational Singleton Sewerage Treatment Plant
- Agricultural land use, including pastoral land
- Houses and buildings within the proposal area potentially containing asbestos.

Potential sources of contamination are shown on Figure 6.1

6.2.2 Contaminants of potential concern (CoPC)

Based on the AECs identified above, the contaminants of potential concern (CoPC) associated with the above sources are as follows:

- Total Recoverable Hydrocarbons (TRH) – present in fuels, solvents and oils etc., within:
 - Heavy machinery and equipment maintenance businesses (Maitland Diesel Service and Complete Parts and Equipment Solutions)
 - Motor vehicle servicing and sales businesses (Singleton Toyota and Lancaster Motor Group)
 - Associated from residual spills on the New England Highway and associated collector roads
 - Caltex service station
 - Main Northern Railway Line and associated rail corridor
 - Existing New England Highway and associated collector roads
 - Concrete Batch plant
 - Hunter Valley Mines Rescue Station
 - Former Singleton Gasworks
 - Former Water Pumping Station
 - Agricultural land
 - Market gardens
 - Waste material from Roads and Maritime Singleton Maintenance Office compound and fuel storage
 - Storage and use during operations at Singleton Sewerage Treatment Plant.
- Polycyclic Aromatic Hydrocarbons (PAHs) – related to some waste and lubricating oils and potentially uncontrolled fill material within:
 - Heavy machinery and equipment maintenance businesses (Maitland Diesel Service and Complete Parts and Equipment Solutions)
 - Motor vehicle servicing and sales businesses (Singleton Toyota and Lancaster Motor Group)
 - Associated from residual spills on the New England Highway and associated collector roads
 - Caltex service station
 - Hunter Valley Mines Rescue Station
 - Rixs Creek Mine.
- Benzo(a)pyrene Toxic Equivalence Quotient (BaPTEQ) – TRH within bitumen.
 - New England Highway and associated collector roads
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) – present in fuel, oils, gas, paints and lacquers, thinners, rubber products and adhesives including potentially uncontrolled fill material within:
 - Heavy machinery and equipment maintenance businesses (Maitland Diesel Service and Complete Parts and Equipment Solutions)
 - Motor vehicle servicing and sales businesses (Singleton Toyota and Lancaster Motor Group)
 - Associated from emissions of vehicles on the New England Highway and collector roads
 - Caltex service station
 - Main Northern Railway Line and associated rail corridor

- Concrete Batch plant
- Hunter Valley Mines Rescue Station
- Former Singleton Gasworks
- Former Water Pumping Station
- Agricultural pastoral land
- Market gardens
- Waste material from Roads and Maritime Singleton Maintenance Office compound and fuel storage
- Storage and use during operations at Singleton Sewerage Treatment Plant.
- Phenols present within coal tar and fuel:
 - Heavy machinery and equipment maintenance businesses (Maitland Diesel Service and Complete Parts and Equipment Solutions)
 - Motor vehicle servicing and sales businesses (Singleton Toyota and Lancaster Motor Group)
 - Associated from residual spills on the New England Highway and associated collector roads
 - Caltex service station
 - Concrete batch plant
 - Former Water Pumping Station
 - Agricultural land
 - Market gardens
 - Waste material from Roads and Maritime Singleton Maintenance Office compound and fuel storage
 - Storage and use during operations at Singleton Sewerage Treatment Plant.
- Asbestos – includes asbestos containing material (ACM) from uncontrolled fill:
 - Main Northern Railway Line
 - Concrete batch plant
 - Current and former rail corridor in Section 1 has potential ACM within uncontrolled fill and potentially lined within sub-surface water main
 - Former Water Pumping Station,
 - Sheds and buildings associated with rural residential properties and agricultural land
- Heavy Metals (in particular lead, cadmium, chromium, zinc, copper, mercury) and other inorganics (e.g. cyanides and ammonia) –within the proposal area and from potentially uncontrolled fill material;
 - Former Singleton Gasworks
 - Concrete batch plant
 - Heavy machinery and equipment maintenance businesses (Maitland Diesel Service and Complete Parts and Equipment Solutions)
 - Motor vehicle servicing and sales businesses (Singleton Toyota and Lancaster Motor Group)
 - Associated from residual spills on the New England Highway and associated collector roads
 - Caltex service station
 - Hunter Valley Mines Rescue Station
 - Former Water Pumping Station
 - Agricultural pastoral land
 - Market Gardens
 - Waste material from Roads and Maritime Singleton Maintenance Depot and fuel storage
 - Storage and use during operations at Singleton Sewerage Treatment Plant.
- Potential coal tar presence from bitumen associated from the New England Highway and associated collector roads
- Ammonia presence in groundwater migration from the former Singleton Gasworks
- Organochlorine Pesticides, Herbicides and Polychlorinated biphenyls (PCBs) from agricultural activities
- PFAS associated with the Singleton Heights Mines Rescue Station

- Nutrients and Microbial contaminants migrating from Singleton Sewage Treatment Plant south of the proposal area.

6.2.3 Potential Receptors

This Phase 1 Assessment provides a broad scale approach to determine potential human receptors that may be affected by potential contamination within the study area. The following potential human receptors have been identified for potential contamination exposure:

- Staff and visitors of the site, including sub-surface maintenance workers/users and construction workers for the Singleton Bypass
- General public commuters using the New England Highway and surrounding public roads
- General public commuters using the Singleton Bypass upon its operation
- General public commuters accessing Singleton Train Station during the construction of the Singleton Bypass
- Adjacent site users and visitors accessing the proposal area prior to construction
- Recreational users of Rose Point Park, Hunter River and the surrounding public area
- Workers and visitors of Singleton Sewerage Treatment Plant
- Workers and customers within the commercial business district and industrial areas of Singleton and McDougalls Hill
- Agricultural industry utilising land adjacent to the proposal area for market gardens and pastoral use
- Groundwater users
- Surrounding residential properties exposing soil for landscaping and vegetable gardens.

The following potential environmental receptors have been identified:

- Surface water, including the Hunter River
- Groundwater, which has variable depth beneath the proposal area (available data from Water NSW indicates standing water depths of between 7.30 metres to 14.60 metres)
- Native vegetation and wildlife
- Agricultural land.

6.2.4 Potential Pathways and Pollutant Linkages

The following potential contamination migration pathways between sources and receptors are identified as:

- Direct contact (dermal, oral ingestion or inhalation) of contaminated soil/soil dust particularly during maintenance or construction activities
- Direct contact with shallow contaminated groundwater during maintenance and or construction activities
- Potable users of groundwater
- Surface water runoff, potentially mobilising any contaminants on the surface or in soil towards sensitive water bodies
- Possible leaching and off-site migration of mobile contaminants from soils to groundwater beneath the study area which may be encouraged by any disturbance of the surface of the proposal area during maintenance or construction activities
- Vapour inhalation of volatile contaminants in the soil or groundwater phase from on-site or up-gradient sources
- Ingestion of contaminated water for potable water users.

6.2.5 CSM Data Gaps

There is currently no data available to complete a thorough assessment of the concentrations of CoPC within the boundary of the proposal area.

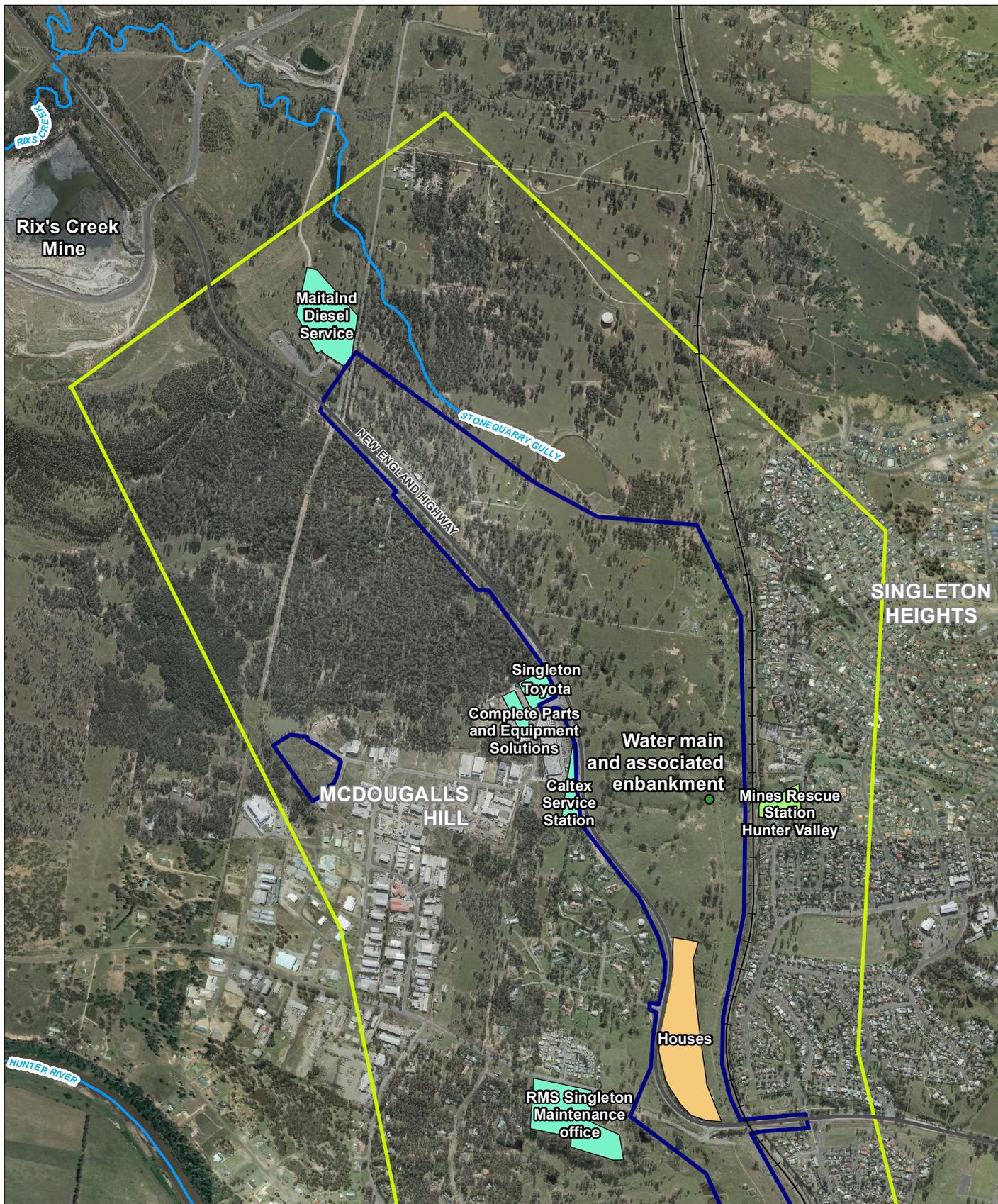


Fig. 6.1 Potential sources of contamination



0 250 500 Meters



Legend

Investigation extents

- Proposal area
- Study area

Potential contamination

- Asbestos Containing Material
- Singleton Sewage Treatment Plant
- Singleton Gas Works
- Concrete batching plant
- Potential PFAS

- Automotive, fuels and heavy machinery
- Isolated Asbestos Containing Material

Other features

- State roads
- Watercourse
- Main North railway line

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Fig. 6.1 Potential sources of contamination



Legend

Investigation extents

- Proposal area
- Study area

Potential contamination

- Asbestos Containing Material
- Singleton Sewage Treatment Plant
- Singleton Gas Works
- Concrete batching plant
- Potential PFAS

- Automotive, fuels and heavy machinery
- Isolated Asbestos Containing Material

Other features

- State roads
- Watercourse
- |— Main North railway line

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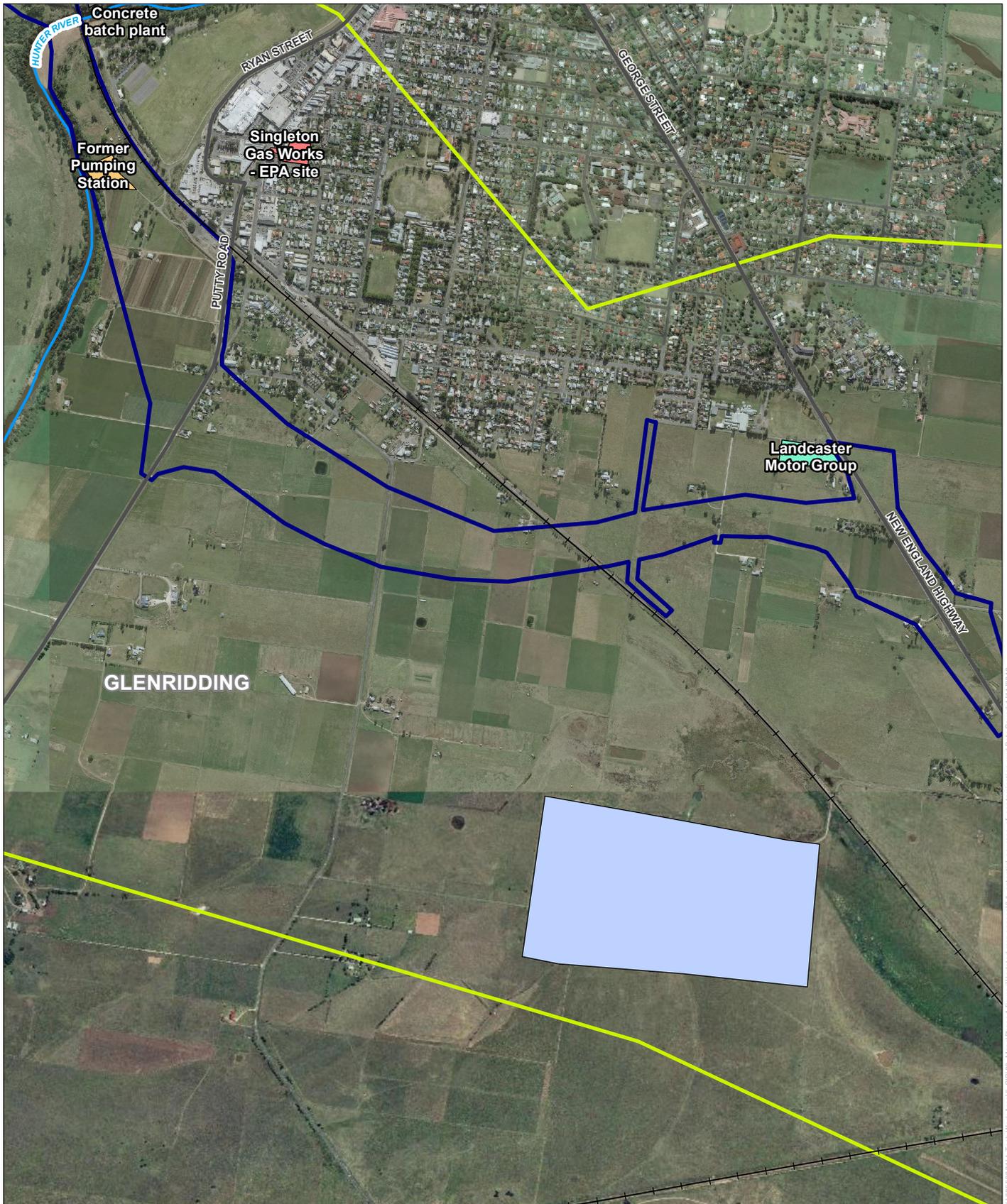


Fig. 6.1 Potential sources of contamination

Legend

Investigation extents

- Proposal area
- Study area

Potential contamination

- Asbestos Containing Material
- Singleton Sewage Treatment Plant
- Singleton Gas Works
- Concrete batching plant
- Potential PFAS

- Automotive, fuels and heavy machinery
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Fig. 6.1 Potential sources of contamination



Legend

Investigation extents

- Proposal area
- Study area

Potential contamination

- Asbestos Containing Material
- Singleton Sewage Treatment Plant
- Singleton Gas Works
- Concrete batching plant
- Potential PFAS

- Automotive, fuels and heavy machinery
- Isolated Asbestos Containing Material

Other features

- State roads
- Watercourse
- |— Main North railway line

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K:\026\883114_Tech Work Area\5_25102_Map\Phase 1 Figure 6.1 Potential sources of contamination.mxd Date Saved: 11/11/2019

7 Conclusions and Recommendations

7.1 Conclusions

7.1.1 General

The objective of the Phase 1 Site Contamination Assessment review was to conduct a preliminary desktop site based investigation of potential contamination of the study area.

The following key information was obtained from the review of available historical information:

- The study area is predominantly agricultural land use with a combination of pastoral open paddock and market gardens
- The Main Northern Railway Line and New England Highway occurred prior to earliest historical imagery (pre 1963)
- The commercial industrial area of McDougalls Hill was not existent until 2000s
- Rural residential development began to occur in Singleton Heights during the 1980s
- Commercial development within the northern portion of Singleton did not occur until the 1990s
- The land does not include or comprise critical habitat
- The land is not an environmental conservation area
- The land within the northern portion of the proposal area (located south of Maison Dieu Road to north of the Hunter River), is currently zoned R1 General Residential and RE2 Private Recreation
- The Stage 2 PACHCI Aboriginal Archaeological Survey Report identified Aboriginal heritage items from the Aboriginal Heritage Management Systems (AHIMS) and during field investigations within the land
- Technical working paper: Historical Archaeological Assessment Report identified Historical heritage items within the land
- The land is not within a mine subsidence district
- The land is restricted by Council and other public authorities because of the likelihood of flooding within the proposal area south of the Hunter River
- The land is not subject to a bio-banking agreement
- The land is not subject to a property vegetation plan
- The Former Singleton Gasworks (EPA Listed site) some 300 metres up-gradient from the Study area identified groundwater is contaminated with petroleum hydrocarbons, PAHs, phenol and ammonia at concentrations exceeding the trigger values for 95% of freshwater ecosystems in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC and ARMCANZ, 2000. Contaminated groundwater has the potential to migrate off-site and have an impact on the Hunter River and the users of the river and regional groundwater
- A search of the Protection of Environment Operations Act 1997 environment protection register did not show any POEO licences located within the proposal area.

7.1.2 Tier 1 Qualitative Risk Assessment

Tier 1 Assessment Method

A Tier 1 qualitative assessment was conducted utilising the methodology outlined within in Schedule B2 of the NEPM. This involves preliminary risk screening of existing data and the development of a preliminary Conceptual Site Model (refer to Section 6.2). The CSM identified:

- Potential sources of contamination
- Pathways that contamination could potentially come into contact with humans and the environment (e.g. dermal contact, ingestion of soil, inhalation of dust)

- Receptors (e.g. potential worker exposure during redevelopment of the site, residents potentially eating vegetables grown within contaminated soil).

Tier 1 Assessment Outcome

Overall, based on the above information it is considered that there is a moderate risk of potential contamination from a range of potential contaminants and sources (refer Section 6.2) associated with the study area that may present an unacceptable risk to human health and/or the environment. These identified CoPC are:

- Total Recoverable Hydrocarbons (TRH) – present in fuels, solvents and oils etc
- Polycyclic Aromatic Hydrocarbons (PAHs) – related to some waste and lubricating oils and potentially uncontrolled fill material
- Benzo(a)pyrene Toxic Equivalence Quotient (BaPTEQ) – TRH within bitumen
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) – present in fuel, oils, gas, paints and lacquers, thinners, rubber products and adhesives including potentially uncontrolled fill material
- Phenols present within coal tar and fuel
- Asbestos – includes asbestos containing material (ACM) from uncontrolled fill
- Heavy Metals (in particular lead, cadmium, chromium, zinc, copper, mercury) and other inorganics (e.g. cyanides and ammonia) –within the proposal area and from potentially uncontrolled fill material
- Potential coal tar presence from bitumen associated from the New England Highway and associated collector roads
- Ammonia presence in groundwater migration from the former Singleton Gasworks
- Organochlorine Pesticides, Herbicides and Polychlorinated biphenyls (PCBs) from agricultural activities
- PFAS associated with the Singleton Heights Mines Rescue Station
- Nutrients and Microbial contaminants migrating from Singleton Sewage Treatment Plant south of the proposal area.

Specifically it was found that there were multiple potential pathways for contaminants to reach humans and the environment as detailed in Section 6.2.4.

7.1.3 Summary of findings

Based on the findings of our investigation, AECOM identifies evidence of potential contamination from various sources within the study area. Locations identified as potentially containing contamination include Market Gardens, pastoral lands, potential for contaminants within the existing New England Highway and associated collector roads, Main Northern Railway Line and, existing buildings and historical structures which may contain potential asbestos containing material (ACM).

During geotechnical investigations it was observed the northern portion of the proposal area may contain ACM within fill material and in situ pipeline within the rail corridor.

It was further noted additional potential contamination sources were in close proximity to the proposal area which included car sales and servicing businesses, heavy machinery sales and servicing businesses, a concrete batch plant, a former gasworks, mines rescue centre, coal mine and a sewerage treatment plant.

7.2 Recommendations

It is recommended that a contaminated lands unexpected finds procedure be developed as part of the construction environmental management plan (CEMP) for the proposal and implemented during the construction phase.

If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. This may include but not be limited to:

- Diversion of surface runoff
- Capture of any contaminated runoff
- Temporary capping.

All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or the EPA.

To manage the potential to encounter and impact on ACM within the proposal area, an Asbestos Management Plan will be developed and implemented. The plan will include:

- Identification of potential asbestos on site
- Procedures to manage and handle any asbestos
- Mitigation measures if asbestos is encountered during construction
- Procedures for disposal of asbestos in accordance with NSW EPA guidelines, Australian Standards and relevant industry codes of practice.

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Appendix A

Historical Aerial Photography



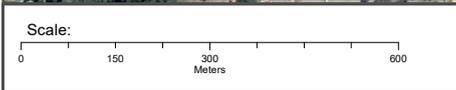
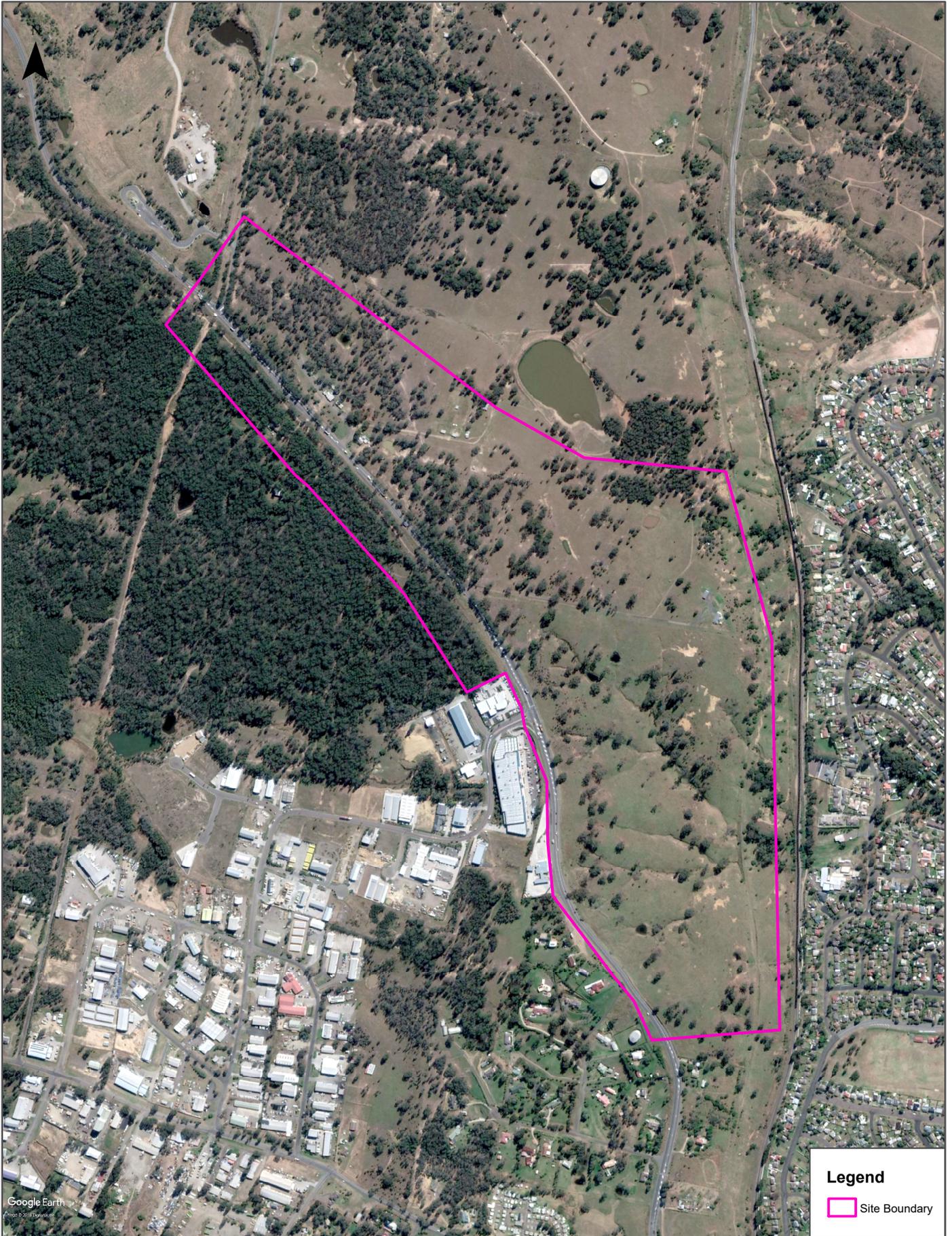
Aerial Imagery Report

Singleton Bypass Concept Design and Environmental Assessment (Section 1)

Report Date: 20 February 2018

Aerial Imagery 2017

Singleton Bypass Concept Design and Environmental Assessment (Section 1)



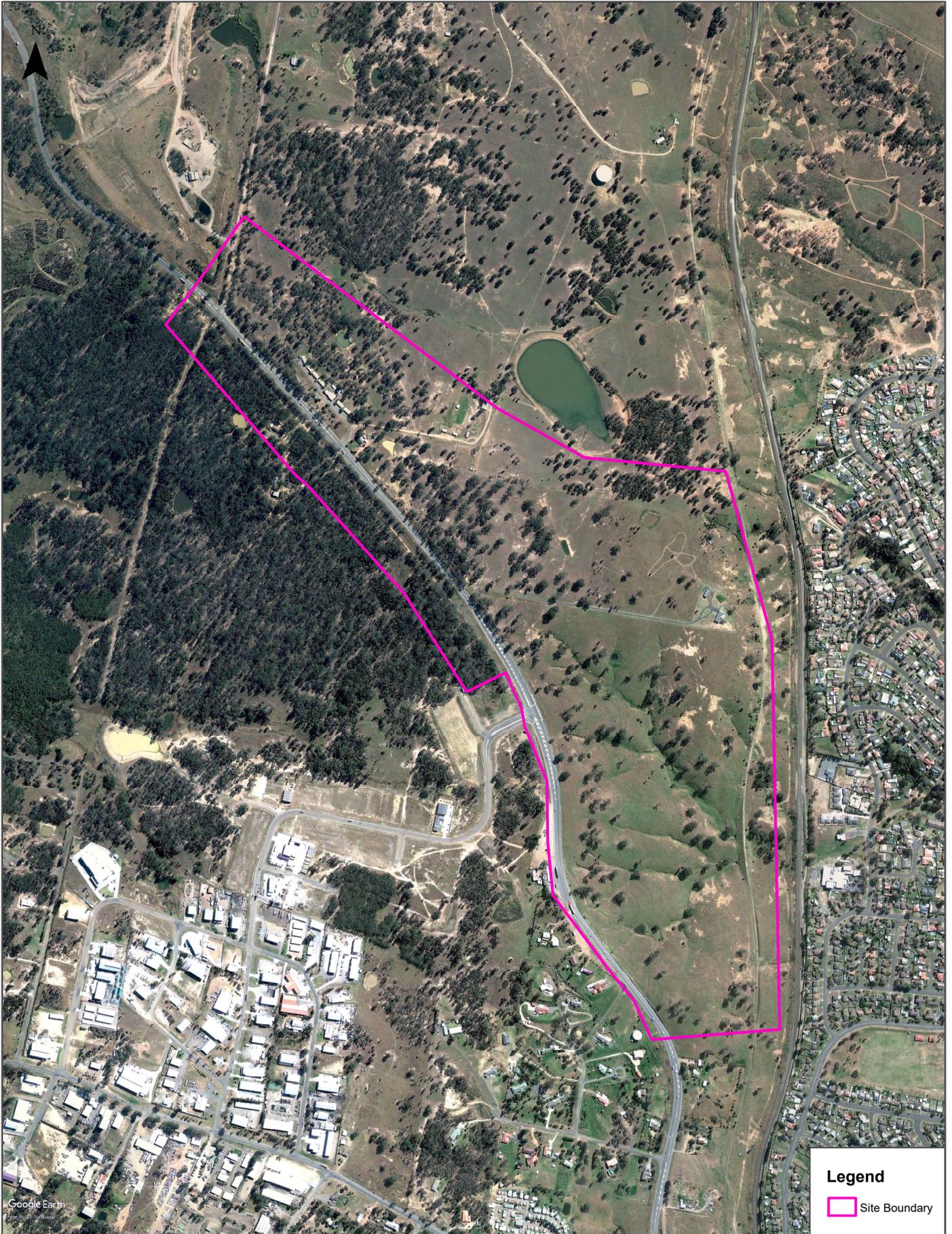
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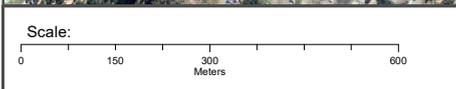
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Aerial Imagery 2009

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Legend
[Pink line symbol] Site Boundary



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Scale:

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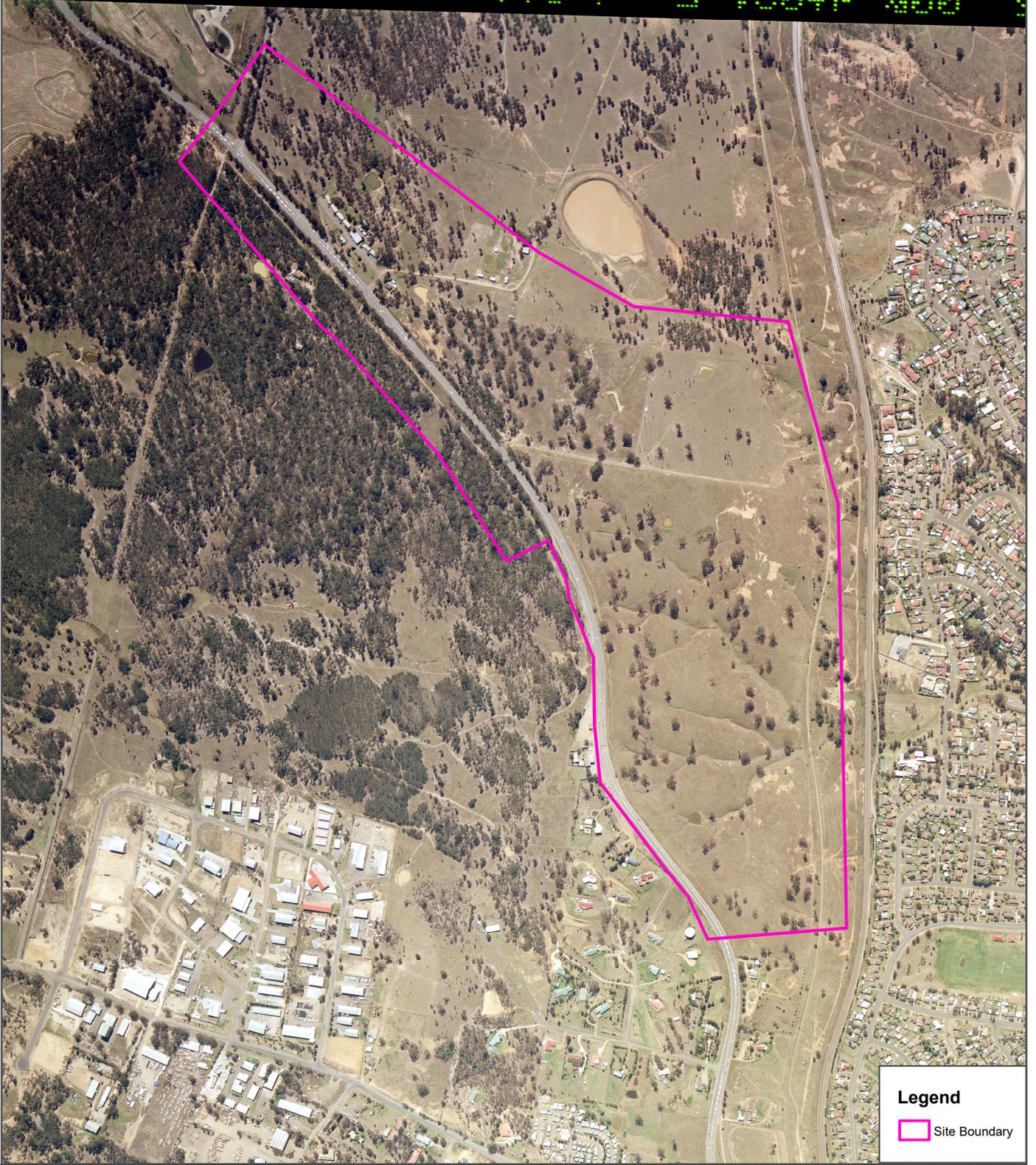
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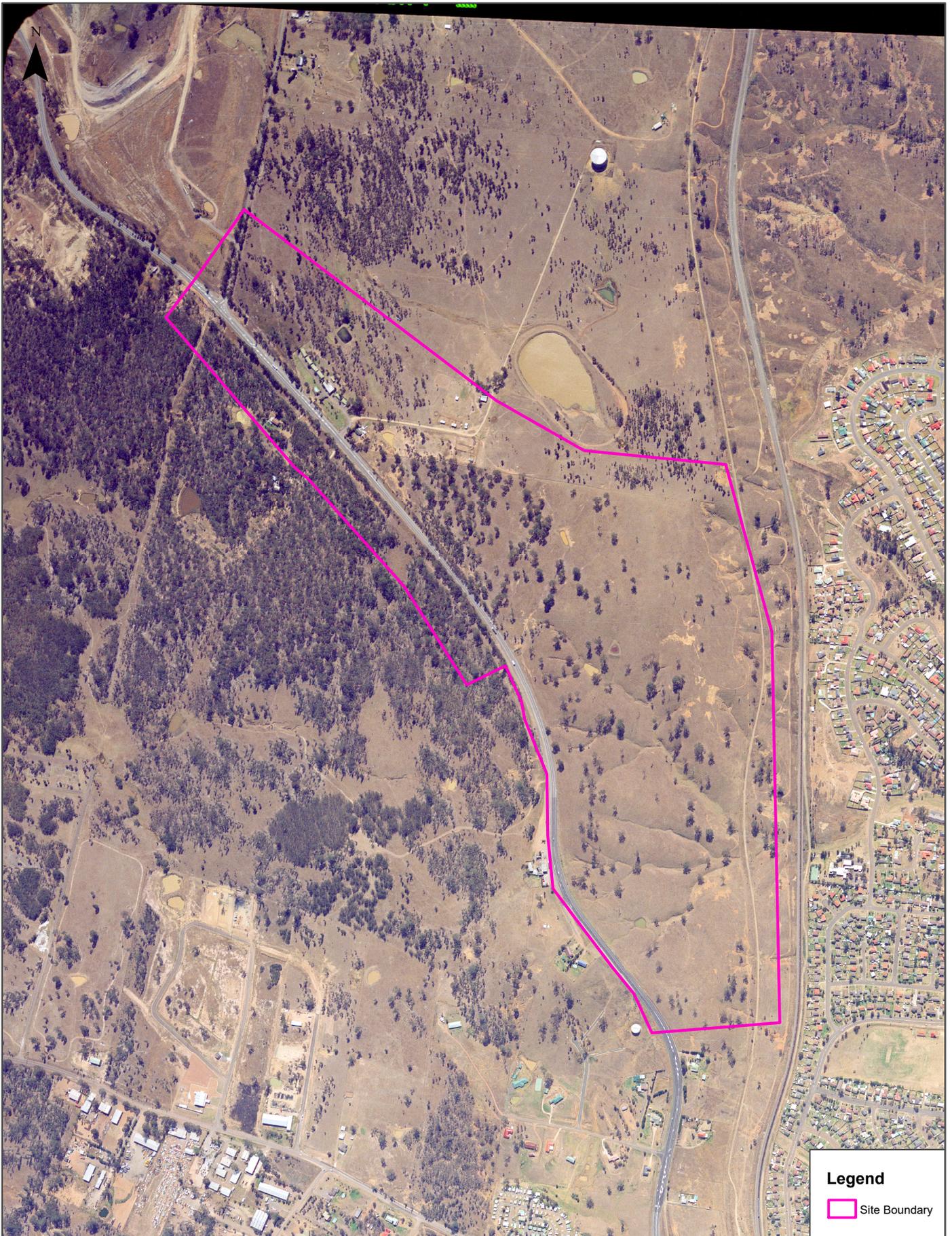
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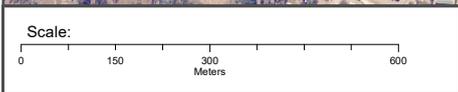
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Singleton Bypass Concept Design and Environmental Assessment (Section 1)



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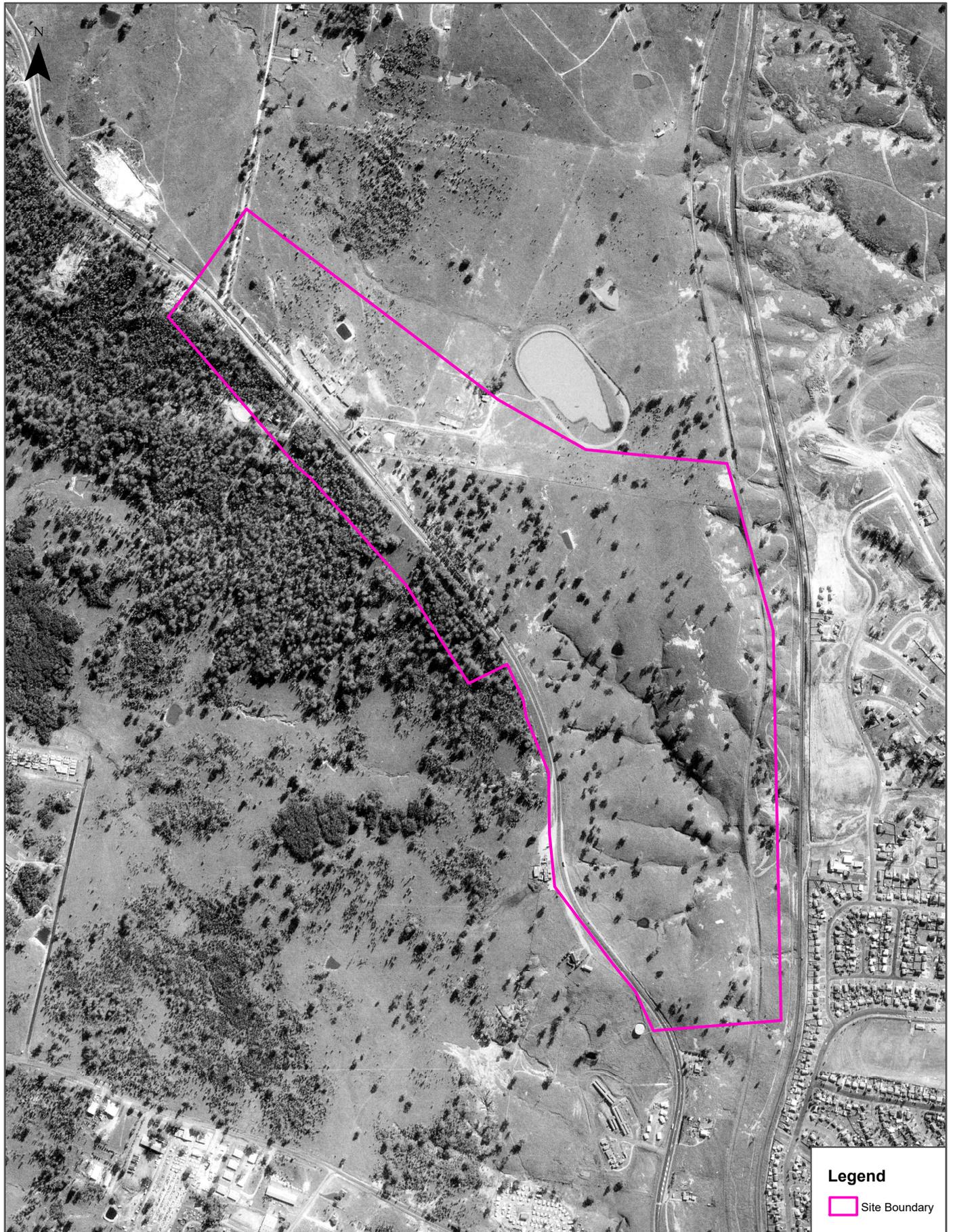
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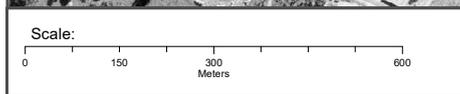
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Singleton Bypass Concept Design and Environmental Assessment (Section 1)



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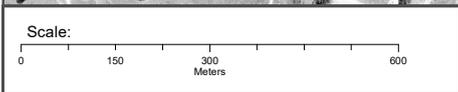
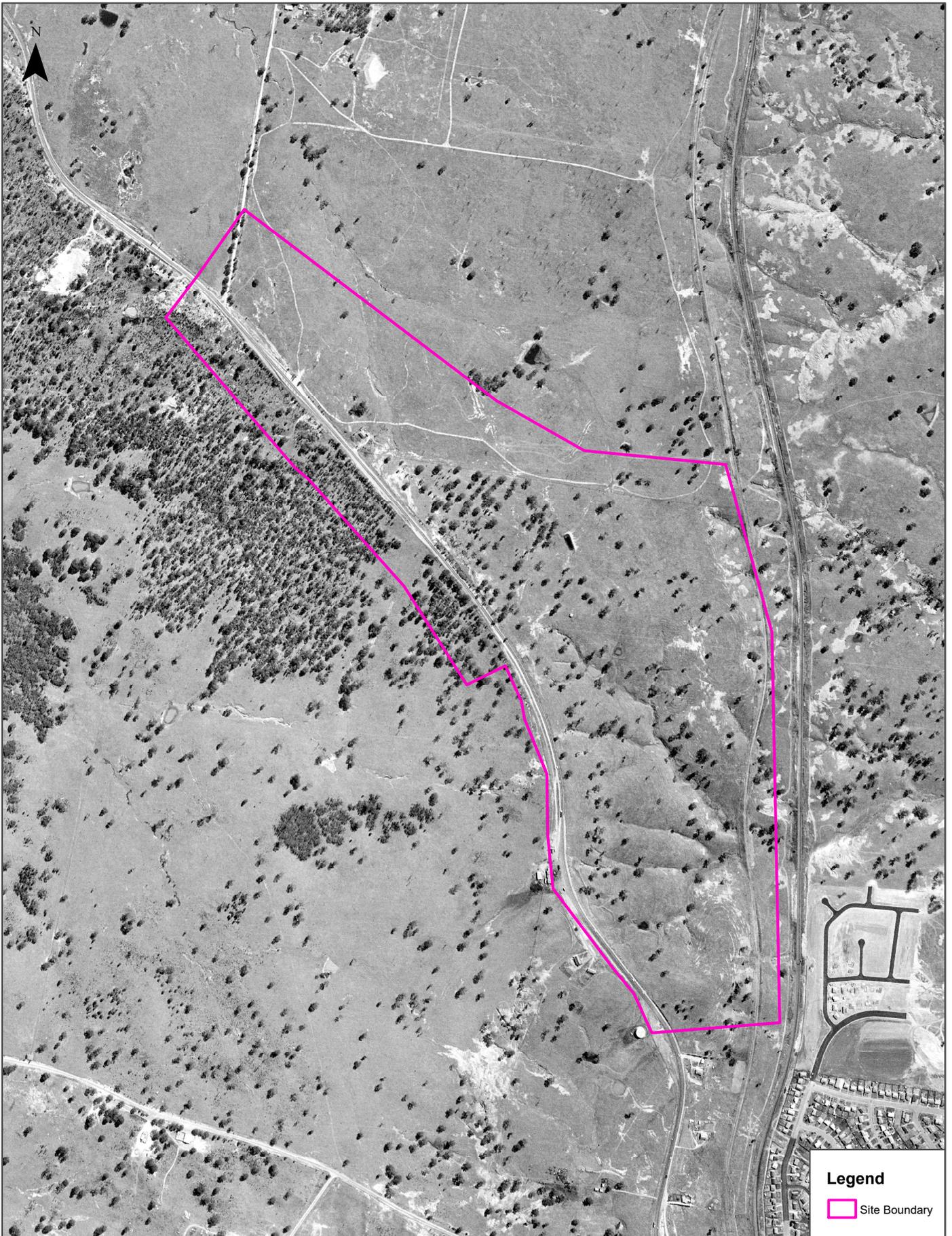
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Aerial Imagery 1975

Singleton Bypass Concept Design and Environmental Assessment (Section 1)



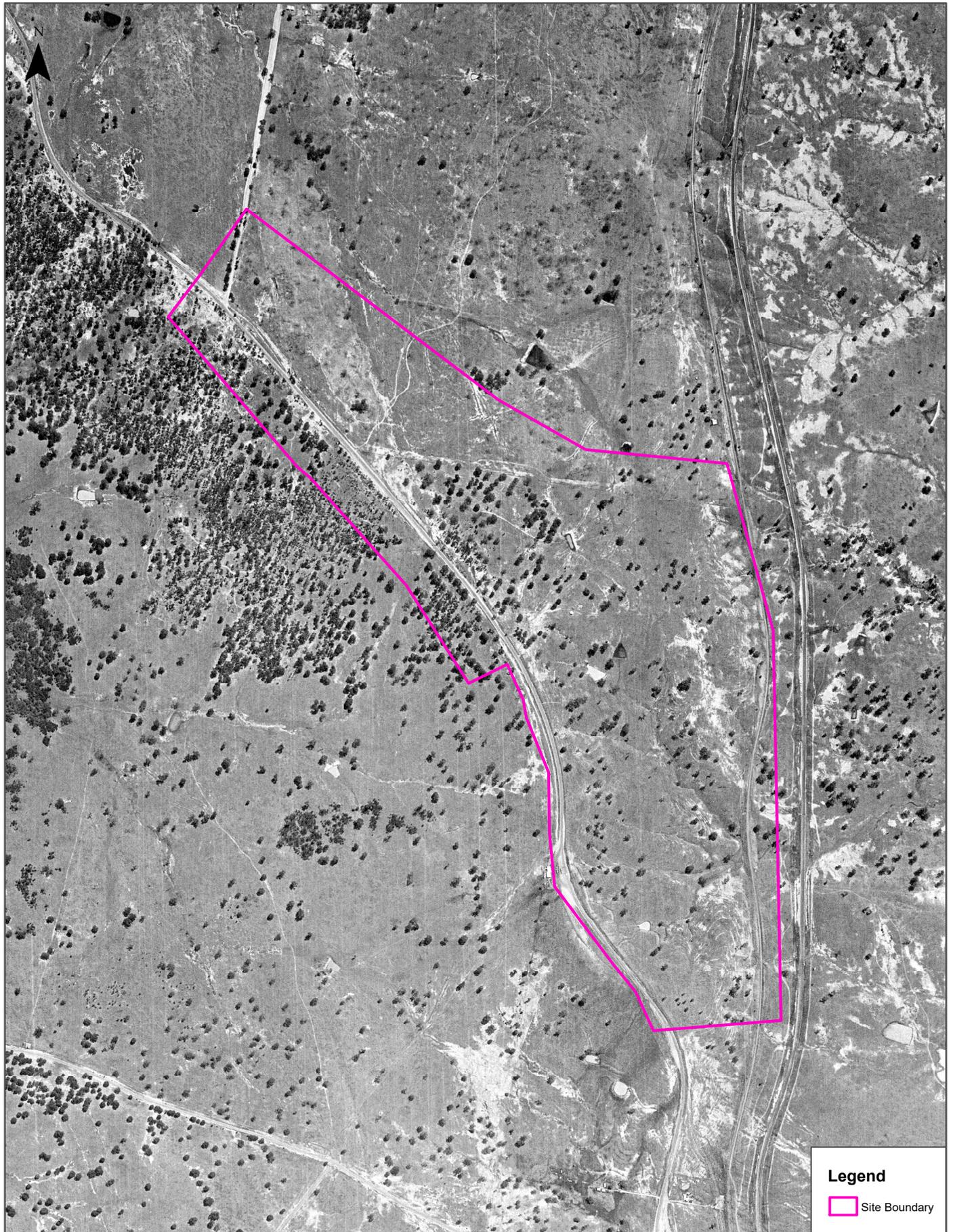
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Aerial Imagery 1963

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Legend

-  Site Boundary

Scale:



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Meters

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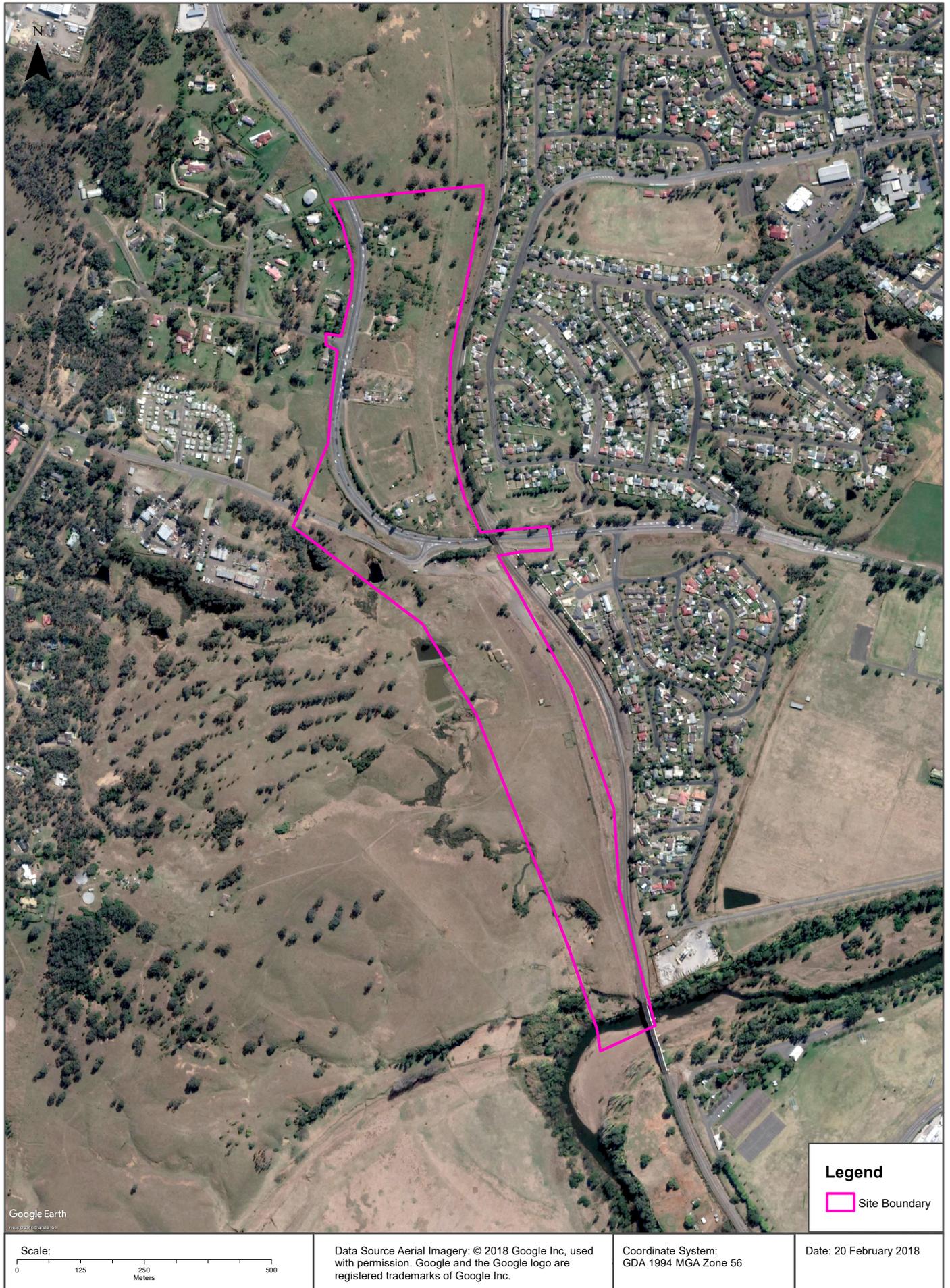
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Report Date: 20 February 2018

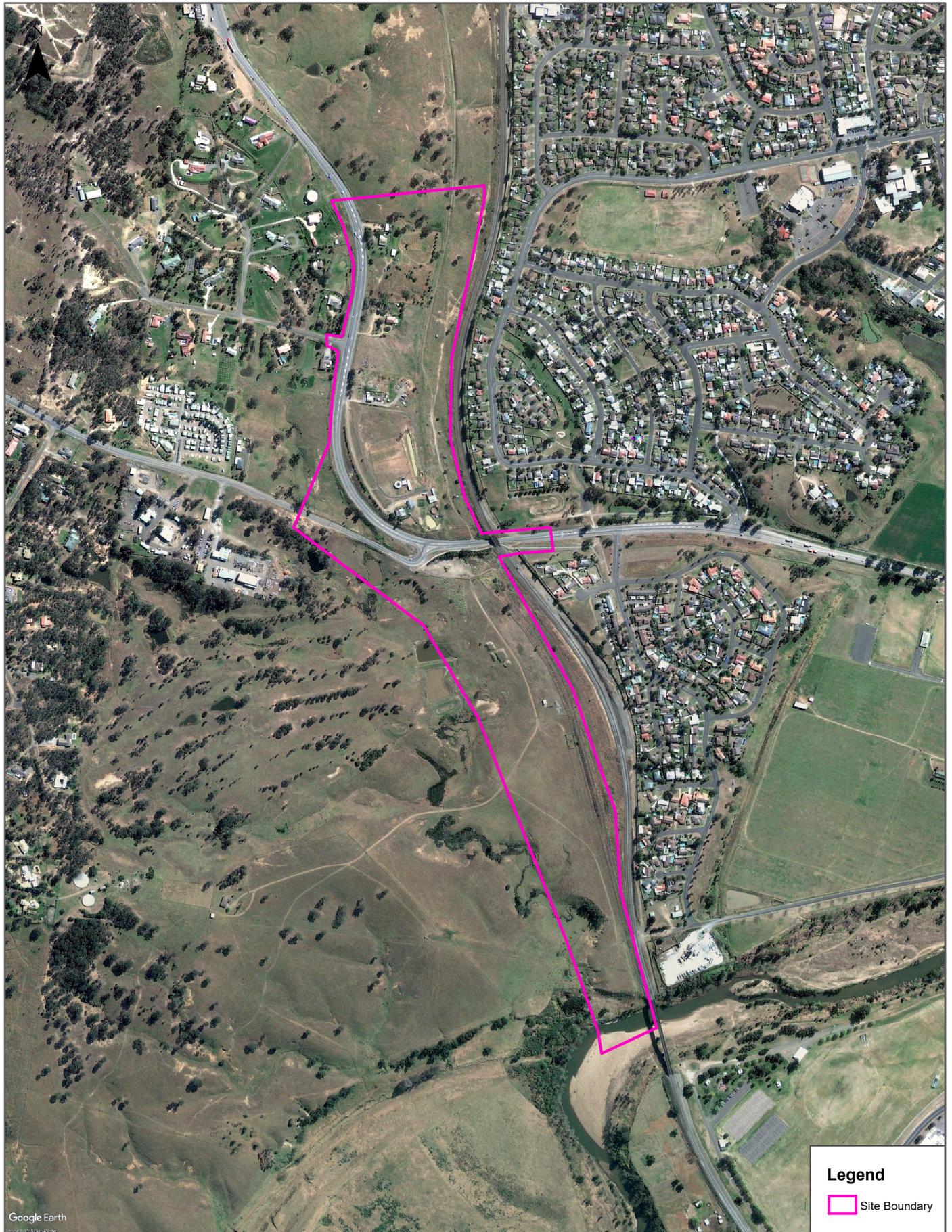
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Aerial Imagery 2009

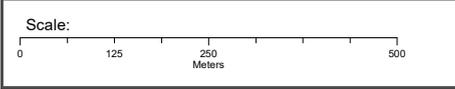
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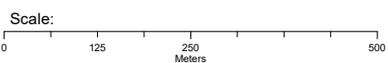
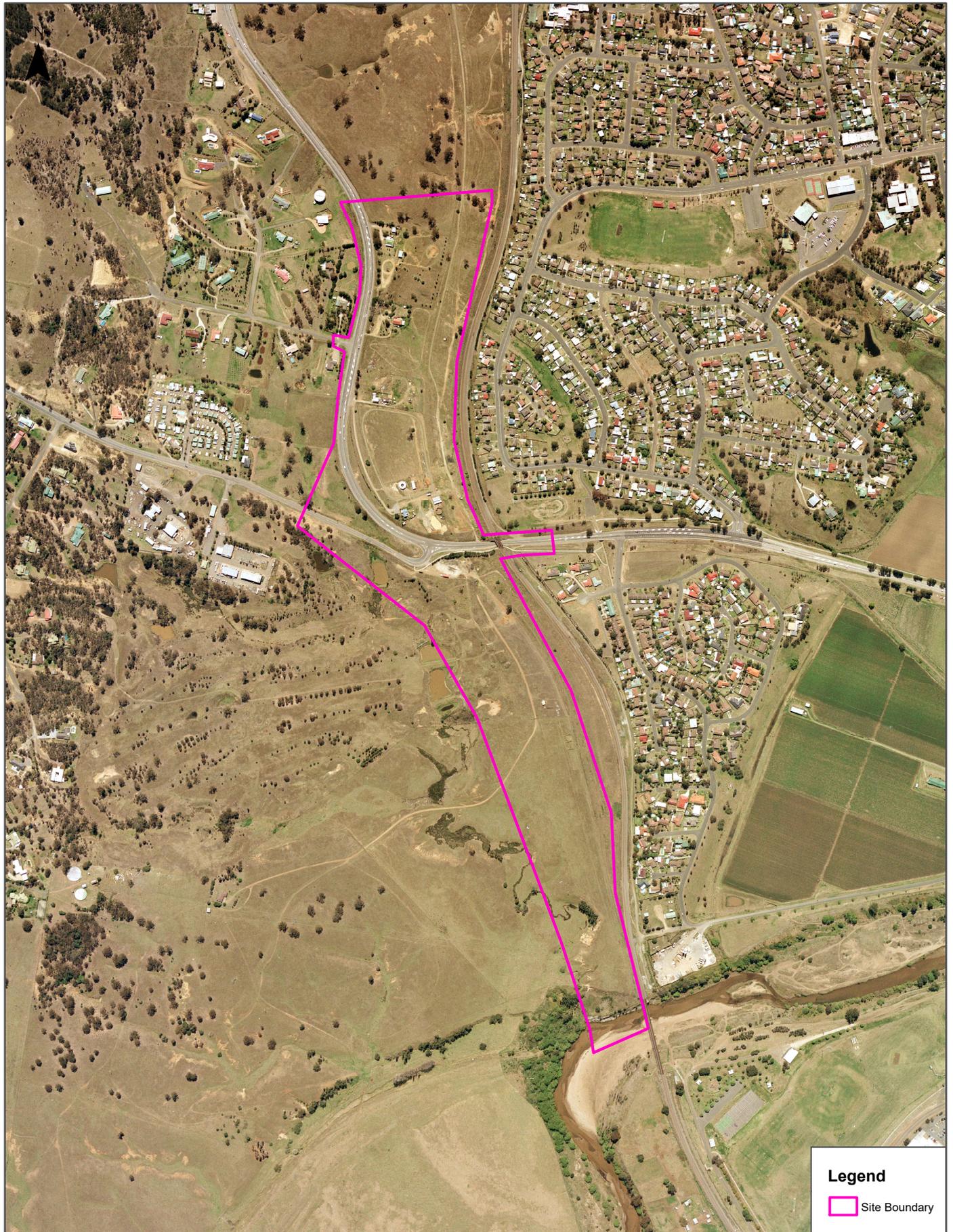
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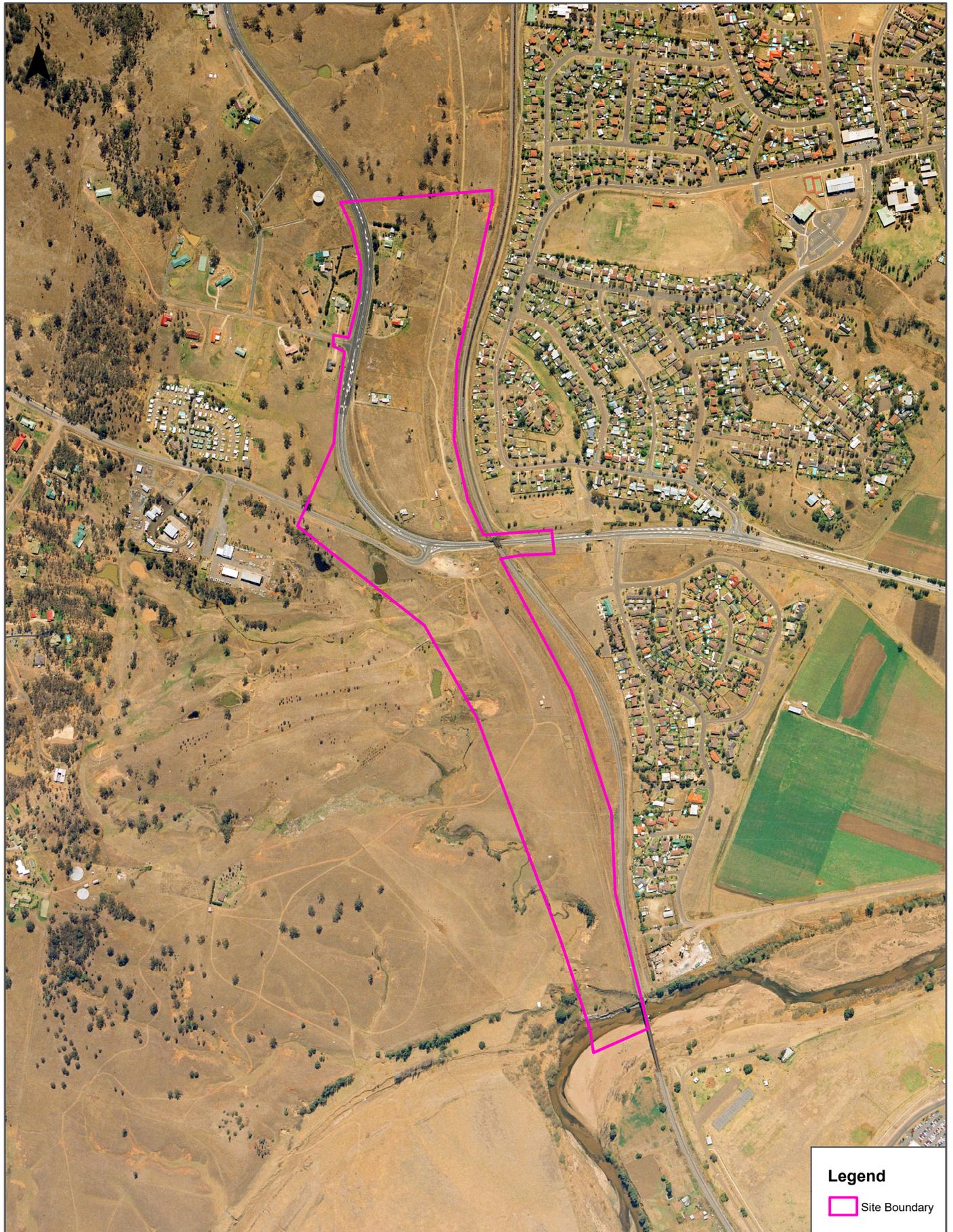
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Legend

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Scale:



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Meters

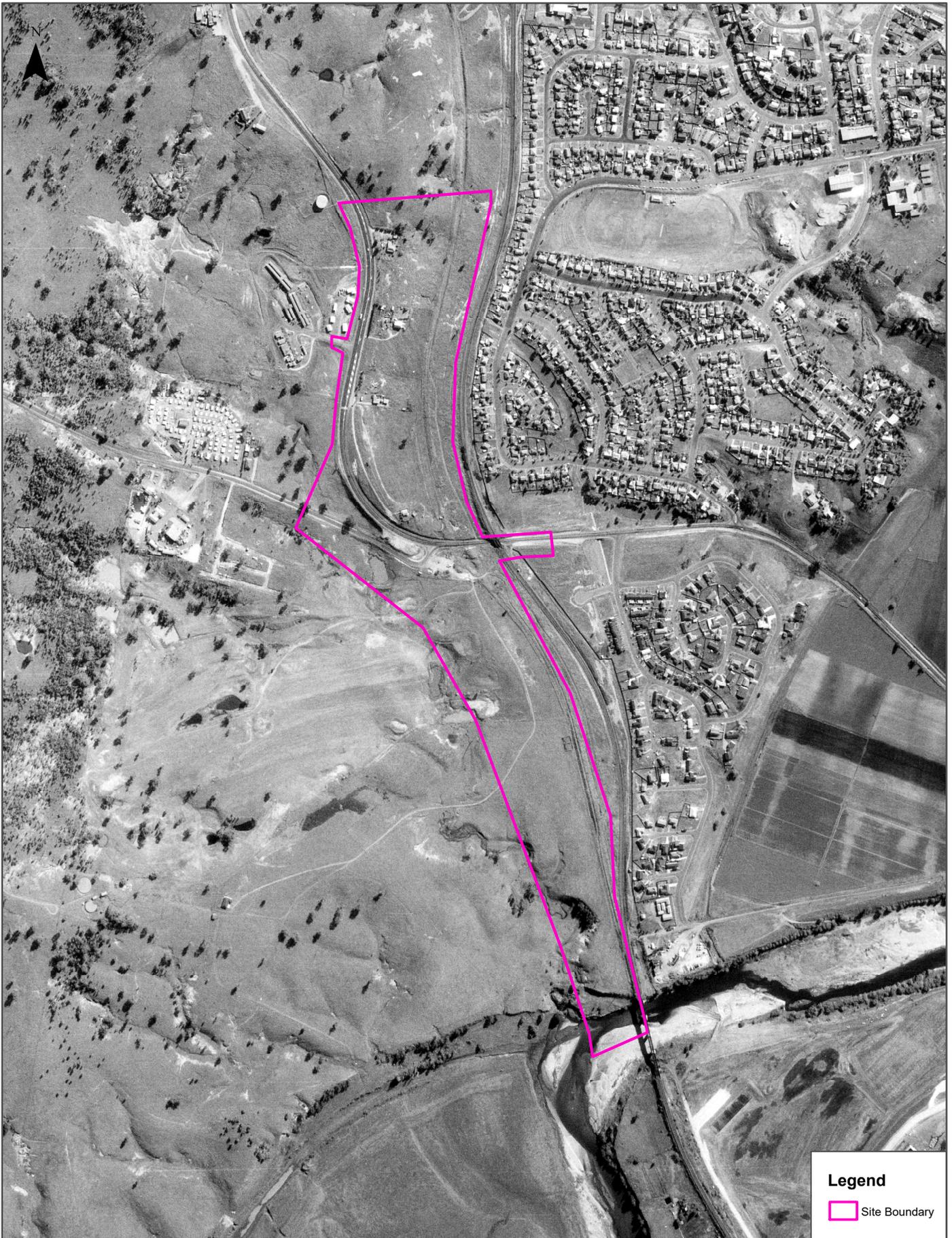
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Scale:



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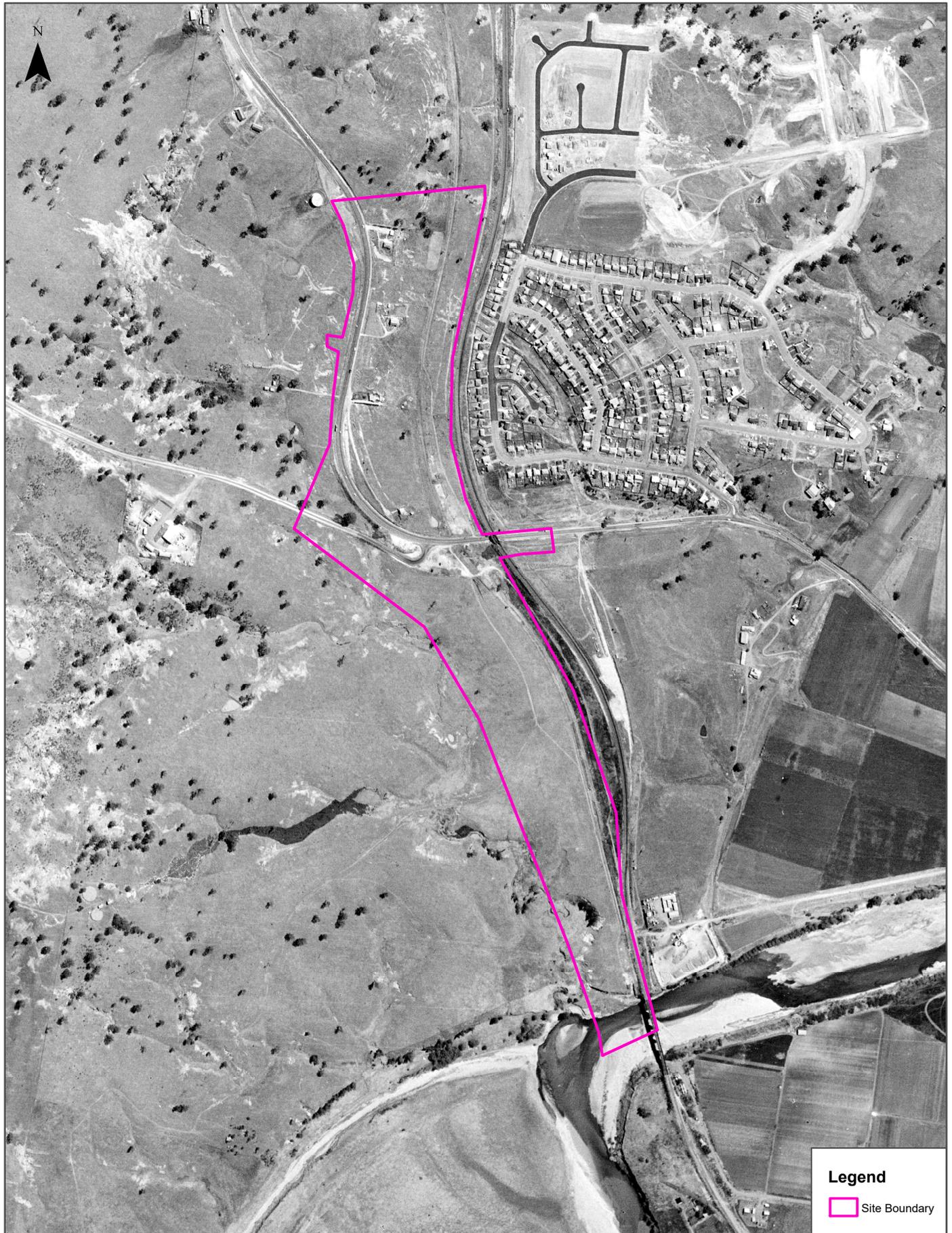
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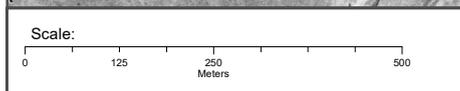
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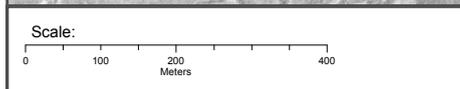
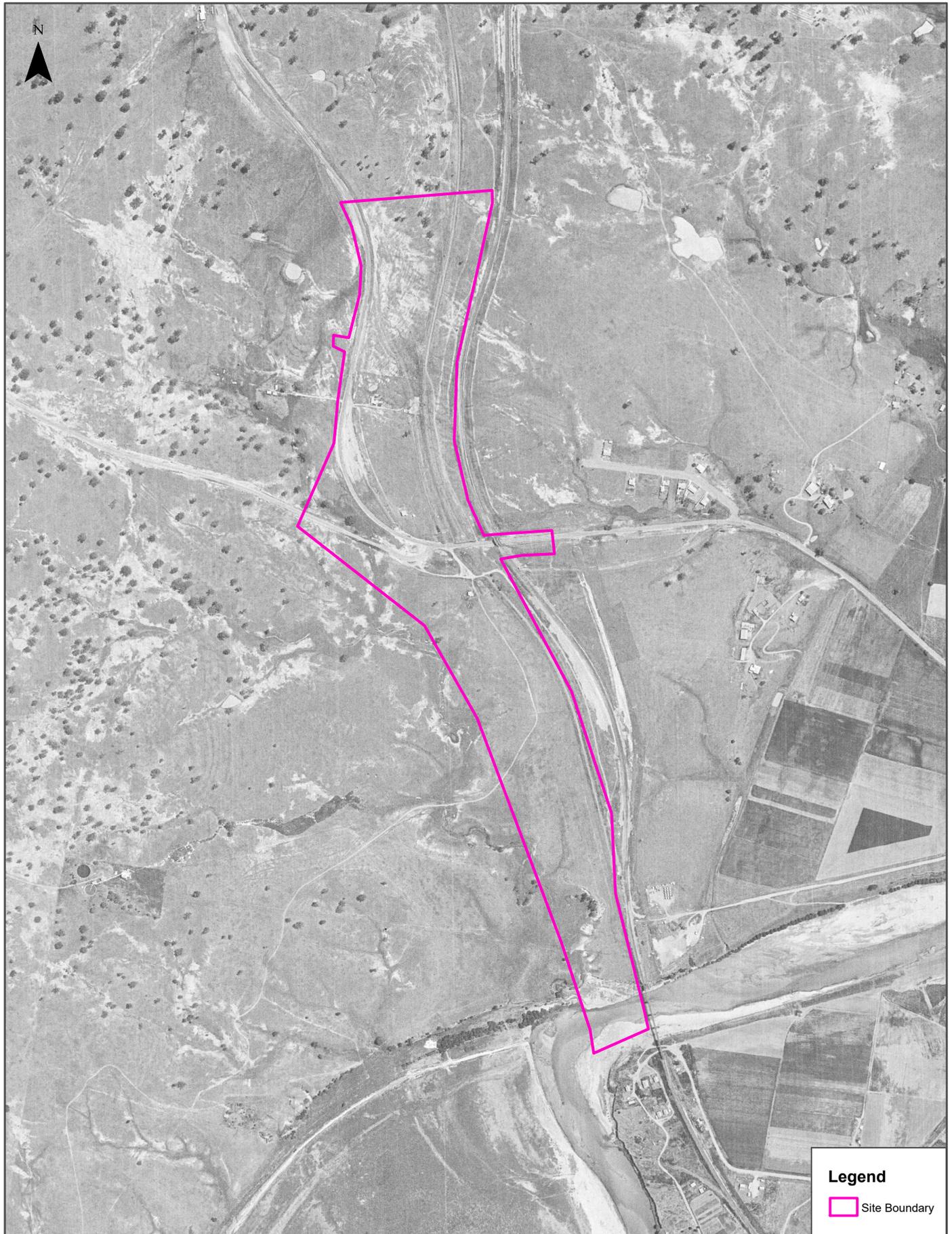
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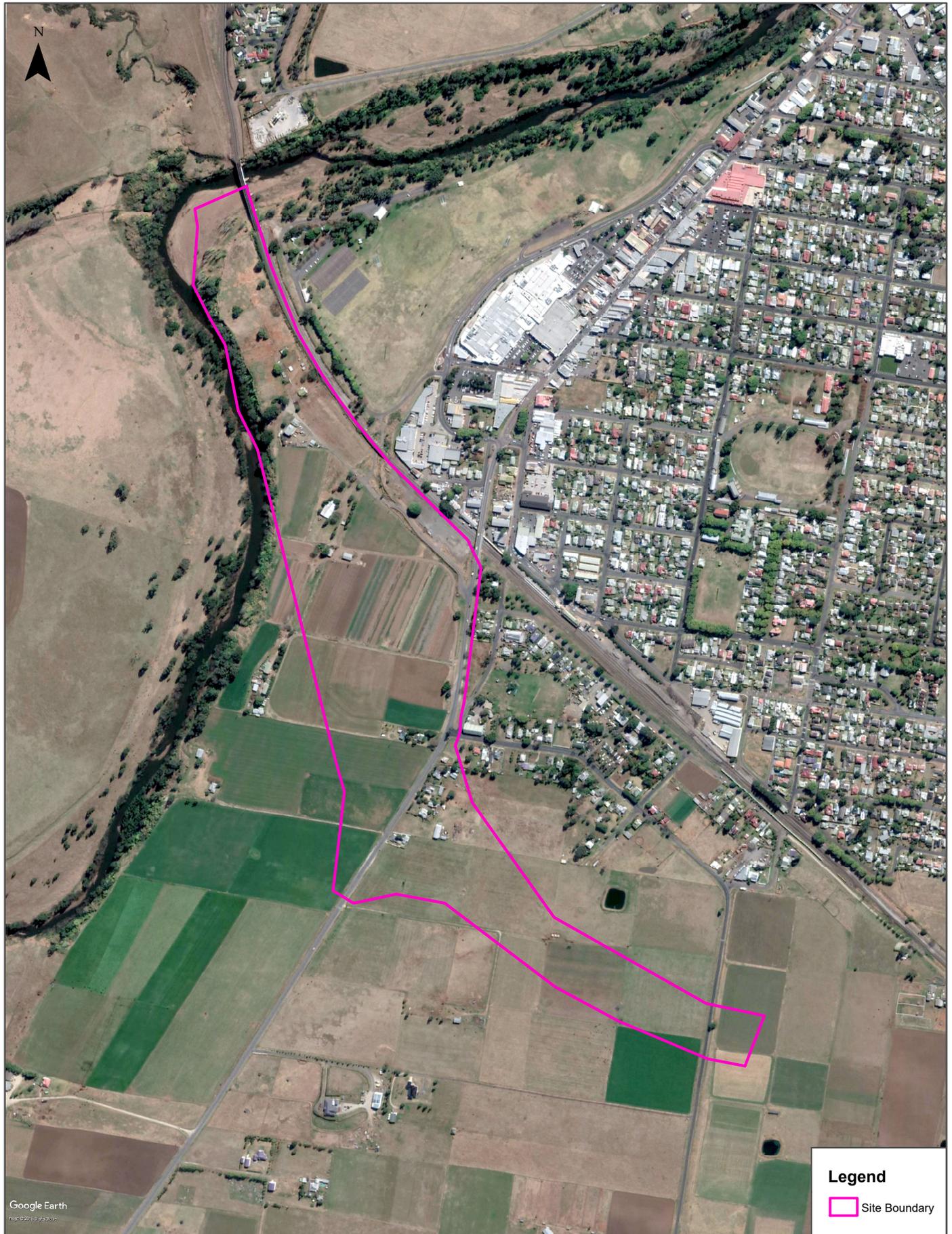


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Legend
Site Boundary



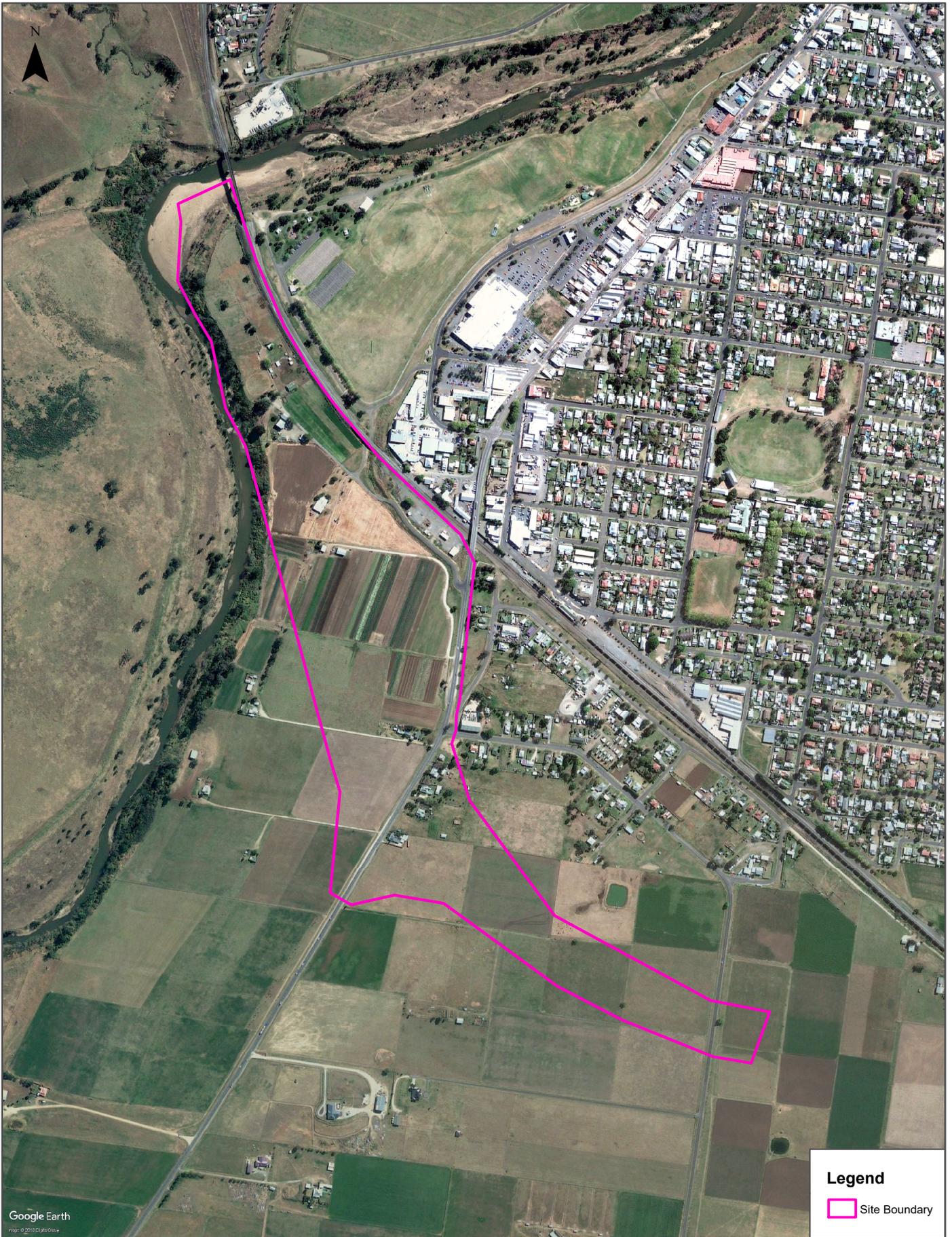
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Scale:



0 125 250 500
Meters

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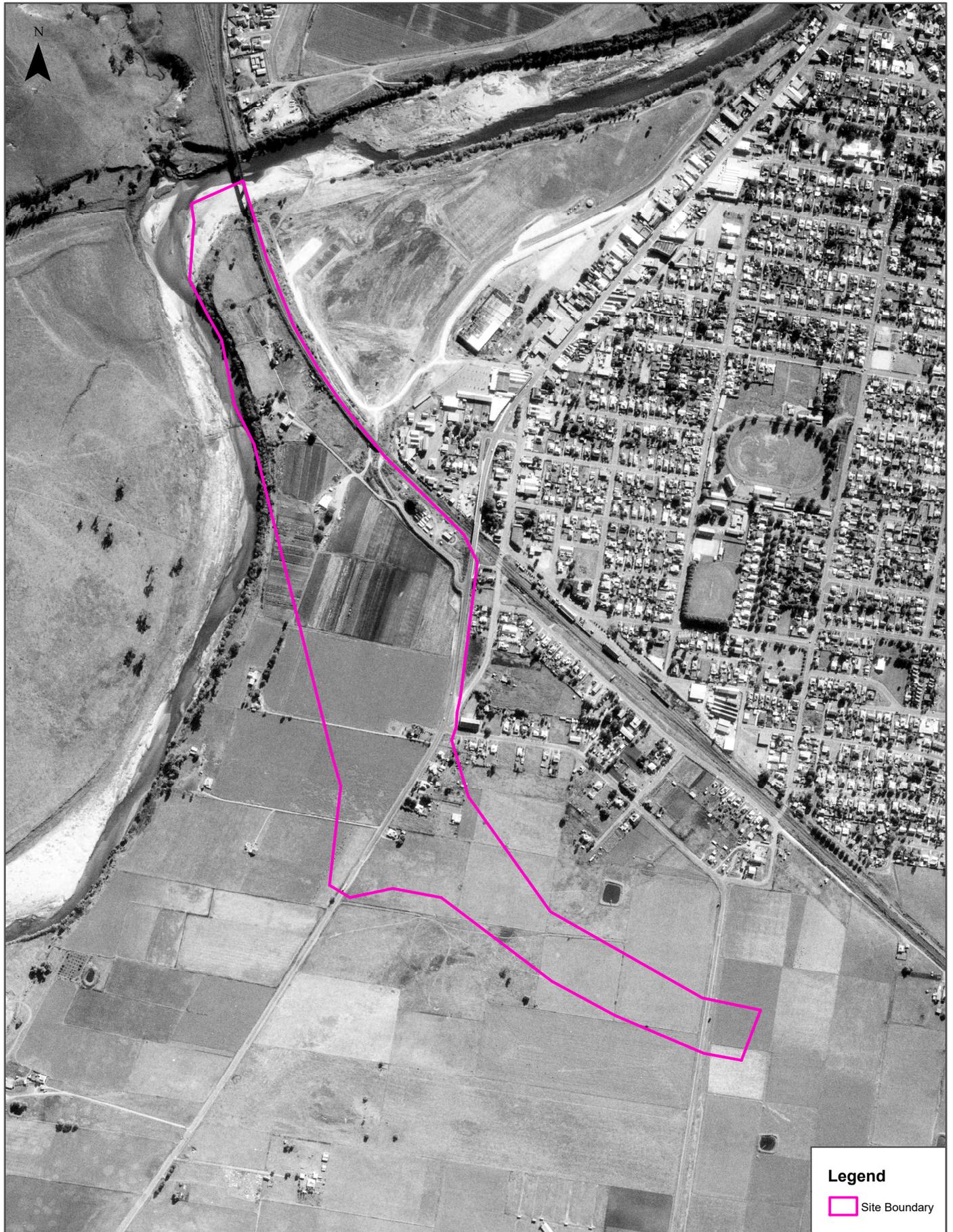
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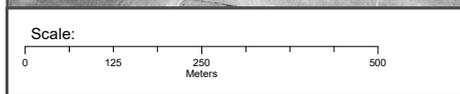
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Legend

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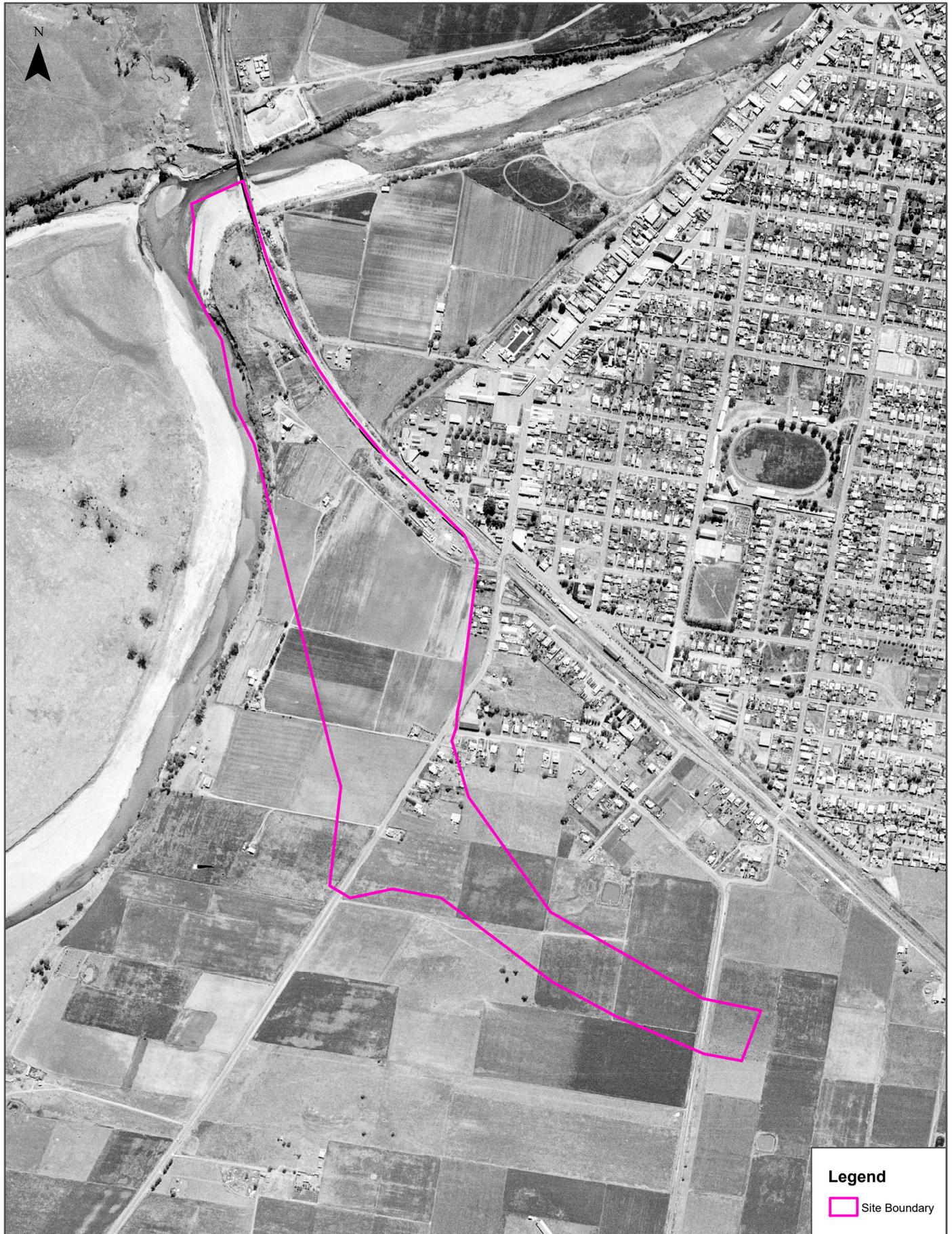
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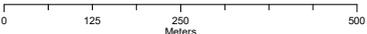
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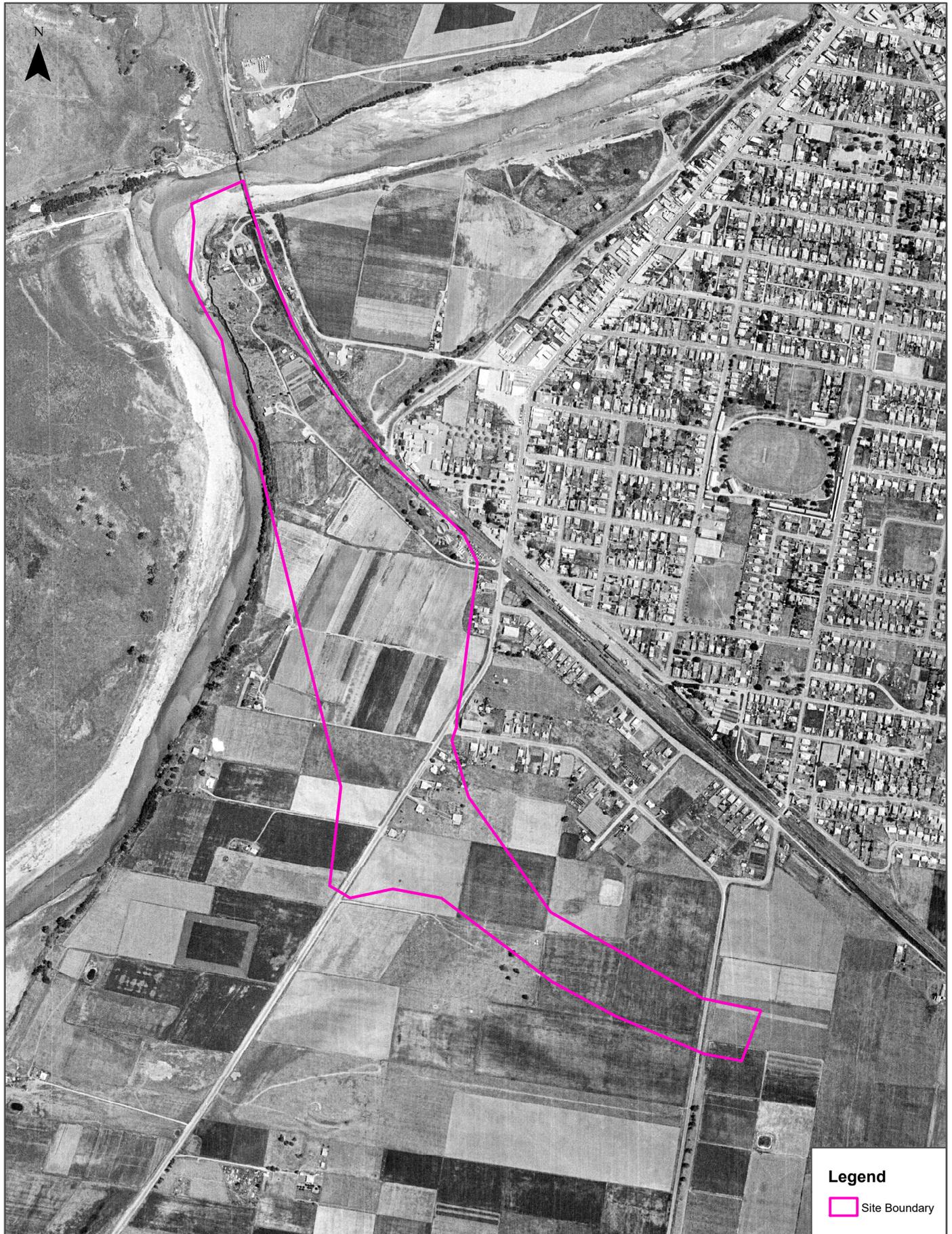
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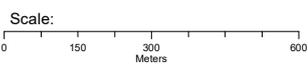
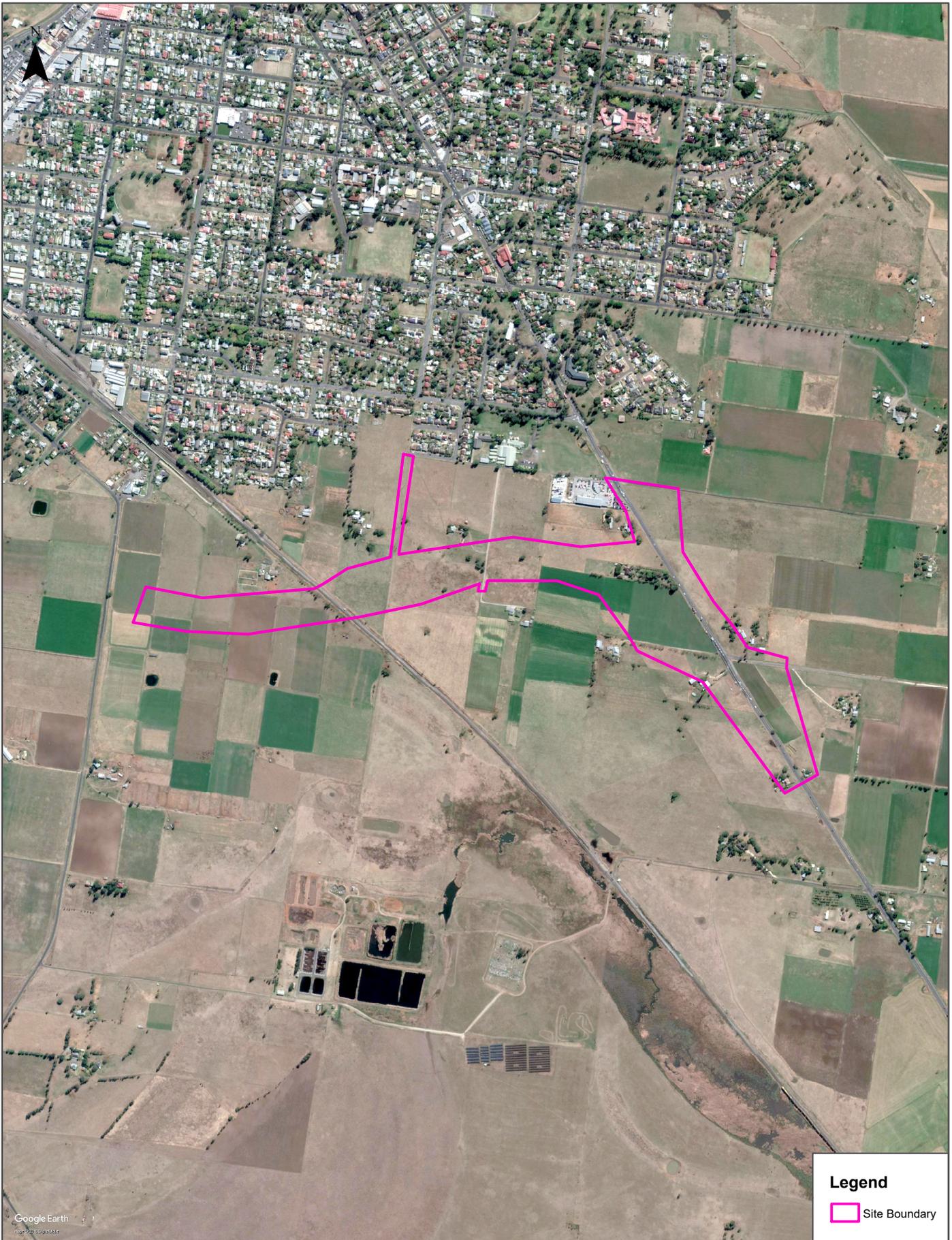
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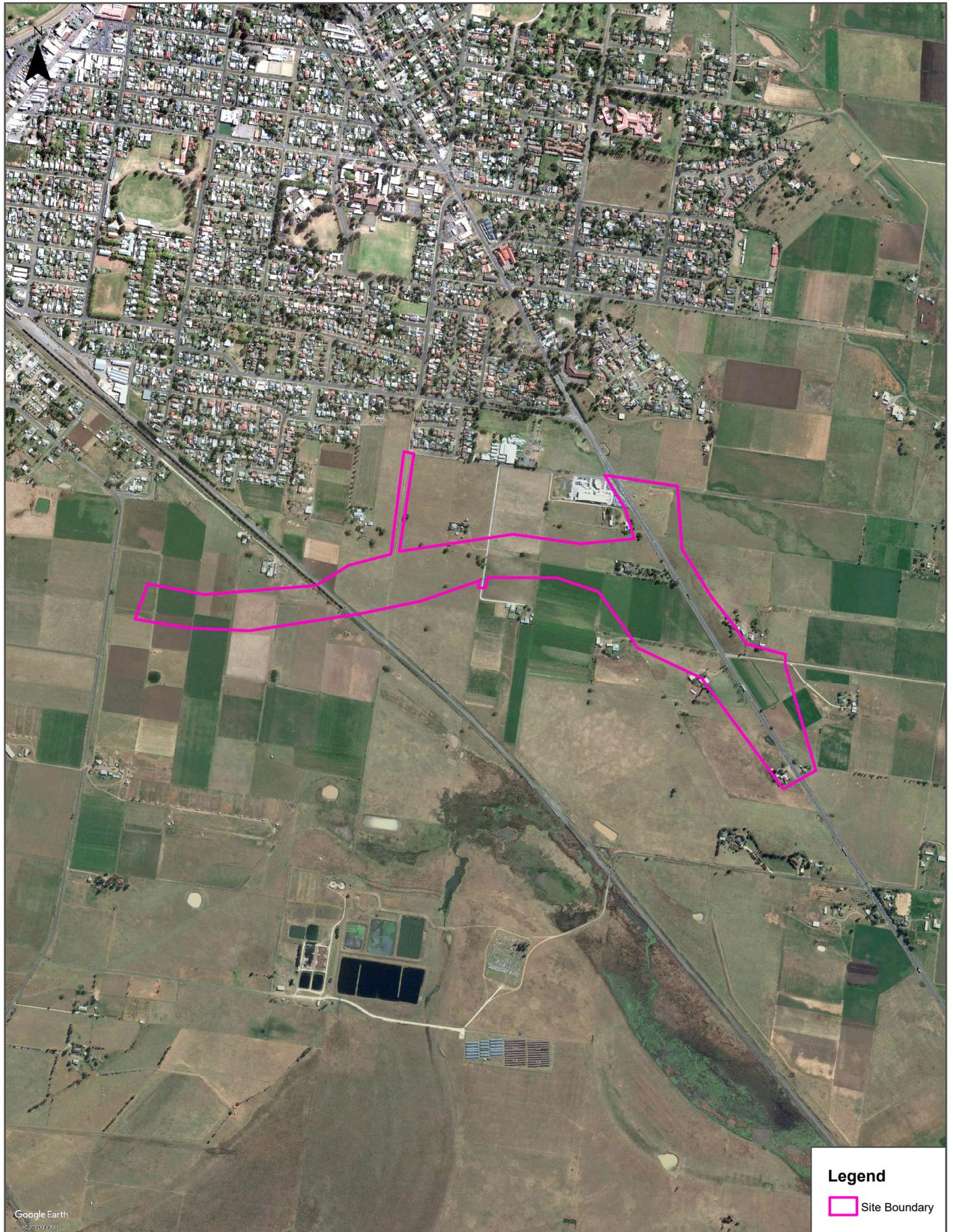
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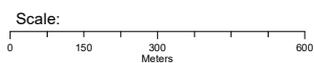
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- Site Boundary

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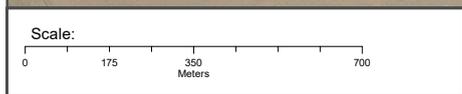
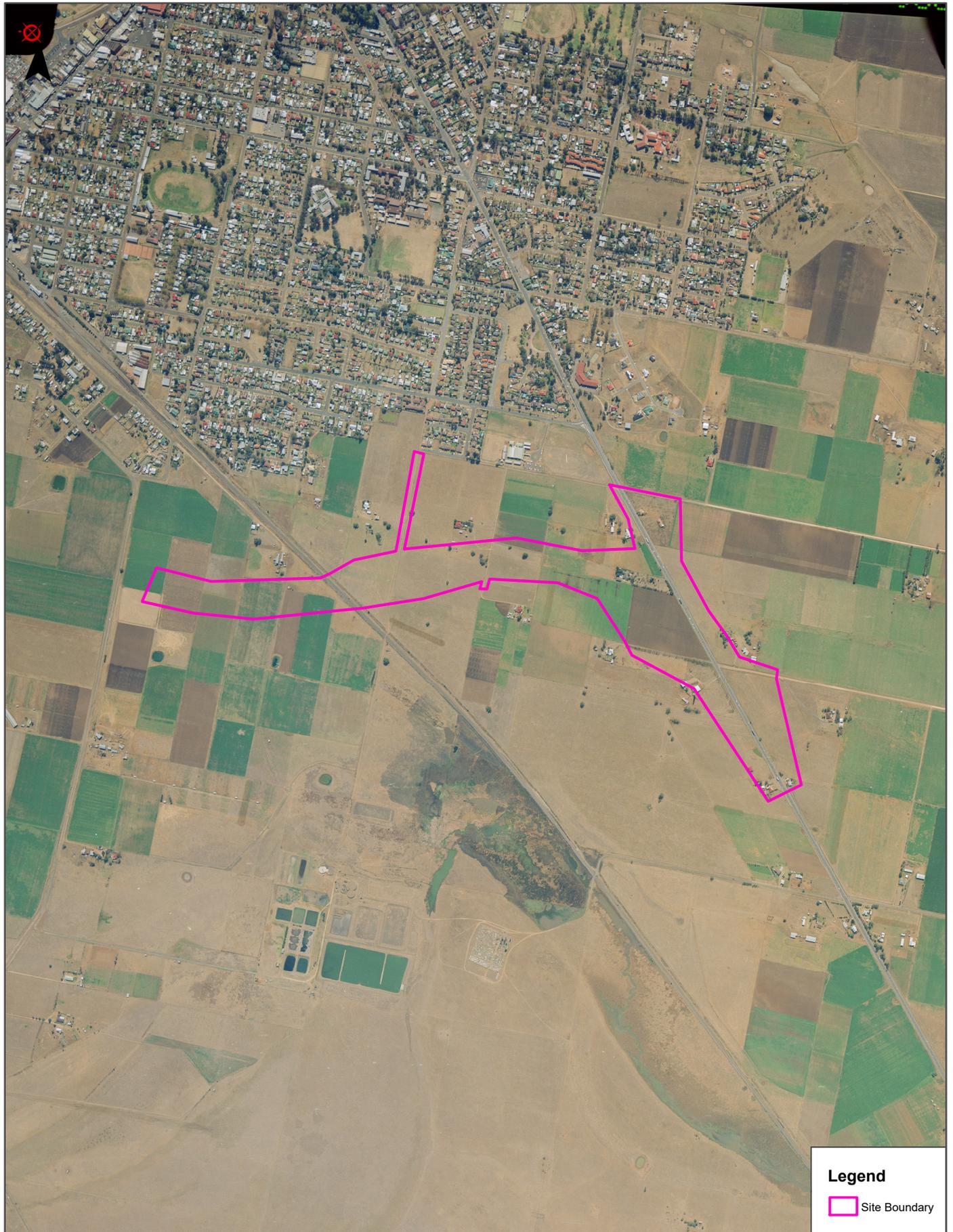
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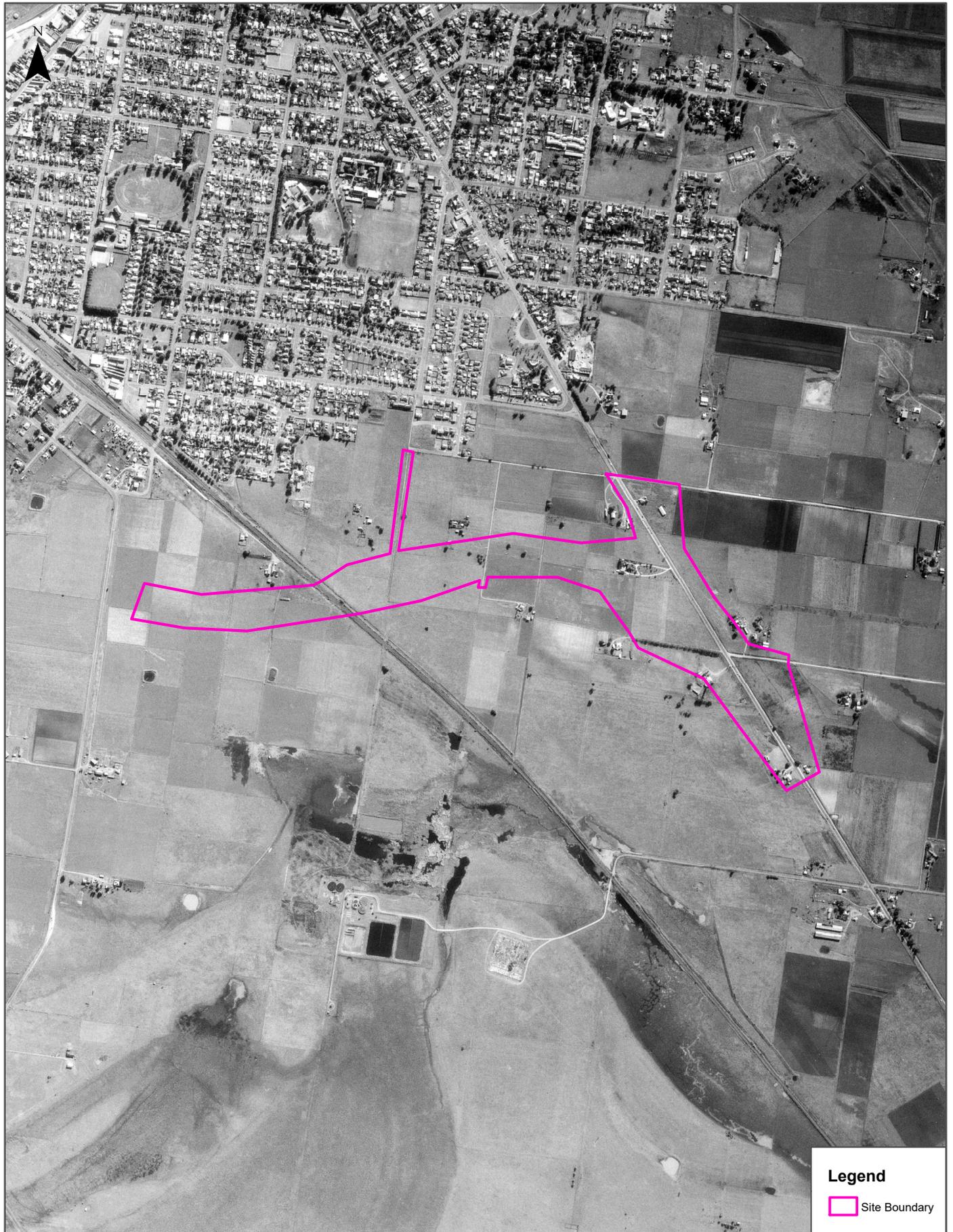
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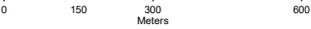
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Legend
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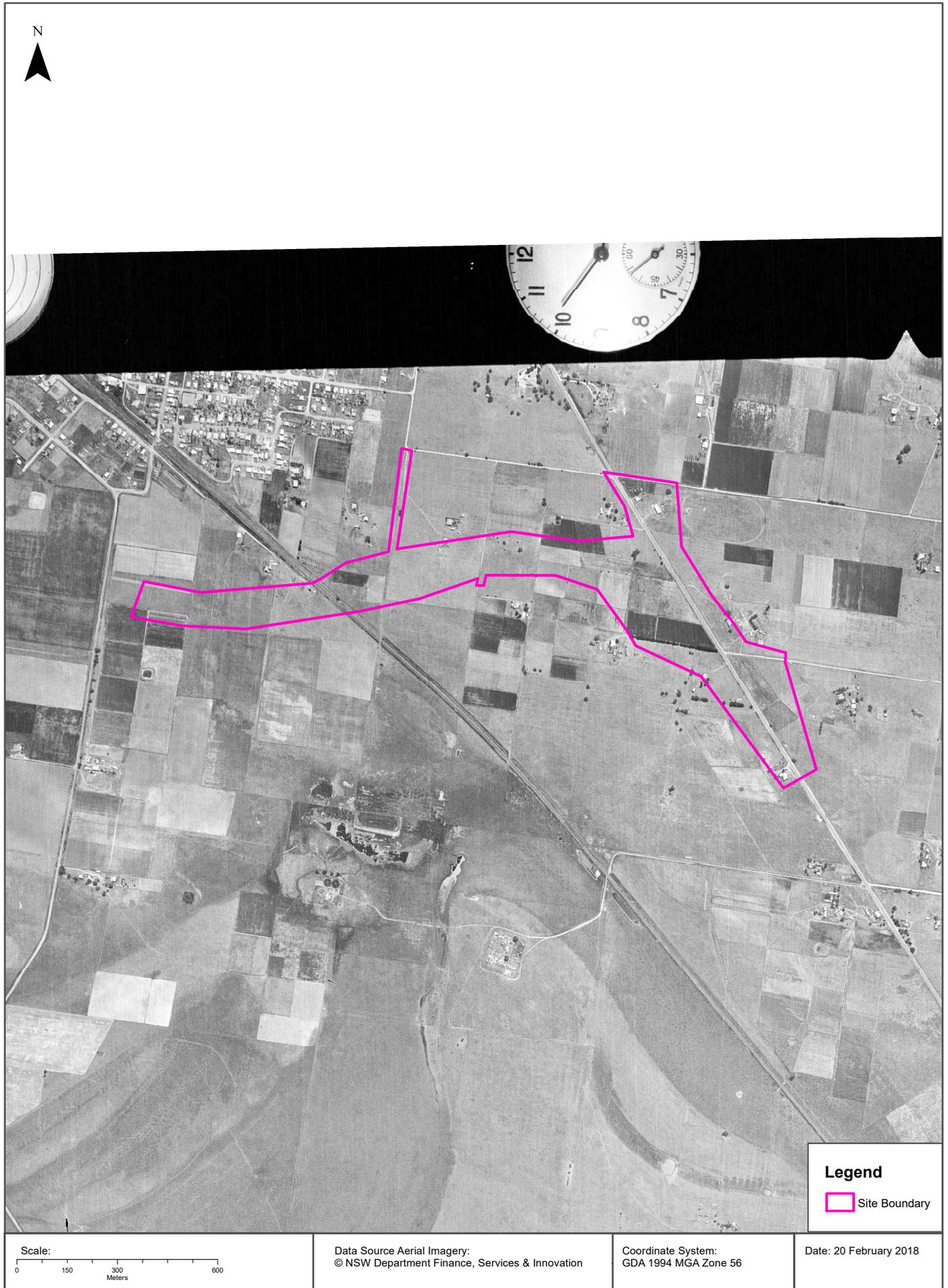
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Appendix B

Groundwater Bore Search

Number	Bore ID	Northing	Easting	Final Depth (m)	Purpose	Log	Industry
1	GW027758	6393903	329667	11.4	Irrigation, stock	x	
2	GW031797	6393930	329432	12.5	Irrigation	x	
3	GW047625	6393827	328834		Stock, Irrigation, Domestic	x	
4	GW037865	6393947	328675	12.1	Irrigation, stock	x	
5	GW021636	6393728	328444	12.8	Irrigation	x	
6	GW016054	6393570	328238		Irrigation		
7	GW038199	6394116	327707	11.8	Irrigation	x	
8	GW030955	6393802	327373	13.5	Public/Municipl	x	
9	GW016052	6393553	327273		Irrigation		
10	GW030952	6394264	327365	11.5	Public/Municipl	x	
11	GW200693	6394318	328061		Stock, Irrigation, Domestic		
12	GW025863	6393976	326744		Irrigation		
13	GW013711	6393601	326438		Irrigation		
14	GW013713	6393538	326387		Irrigation		
15	GW030958	6394154	326376	17.2	Stock, Irrigation, Domestic	x	
16	GW024140	6393967	326275		Irrigation		
17	GW026241	6393465	325736	6.1	Irrigation	x	
18	GW200591	6394497	328033	12	Test Bore, irrigation	x	
19	GW025864	6394381	327024	4.1	Irrigation	x	
20	GW056493	6394569	327204	12.8	Domestic, stock	x	
21	GW025865	6394629	327124	7.2	Irrigation	x	
22	GW030956	6394544	327543	13	Public/Municipl	x	
23	GW030951	6394927	328319	10	Public/Municipl	x	
24	GW200590	6394375	329248	13	Test Bore, irrigation	x	
25	GW078805	6393450	330562	16	Stock, Irrigation, Domestic	x	
26	GW080195	6393844	330622	16	Stock	x	
27	GW066588	6393800	330869		Domestic, stock	x	
28	GW027106	6394535	330622	13.7	Irrigation	x	
29	GW201783	6395186	327757	13	Monitoring Bore	x	Mobil Service Station John St Islington
30	GW201784	6395163	327766	13	Monitoring Bore	x	Mobil Service Station John St Islington
31	GW201785	6395167	327744	13	Monitoring Bore	x	Mobil Service Station John St Islington
32	GW202517	6395228	327755	10	Monitoring Bore	x	
33	GW202516	6395209	327706	10	Monitoring Bore	x	
34	GW202515	6395207	327739	10	Monitoring Bore	x	
35	GW201782	6395185	327797	13	Monitoring Bore	x	Mobil Service Station John St Islington
36	GW030949	6395379	327711	16.9	Test Bore, Town water supply	x	
37	GW030936	6395502	327735	14.5	Test Bore, Town water supply	x	
38	GW200847	6395443	327792	14	Monitoring Bore	x	
39	GW200846	6395462	327792	14	Monitoring Bore	x	
40	GW200848	6395443	327802	14	Monitoring Bore	x	
41	GW042809	6395092	327169	16.7	Public/Municipl	x	
42	GW042810	6395093	327195	17.4	Public/Municipl	x	
43	GW200468	6395129	327279	20.4	Domestic, stock	x	
44	GW057823	6395247	327244	13.6	Public/Municipl	x	
45	GW030950	6395459	327006	16.5	Test Bore, Town water supply	x	
46	GW042811	6395401	327189	16.8	Public/Municipl, Town water supply	x	
47	GW024732	6395495	327292		Public/Municipl		
48	GW057822	6395523	327161	15.1	Public/Municipl, Town water supply	x	
49	GW059179	6395590	327473	15.8	Public/Municipl	x	
50	GW030940	6395406	327502	18	Test Bore, Town water supply	x	
51	GW030939	6395529	327474	15.6	Test Bore, Town water supply	x	
52	GW030934	6395623	327603	16.5	Test Bore, Town water supply	x	
53	GW059180	6395655	327628	14.6	Public/Municipl, Town water supply	x	
54	GW030937	6395626	327785	15	Test Bore, Town water supply	x	
55	GW042812	6395061	327169	18	Public/Municipl, Town water supply	x	
56	GW030938	6395723	328019	14.5	Test Bore, Town water supply	x	
57	GW059181	6395785	328070	12.2	Public/Municipl, Town water supply	x	
58	GW059335	6394968	325345	16	Stock, Irrigation, Domestic	x	
59	GW059336	6394784	325400	18	Stock, Irrigation, Domestic	x	
60	GW053236	6395834	327338	15.5	Stock, Irrigation, Domestic	x	
61	GW071297	6396127	328220	13.2	Irrigation	x	
62	GW066057	6396127	328220	13.2	Irrigation	x	
63	GW060320	6396196	328663	15	Recreation	x	Civic Park Well
64	GW200178	6397109	327984		Domestic, stock	x	
65	GW044861	6397327	328148	12.2	Domestic, stock	x	
66	GW035785	6396867	328234	13.2	Irrigation	x	

9 bore logs not available
13 bore logs within Project site



rms.nsw.gov.au



contactus@rms.nsw.gov.au



Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059



Transport
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