

A.4 Preliminary Site Investigation



Manuwarra Red Dog Highway Alignment

Preliminary Site Investigation

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Main Roads Western Australia

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Important note about your report

Main Roads Western Australia (MRWA) engaged Jacobs Group (Australia) Pty Ltd (Jacobs) to complete a desktop Preliminary Site Investigations (PSI) for Stage 4 the proposed Manuwarra Red Dog Highway ('MRDH4').

This report was produced in accordance with the *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM) and *Identification, reporting and classification of contaminated sites in Western Australia* (DER, 2017) and is limited to the scope of services set out in the agreement between Jacobs and MRWA. Environmental conditions may exist at the site that is beyond the scope of our investigation and this report.

The findings presented in this report are professional opinions based solely upon information and data gathered by Jacobs, provided, or made available by MRWA, or has been otherwise made available to Jacobs in the public domain, as at May 2021. Jacobs has relied upon and presumed that this data is accurate and representative of the environmental conditions at the site. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of data collected by others. If information presented by others is subsequently determined to be false, inaccurate, or incomplete, or if site conditions change beyond the aforementioned dates, then it is possible that our conclusions as expressed in this report may change.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. Opinions and judgements expressed in the report are based on Jacobs' understanding and interpretation of current regulatory standards and should not be construed as legal opinions.

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Abbreviations

Acronym	Definition
ASS	Acid Sulfate soils
BGL	Below ground level
COPC	Contaminants of Potential Concern
ESA	Environmentally Sensitive Areas
DEM	Department for Energy and Mining
DWER	Department of Water and Environmental Regulation
DIT	Department for Infrastructure and Transport
DWER	Department of Water and Environmental Regulation
GDE	Groundwater dependent ecosystems
Jacobs	Jacobs Group (Australia) Pty Ltd
MRDH	Manuwarra Red Dog Highway
MRWA	Main Roads Western Australia
NEPM	National Environment Protection Measure
NOA	Naturally Occurring Asbestos
PFAS	Per- and Polyfluoroalkyl substances
PPM	Parts per million
PSI	Preliminary Site Investigation
RPT	Report

Executive Summary

Background and Objectives

Jacobs Group (Australia) Pty Ltd (Jacobs) have been engaged by MRWA to undertake contaminated land desktop preliminary site investigations (PSI) for the area of the proposed Manuwarra Red Dog Highway Stage 4 Project (MRDH4).

This report presents the findings of the desktop PSI for Stage 4 of the proposed MRDH which is the approximately 110 km stretch from Roeburn Wittenoom Road to Nanutarra Road which is located approximately 22km north of the Tom Price township in Western Australia.

Scope of Work

The overarching objective of the investigation is to assess the potential for soil and groundwater contamination within the Study Area, based on the review of publicly available information in accordance with the *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM) and *Identification, reporting and classification of contaminated sites in Western Australia* (DER, 2017). In order to meet this objective, preliminary (desktop) relevant environmental data and information associated with the Study Area has been gathered and contextualised such that it informs a summary of potential contamination and contaminant sources.

Summary of Findings and Recommendations

Based on the information on potential contaminant sources reviewed in this report and considering the historical rural land uses in the area, it is considered unlikely that contamination or contamination impacts will be present within or adjacent to the Study Area.

As there is considered to be low likelihood of contamination or contamination impacts within the Study Area, intrusive investigations and detailed investigations are not necessary prior to commencement of the proposed development works. If contamination is identified during construction activities (i.e. 'unexpected finds'), additional intrusive investigations and detailed site assessment may be required. In order to manage potential environmental impacts associated with the proposed works, it is recommended that a contamination unexpected finds protocol is implemented within the project construction environmental management plan (CEMP).

It is expected that soils with naturally occurring elevated concentrations of metals (e.g. iron, and potentially other metals) may be present in areas of the alignment. This is not expected to present a risk to human health or the environment where these soils are disturbed and re-used locally for the road construction. Where these soils are to be relocated elsewhere (either re-used off-site or at distant project locations), it is recommended that they are characterised and assessed relevant to the proposed use/land-use setting prior to re-use.

In the event that identified contaminated soil is required to be excavated and disposed (off-site) during the proposed construction works (which may include soils containing NOA or naturally occurring elevated metals), then any such waste soil should be classified and removed in accordance with Government of Western Australia Department of Water and Environmental Regulations *Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)* (DEWR, 2019).

1. Introduction

1.1 Background

The Manuwarra Red Dog Highway (MRDH, formerly Karratha – Tom Price Road) is a predominantly unsealed road linking the regional centres of Karratha and Tom Price in the Pilbara Region of Western Australia. The 269 km road provides crucial connectivity between these centres, as well as access to significant tourism destinations and mine sites in the region.

However, use of this valuable route is currently restricted with nearly 60% of the road is unsealed and unable to safely sustain high volumes of traffic and freight. While safer sealed routes do exist, they compromise time efficiency, stretching over 550 km and adding at least another three hours to the journey. The lack of a safe and time efficient transport option adversely affects the residents and businesses of Karratha, Tom Price, Paraburdoo and the wider Pilbara Region and is a major inhibitor to investment and growth in the tourism and mining sector. The intent of the MRDH4 Project is to improve network resilience, safety and efficiency.

The project consists of four stages: Stages 1 to 3 have already been completed and Stage 4 is a new road currently in the planning and design phase. This report relates solely to the Stage 4 Section which is an approximately 110 km proposed highway that runs mostly parallel to the existing railway line and Tom Price Railway Road between Roebourne Wittenoom Road and Nanutarra Road in Western Australia shown in **Figure 1.1** below, with the exception of a short section around Hammersley Homestead which is aligned further west. Stage 4 will henceforth be referred to as the 'study area'.

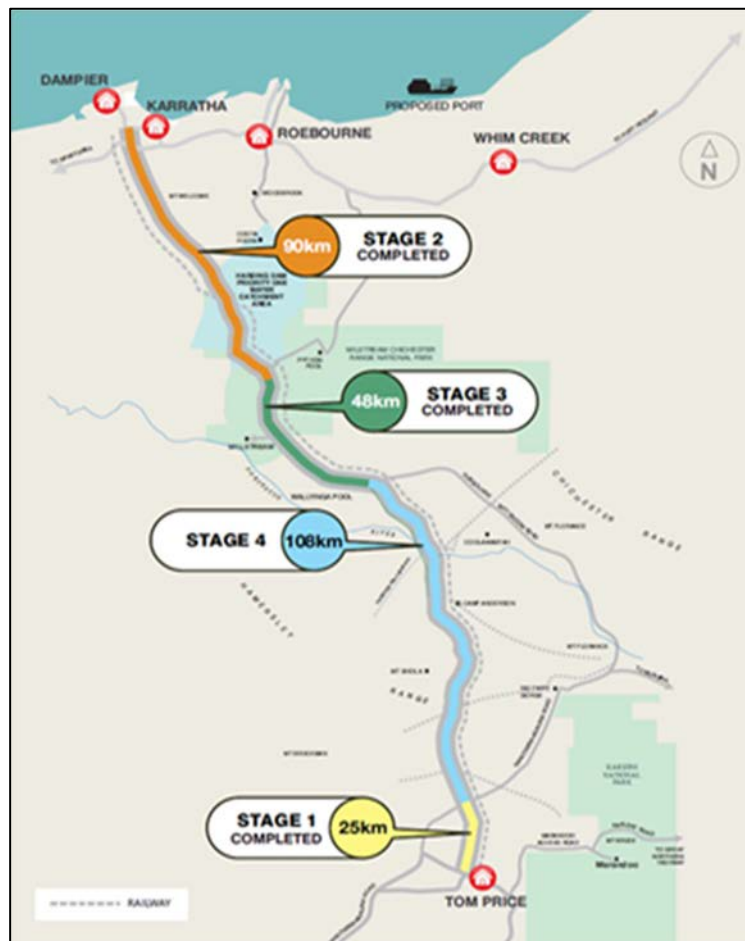


Figure 1.1: Location Plan of Stages 1-4 of the MRDH

1.2 Objectives

The objectives of this desktop Preliminary Site Investigation (PSI) are:

- to identify known and potentially contaminated sites within and adjacent to the corridor
- to identify the potential for naturally occurring asbestos (NOA) within and adjacent to the corridor
- to identify potential risks and constraints to the proposed project (MRDH4) from contaminated land and NOA, and provide recommendations for appropriate actions to mitigate or minimise/manage associated risks to the project, as well as associated human health and environment risks

1.3 Scope and Methodology

The scope of work for this desktop PSI involved a review and assessment of available information relevant to the Study Area, including:

- Records and published information relevant to the environmental setting and site history with a 1.0 km radius of the site, including:
 - Surrounding land uses, geology, hydrogeology and surface waters;
 - Groundwater Dependent Ecosystems (GDEs);
 - Registered groundwater drill holes, surface and groundwater abstraction licences (2.0km radius);
 - Environmentally Sensitive Areas (ESA's);
 - Contaminated sites, as identified by the Department of Water and Environmental Regulation (DWER)
 - Government freedom on information requests pertaining to pollution and contamination.
- Investigation into nearby cultural heritage, including Aboriginal heritage, Native Title and European heritage;
- Published information pertaining to geological formations of the site to investigate naturally occurring asbestos (NOA) at the site, including:
 - Geological Survey of Western Australia (GSWA) interactive geological maps;
 - Minerals Research Institute of Western Australia (MRIWA) interactive map;
 - Australian Geosciences Information Network (AusGIN) interactive portal; and
 - Geological map Dampier, WA (Sheet 2256), 1997
- Identification of potential contaminants of potential concern (COPCs), contamination sources and summary of findings; and
- Identification of data gaps and recommendations for further assessment.

Geographical and historical information reports (Lotsearch™, 2021) of the Study Area, incorporating a 1,000 m buffer for aerial photos and a 1.0 - 2.0 km buffer for environmental information searches, has been obtained and provided as **Appendix A**. Due to the large size of the investigation area, the site has been divided into 10 Lotsearch reports, each summarising a 12 km section of the proposed highway.

1.4 Regulatory Framework

The PSI has been completed in general accordance with the Government of Western Australia Department of Environmental Regulation (WADER) Identification, reporting and classification of contaminated sites in Western Australia Contaminated Sites Guidelines (2017), the WADER Assessment and Management of Contaminated

Sites Guidelines (2014), the National Environment Protection (Assessment of Site Contamination) Measure NEPM (NEPC, 2013), and the *Contaminated Sites Act 2003*.

2. Study Area Details

The following information has been sourced from Lotsearch™ reports (Lotsearch, 2021) as well as information obtained from a range of sources including publicly available information / datasets as described in Section 1.3.

2.1 Study Area Identification and Surrounding Land-Use

The Study Area is an approximately 110 km stretch running north-south from Roebourne Wittenoom Road to Nanutarra Road which is located approximately 22 km north of the Tom Price township in Western Australia. The study area has a 1 km wide radius around the proposed MRDH4.

The study area is dominated by vast rural plains with the Tom Price Railway Road and Railway Line running down the centre of the area. The railway line has been in use since 1964 and is primarily used for transporting iron ore materials from the mines in the area to the Port of Dampier at King Bay to the north of the study area.

The majority of the proposed road alignment is separated from the railway line by at least 100m. The proposed alignment intersects with the railway line at a single location at chainage 30300 in the Tom Price section. The following locations are adjacent to the railway line with a separation of less than 100m:

- Chainage 16200 in the Coolawanya Section
- Chainage 34200 to 27800 in the Coolawanya Section
- Chainage 40800 to 41600 in the Coolawanya Section
- Chainage 42900 in the Coolawanya Section to Chainage 1100 in the Hamersley Section
- Chainage 24300 to 25700 in the Hamersley Section and
- Chainage 38000 to 38381 in the Tom Price section.

Several mines are also present within the vicinity of the alignment (refer section 3.1.5), however these are a significant distance away from the proposed MRDH4 to be of potential concern (minimum 1 km).

The above features as well as other layers referred to in this report can be viewed on the project-specific Manuwarra Red Dog Highway Stage 4 GIS SmartHUB project platform.

Due to the long extent of the proposed highway, the project site has been split into ten sections for the Lotsearch reports. A map showing the break-down of these areas is presented in **Figure 2.1**

2.2 Contaminants of Potential Concern (COPCs) associated with Land-Use

During the desktop review of the available information of the study area, the following were identified as potential contaminants of concern within the study area.

- Heavy Metals (primarily arsenic),
- Hydrocarbons,
- Solvents,
- Creosote/phenols,
- Asbestos Fibres,
- Herbicides,
- Pesticides.

These are primarily associated with the existing railway lines operating within the study area.



Figure 2-1: Lotsearch report areas.

2.3 Study Area History

Table 2.1 below presents the historical summary for the Study Area based on review of the historical aerial imagery provided by Lotsearch™. No potentially contaminating activities or land uses were identified within the study area during the review of the aerial imagery, with the exception of the existing railway line and minor road/track crossings and a rail line crossing (chainage 30300 – 30400 at the southern end of the Tom Price section).

Table 2.1: Study Area History

Date	Details
1947 & 1957	The aerial imagery from 1947 is limited and only covers the northern half of the proposed MRDH4 and the 1957 imagery only covers the middle third of the proposed MRDH4. The imagery from both years shows the study area as vacant rural plains with no infrastructure observed.
1967-1968	The 1967 historical aerial imagery shows the study area consisting of vast rural plains with a railway line visible running north-south through the study area. Evidence of earth disturbance and stockpiling can be seen to the east of the proposed MRDH4 at chainage 38500 in the Coolawanyah section. A cluster of buildings can be seen (the Hamersley Homestead) approximately 1 km north of the proposed MRDH4 at chainage 13400 in the Tom Price section. A stock holding pen can be observed approximately 60m west of the proposed MRDH4 at chainage 19500 in the Tom Price section. There is the potential for the presence of an associated cattle dip and therefore ground contamination associated with pesticides may be present. A cluster of buildings/structures can also be observed approximately 400m east of the proposed MRDH4 at chainage 20000 in the Tom Price section.
1978	The 1978 historical aerial imagery shows the study area relatively unchanged from the 1967 photograph. The study area remains covered in vast plains. Potential earth disturbance and stockpiling can now be observed to the east of the proposed MRDH4 at chainage 17000 in the Coolawanyah section and a small structure has been erected to the east of the railway line. Additional buildings have also been erected at Hamersley Homestead. The group of buildings at chainage 20000 in the Tom Price section has also grown. Machinery workshops and above ground storage tanks for unknown storage (potential grain/hopper, or less likely fuel (due to size)) can be observed within the settlement. A large reservoir pit has also been created to the west of the settlement.
1993	The 1993 historical aerial imagery shows the study area relatively unchanged from the 1967 photograph. A small cluster of buildings appear to have been constructed to the east of the proposed alignment at chainage 28600 in the Coolawanyah section. The earth disturbance at chainage 38500 in the Coolawanyah section observed in the 1967 to 1978 photographs appears to have ceased. The settlement observed in the 1967 and 1978 photographs (at chainage 20000 in the Tom Price section, to the east of the railway line) has been removed.
Current	The current aerial imagery shows the study area has undergone little change between 1967 and the current day. The study area remains dominated by vast rural plains. A potential aeroplane landing strip can be observed to the east of the study area at chainage 23800 in the Coolawanyah section. A new settlement has also been constructed to the east of the proposed MRDH4 at chainage 27800 in the Coolawanyah section. The Pelican Camp settlement can also be observed to the east of the proposed MRDH4 at chainage 12100 in the Hamersley section and the Weelumurra camp to the east of the MRDH4 at chainage 7000 in the Tom Price section. A pit has also been excavated to the east of the MRDH4 at chainage 20100 in the Tom Price section adjacent to where the former settlement (c.a 1978) was situated. A train station/depot also appears to have been constructed to the east of the MRDH4 at chainage 29100 in the Tom Price section.

3. Environmental Setting

3.1 Geological Setting

3.1.1 Regional Geology

The following summary of the regional geology is based on two geological map sheets 'Pyramid' (GSWA, 2004, SF-50-7) and 'Mount Bruce' (GSWA, 1996, SF 50-11) at 1:250,000 scale. The 1:500,000 State interpreted bedrock geology shapefile layer (DMIRS-016) has also been reviewed and presented as a layer incorporated within the Manuwarra Red Dog Highway Stage 4 GIS SmartHUB project platform.

The dominant geological formations along the proposed road corridor and wider development envelope are the metamorphosed sedimentary rocks of the Hamersley Group comprising chert, banded iron-formation (BIF), dolomite, mudstone, siltstone and shallow reef limestone. These rocks are approximately 2500 million years old formed within the Archean eon. The proposed road corridor crosses the following four main geological formations (from oldest to youngest):

- Marra Mamba Iron Formation: comprises bands of chert, BIF, mudstone and shale. This forms the hills and slopes at the southern and northern ends of the Site;
- Wittenoom Formation: comprises thin to medium bedded dolomite, dolomitic mudstone, chert and haematite sediments. This underlies the flats and plains of the Fortescue River Valley in the north and Hamersley Plateau Flats in the south and forms the toe slopes within the northern Hamersley Ranges;
- Mount McRae and Mount Sylvania Formations: comprises mudstone, siltstone, chert, BIF, dolomite and haematite. This typically forms low foothills or the mid and lower slopes of the Hamersley Range underlying the Brockman Iron Formation;
- Brockman Iron Formation; comprises BIF, chert, mudstone and siltstone forming the distinctive high hills with sloping duricrust surfaces and escarpment cliff edges within the Hamersley Range.

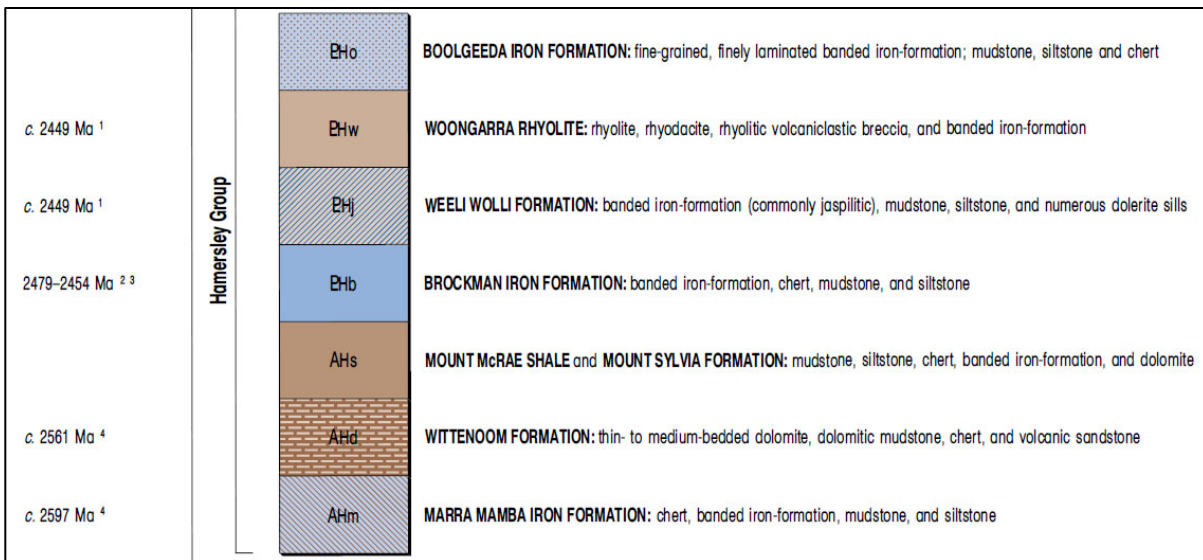


Figure 3-1: Stratigraphic sequence of the Hamersley Group.

The succession of the Hamersley Group dips gently to the south southwest with the road corridor crossing a broad syncline structure striking northwest to southeast.

3.1.2 Geomorphology

The BIF and chert hills form the high ground within the Hamersley Range, the Chichester Range in the north and the local hills within the Hamersley Plateau in the south and are typically intensively weathered, duricrusted and relatively resistant to regional erosional processes.

The duricrusted BIF topographic highs within the Hamersley Range represent the remnants of the dissected Hamersley surface and form characteristic steep slopes and cliffs above alluvium and colluvial deposits. The major topographic features have resulted from differential erosion of folded sediments and volcanic rocks of the area. The jaspillite strata present within the Brockman Iron Formation are the dominant topographic control of this region as they are highly resistant to erosion. The Hamersley Range comprises sediments that have been gently folded into a broad syncline with its northern and southern limits defined by scarps formed by erosion. All major hills are within this syncline or others of a similar nature.

Shale and chert of the Mt Sylvia and Mt McRae Shale formations form the distinctive profile of the Hamersley Hills, identified as moderately (10-27% gradient) to gently (<10% gradient) sloping dissected middle to lower slopes. Shale and dolomite rocks are typically less resistant to weathering and erosion compared to BIF and chert and often form low or rounded hills or valley floors.

Weathering and erosional processes within the region have produced extensive colluvial fans below the BIF hills comprising coarse debris. These debris deposits are colloquially referred to as valley infill deposits, typically comprising sands and gravels cemented within an iron-rich matrix and younger, uncemented colluvial gravel and cobbles. Drainage channels typically incise these surfaces and can form steep-sided linear ridges or interfluvies. The uncemented younger colluvial gravel deposits are often found in more distal colluvial surfaces of lower gradient with less drainage gullying. Because of the significant drainage channels and intersecting Fortescue River, alluvium and alluvial fan wash deposits are anticipated across many areas of the site.

3.1.3 Site Geological Summary

A summary of the natural superficial and bedrock geology anticipated to underlie the proposed road corridor and wider development area is summarised below in **Table 3.1**.

Table 3-1: Summary of the anticipated geology and geomorphology along the site

Project Section and Chainage (m)	Description	Anticipated Geological and Geomorphological Summary
Coolawanyah 0 - 34000	Marra Mamba Hills Footslopes	Wash covered toe slopes of Marra Mamba Formation BIF hills on the north side of the Fortescue River Valley. Very low relief wash plains including colluvial and alluvial channels and floodplains originating from the Chichester Range. Includes at least four significant creek channels. Includes local outcrops of Marra Mamba Iron Formation rock. Expansive clay deposits (Gilgai) may be identified within the western limits of this section. Bedrock formations comprise the Marra Mamba Iron Formation. Intrusive dolerite dykes are anticipated
Coolawanyah 34000 – Hamersley 400	Fortescue River Valley	The regional scale Fortescue River and floodplain and the extensive north-facing, very gently sloping wash plain. Includes the partially confined and unconfined Weelumurra Creek as it emerges from the Hamersley Range and diversion levees. Expansive clay deposits may be identified locally. Flanked on the south by the scarp of the Hamersley Range and to the north by low hills. It is drained by the Fortescue River, which is fed by numerous small creeks draining from the north and by outwash floods from the Hamersley Range.
Hamersley 400 - 12700	Weelumurra Basin Flats	Low hills of shale with chert, BIF and dolomite with wash covered rock pediment slopes. Local calcrete, ferricrete and Channel Iron Deposits (CID). Extensive very gently sloping alluvial wash plains to the west, secondary alluvial channels and the significant Weelumurra Creek and tributaries in the middle and east. Expansive clay deposits may be identified locally. Bedrock formations comprise the Mt Sylvania Formation and Mt McRae Shale overlying Wittenoon Formation.
Hamersley 12700 – Tom Price 12000	Hamersley Range Hills	High relief BIF hills over shale, chert, BIF and dolomite slopes with talus, colluvial gravel fan deposits and wash surfaces. BIF hills typically form steep slopes and cliffs above alluvium and colluvial deposits. Calcrete and ferricrete present. Includes the significant Weelumurra Creek and tributaries. Bedrock formations comprise the Brockman Iron Formation overlying Mt Sylvania Formation and Mt McRae Shale overlying Wittenoon Formation. Intrusive dolerite dykes are anticipated. It has a notable scarp eroded through resistant duricrust and banded iron formation into weaker shale and dolomite. The scarp is considered a purely erosional feature, unlikely to be a fault scarp.
Tom Price 12000 - 38381	Hamersley Plateau Flats	Extensive floodplain with expansive clay soils over calcrete (Gilgai), CID and alluvial wash plan with sandy, clayey silt over ferricrete and distinctive clumps of Mulga vegetation. Expansive clay soils formed as floodplain deposits (Gilgai) or have developed in situ and display significant seasonal volume change developing Gilgai features. Bedrock formations comprise the Mt Sylvania Formation and Mt McRae Shale overlying Wittenoon Formation, overlying the Marra Mamba Iron Formation.

3.1.4 Acid Sulfate Materials

3.1.4.1 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing iron sulphides. When potential ASS (PASS) are exposed to air, the iron sulphides in the soil react with oxygen and water to produce a variety of iron compounds and sulphuric acid. ASS and PASS commonly occur in coastal wetlands as layers of marine muds and sands which are deposited in low energy environments such as low-lying wetlands, back swamps, estuaries, salt marshes and tidal flats although they are not limited to coastal regions. They also occur at former beachfronts where heavy-mineral accumulations can occur, within areas of high groundwater table and inland in response to rising water tables and land salinisation.

In accordance with the Atlas of Australian ASS, the Site is predominantly categorised as being within Class C areas; an extremely low probability of ASS occurrence, with a 1-5% chance of occurrences in small localised areas. Within the central Hamersely Ranges this area is categorised as having a low probability (6-70%) and therefore could potentially provide a risk considering the broad classification. One area localised to the Fortescue River crossing has been identified as high risk with a >70% chance of occurrence between chainage 30000 and 31200 of the Coolawayna Section, as presented in LotSearch Report (Part 4), reference LS01969 EL, dated 19 April 2021.

Based on our experience working within the Pilbara region, as a minimum, ASS testing in accordance with WA Department of Water and Environmental Regulation guidance and the National Acid Sulfate Soils Sampling and Identification Methods Manual (2018) should be undertaken localised to any existing river or creek crossings and in areas of cut which are notably considered high risk areas.

3.1.4.2 Acid Sulfate Rocks

The most common sulphide mineral is pyrite which is present within the Mount Sylvania, Mount McRae and the BIF. Therefore, it is advised that ASS testing is also undertaken on disturbed rock samples within proposed areas of cut to qualify the risk of PASS and actual ASS (AASS).

3.1.4.3 Acid Mine Drainage

It must also be considered that acid mine drainage, whereby acid is formed from the oxidation of iron sulphide (FeS_2 , also known as pyrite), may also pose a risk in areas of cut within the Mount McRae, Mount Sylvania and Brockman Iron Formations, especially if this material is to be stockpiled for reuse as road construction materials.

3.1.5 Mining

Numerous sites containing infrastructure associated with mining activities or mineral deposits were identified within 1 km of the Study Area (LotsearchTM, 2020). These are detailed in Table 3.2 below.

Table 3.2: Summary of Mine sites within 1.0km of the Study Area

Site Code	Lotsearch Section	Site Title	Site Type	Site subtype	Site Stage	Target Commodity
S0231231	3	Borrow Pit BP175L47/47	Mine	Borrow Pit	Operating	Construction Materials
S0231230	3	Borrow Pit BP173L47/47	Mine	Borrow Pit	Operating	Construction Materials
S0231229	3	Borrow Pit BP171L47/74	Mine	Borrow Pit	Operating	Construction Materials
S0233484	4	Temporary Concrete Batching Plant Laydown Area	Infrastructure	Handling, Loading, Storage	Proposed	Construction Materials
S0231232	4	Borrow Pit BP186L47/47	Mine	Borrow Pit	Operating	Construction Materials
S0230436	6	Borrow Pit BP22AL47/48	Mine	Borrow Pit	Operating	Construction Materials
S0237216	6	Pelican Camp	Infrastructure	Town, Village, Camp	Proposed	Iron Ore
S0237275	6	Gudai-Darri Environmental Group	Infrastructure	Town, Village, Camp	Proposed	Iron Ore
S0231164	7	Queens Extension	Mine	Openpit	Proposed	Iron Ore
S0230438	7	Borrow Pit BP233BL47/49	Mine	Borrow Pit	Operating	Construction Materials
S0223448	7	Eliwana Railway	Infrastructure	Railway	Under Development	Iron Ore
S0230437	7	Borrow Pit BP23L47/48	Mine	Borrow Pit	Operating	Construction Materials
S0233132	7	Queens Chemical Grout Trial	Infrastructure	Borefield	Under Development	Iron Ore
S0019305	7	Kangeen	Deposit	Unspecified	Undeveloped	Iron Ore
S0232071	7	Borrow Pit BP225	Mine	Borrow Pit	Operating	Construction Materials
S0024814	8	Mt Sheila SE 3	Occurrence	Drillhole	Undeveloped	Iron Ore
S0024812	8	Sheila Valley Southwest CID	Deposit	Unspecified	Undeveloped	Iron Ore
S0229298	8	Weelumurra Camp Borrow Pit	Mine	Borrow Pit	Operating	Construction Materials
S0225860	9	Mt Barnett Borrow Pit	Mine	Borrow Pit	Proposed	Construction Materials
S0225859	10	Rosella Passing Station – Hope Downs 4 Railway	Infrastructure	Railway	Proposed	Iron Ore

No abandoned mines or petroleum wells were identified within 1.0 km of the study area (Lotsearch™, 2020).

3.1.6 Heavy Metals

Whilst it was not within the agreed scope for a review of potential naturally occurring heavy metals along the site, their presence should be considered with regards to their potential risk to human health during the construction and subsequent use of the proposed road. The presence of elevated naturally occurring heavy metals should also be considered when characterising the site soils for off-site disposal (if required)

Based on the summation of the geology presented in Table 3-1 and the targeted commodity of the localised mine sites in Table 3.2, naturally occurring elevated iron is likely to be encountered along the site. Iron is likely to be present within the fluvial sedimentary deposits of the channel-iron deposits (CID) and the BIF within the Marra Mamba Iron and Brockman Iron formations.

Typically, mineralised deposits display elevated concentrations of more than one metal. Following review of the published information, the presence of other heavy metals including copper, lead, vanadium, nickel, chromium and zinc are not referenced with regards to the geological units anticipated to be encountered, however, this does not exclude the risk of them being encountered during construction.

3.2 Hydrogeological Setting

3.2.1 Groundwater Resource Sensitivity and Usage

A review of Department of Water and Environment (DWER) registered drill holes indicate a total of 115 bore holes within 2 km of the Study Area (Lotsearch™, 2020), as displayed in **Appendix A**. With the exception of one borehole, the status of whether these boreholes are current/in use is unknown.

Table 3.3 below provides a summary of registered drill holes within 500 m of the Study Area, with **Appendix B** providing details of all registered bores. Bore uses include domestic (potentially potable), livestock supply, research, monitoring and exploration.

Table 3.3: Registered Bore Holes within 500 m of the Study Area

Unit No.	Status	Purpose	Drill date	Drilled Depth (m)	Bore Depth (m)	Ground Elevation (m)	Distance from Study Area (m)	Direction
50086592	-	Water Supply Exploration or research	7/27/2000	62	58	347.02	0m	Onsite
50014960	-	Unknown	1/1/1970	15.24	Unknown	421.89	0m	Onsite
50011998	-	Unknown	Unknown	Unknown	Unknown	Unknown	0m	Onsite
50065363	-	Unknown	1/1/1900	9.14	Unknown	427.48	0m	Onsite
50025054	-	Unknown	1/1/1900	36.58	Unknown	345.87	0m	Onsite
50097558	-	Water supply, Exploration or research	8/15/2000	96	84.5	343.61	0m	Onsite
50071549	-	Water supply	8/15/2000	84	83.4	343.54	0m	Onsite
50110014	-	Unknown	Unknown	Unknown	Unknown	Unknown	0m	Onsite
50083068	-	Exploration or research, Water supply	8/12/2000	78	66	347.54	0m	Onsite
50111796	-	Unknown	Unknown	Unknown	Unknown	345.17	0m	Onsite

Unit No.	Status	Purpose	Drill date	Drilled Depth (m)	Bore Depth (m)	Ground Elevation (m)	Distance from Study Area (m)	Direction
50104089	-	Unknown	Unknown	Unknown	Unknown	342.84	0m	Onsite
50037333	-	Unknown	1/1/1900	7.62	Unknown	348.14	16m	North
50093564	-	Unknown	10/12/1975	69	28	425.15	23m	South East
50085475	-	Water supply, Exploration or research	8/11/2000	78	71	354.02	41m	North
50075947	-	Water supply	7/24/2004	87	86	574.29	64m	South
50012362	-	Water supply for livestock, Domestic household, Household	1/1/1900	6.2	Unknown	489.94	70m	South East
50126947	-	Unknown	Unknown	Unknown	Unknown	599.32	81m	South
50080476	-	Exploration or research	7/28/2000	72	6	354.09	81m	North
50084088	-	Exploration or research	7/11/2004	90	90	574.22	83m	South
50075200	-	Water supply, Exploration or research	8/10/2000	72	70	354.33	86m	North
50126946	-	Unknown	Unknown	Unknown	Unknown	598.93	94m	South
50063012	-	Water supply for livestock	1/1/1900	12.19	Unknown	596.38	143m	South
50076153	-	Water supply	3/23/2002	90	90	344.35	204m	North
50067992	-	Unknown	1/1/1900	25.91	Unknown	352.56	213m	North
50079433	-	Exploration or research	7/26/2000	48	6	513.33	214m	South East
50007976	-	Unknown	1/1/1900	28.65	Unknown	402.99	217m	North East
50074956	-	Monitoring	7/14/1976	42.74	42.74	351.81	219m	North
50083083	-	Water supply	8/3/2000	60	58.65	513.33	229m	South East
50094672	-	Exploration or research	7/10/2004	66	66	537.37	248m	South East
50075083	-	Water supply	7/28/2004	73	70	538.07	262m	South East
50045420	-	Unknown	1/1/1900	21.34	Unknown	421.69	269m	East
50065673	-	Unknown	1/1/1900	15.24	Unknown	421.69	269m	East
50062621	-	Unknown	1/1/1900	22.86	Unknown	421.69	269m	East
50055143	-	Unknown	1/1/1900	30.48	Unknown	421.69	275m	East
50064048	-	Unknown	1/1/1900	15.24	Unknown	421.69	276m	East
50083116	-	Water supply	7/6/2004	86	84	604.58	278m	South
50096924	-	Water supply	7/6/2004	86	74	604.58	298m	South
50086326	Functioning	Monitoring	5/15/1975	67.41	58.21	395.91	350m	North East

Unit No.	Status	Purpose	Drill date	Drilled Depth (m)	Bore Depth (m)	Ground Elevation (m)	Distance from Study Area (m)	Direction
50099877	-	Water supply for livestock	6/30/1935	23.16	Unknown	398.87	360m	North East
50068537	-	Unknown	1/1/1900	30.48	Unknown	356.59	380m	North
50050231	-	Unknown	1/1/1900	58.6	Unknown	511.68	382m	South East
50109922	-	Unknown	Unknown	Unknown	Unknown	Unknown	384m	South East
50059631	-	Unknown	1/1/1900	30.48	Unknown	645.48	451m	South
50055487	-	Unknown	1/1/1900	30.48	Unknown	578.51	456m	South
50069925	-	Unknown	Unknown	Unknown	Unknown	Unknown	499m	South

3.3 Groundwater Dependent Ecosystems

There are 55 ecosystems within 1 km of the study area with a low GDE potential, eleven with a moderate GDE potential, five with a high GDE potential and three with a known GDE based on a national assessment (Lotsearch™, 2020). Details of the moderate, high and known GDEs are presented in **Table 3.4**. Further detail around all GDEs within the study area can be seen in **Appendix A** and the GIS web viewer.

Table 3.4: Groundwater Dependent Ecosystems within 1.0 km of the Study Area

Type	GDE Potential	Geomorphology	Ecosystem Type	Distance (m)	Direction	Lotsearch Section
Terrestrial	Known GDE	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks	Riparian Vegetation	0m	Onsite	1
Terrestrial	Known GDE	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks	Riparian Vegetation	68m	West	3
Aquatic	High	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	River	650m	South East	3
Aquatic	High	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	River	0m	Onsite	4
Aquatic	High	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	River	0m	Onsite	4
Terrestrial	Moderate	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	Vegetation	0m	Onsite	4
Aquatic	High	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	River	0m	Onsite	4
Terrestrial	Known GDE	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks	Riparian Vegetation	0m	Onsite	4
Terrestrial	Moderate	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	Vegetation	135m	North East	4
Terrestrial	Moderate	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	Vegetation	0m	Onsite	5
Aquatic	High	Mainly alluvial lowland with hardpan wash plains and sandplain possibly a graben	River	0m	Onsite	5
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	5
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	6

Type	GDE Potential	Geomorphology	Ecosystem Type	Distance (m)	Direction	Lotsearch Section
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	6
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	7
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	7
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	199m	North East	7
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	0m	Onsite	8
Terrestrial	Moderate	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks	Vegetation	14m	North	8

3.4 Ramsar Wetlands

There are no registered Ramsar Wetlands within 1. km of the Study Area (Lotsearch™, 2020).

3.5 Hydrological Setting

The proposed MRDH Stage 4 crosses the Cowcumba Creek in the northern section and the Fortescue River in the middle section. The middle portion of the proposed MRDH Stage 4 also runs alongside the Weelumurra Creek and the southern portion runs alongside the Barnett Creek. These are both considered ephemeral water courses.

3.6 Potential Contaminating Environments

3.6.1 DWER Contaminated Land

There are no sites within 1 km of the Study Area that are registered on the WA DWER Contaminated Sites Database (Lotsearch™, 2020).

3.6.2 DWER Authorisations and Applications

Five sites within 1 km of the Study Area have DWER Licence and Works Approvals (Lotsearch™, 2020). All of these sites are sewerage facilities with two additionally for materials screening. The details of these sites are described in Table 3.5 below with further detail provided on the GIS Maps.

Table 3.5: Summary of DWER Licences and Works Approvals within 1.0km of study area

Licence/Works Number	Lotsearch Report Section	Type	Premise	Location	Date Issued	Date Commenced	Date of Expiry	Category
L9263/2020/1	5	Licence	Koodaideri Railway Project	Miscellaneous Licence for Railway 7 (L7SA)	17/12/2020	18/12/2020	17/12/2040	12-Screening of Material 54-Sewerage Facility
W6238/2019/1	5	Works Approval	Koodaideri Railway Project	Miscellaneous Licence for Railway 7 (L7SA)	05/08/2019	06/08/2019	05/08/2022	12-Screening of Material 54-Sewerage Facility
W6218/2019/1	6	Works Approval	Pilbara Iron Pty Limited	Tom Price Railway Road	02/04/2019	02/04/2019	02/04/2024	85-Sewerage Facility
L9265/2020/1	8	Licence	Eliwana Rail Camp CH50	Part of Miscellaneous lease L47/794	08/04/2021	08/04/2021	07/04/2024	54-Sewerage Facility
W6300/2019/1	8	Works Approval	Fortescue Metals Group Limited	Part of Miscellaneous Licence L47/794 As defined by the coordinates in Schedule 1 of the Works	06/02/2020	06/02/2020	05/02/2023	85-Sewerage Facility

3.6.3 Defence PFAS Investigation and Management Program

There are no sites within 2 km of the Study Area that are being investigated or managed by the Department of Defence in relation to per- and polyfluoroalkyl substances (PFAS) (Lotsearch™, 2020).

3.6.4 Airservices Australia National PFAS Management Program

There are no sites within 2 km of the Study Area that are being investigated or managed by Airservices Australia as part of their National PFAS Management Program (Lotsearch™, 2020).

3.6.5 Defence 3 Year Regional Contamination Investigation Program

There are no sites within 2 km of the Study Area that have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program (Lotsearch™, 2020).

3.6.6 National Waste Management Site Database

There are no sites within 1 km of the Study Area that are registered on the National Waste Management Facilities Database (Lotsearch™, 2020).

3.6.7 National Liquid Fuel Facilities

There are no sites within 1 km of the Study Area that are registered as National Liquid Fuel Facilities (Lotsearch™, 2020).

4. Potential Contamination Risk Assessment

Based on the information reviewed for the study area, a risk assessment for potential contamination of the study area is presented below in Table 4-1.

Table 4-1: Summary of all potentially contaminated land sections and associated risks within the study area

Land Use	Location	Likelihood of Land Parcel Contamination	Location Relative to Proposed Alignment	Risk of Contamination within the Alignment	Potential Contaminants of Concern
Railway Line for transporting Iron Ore	Chainage 16200 in the Coolawanya Section	Medium	Adjacent	Low	Heavy Metals (primarily arsenic), Hydrocarbons, Solvents, Creosote/phenols, Asbestos Fibres, Herbicides, Pesticides
	Chainage 34200 to 27800 in the Coolawanya Section	Medium	Adjacent	Low	
	Chainage 40800 to 41600 in the Coolawanya Section	Medium	Adjacent	Low	
	Chainage 42900 in the Coolawanya Section to Chainage 1100 in the Hamersley Section	Medium	Adjacent	Low	
	Chainage 24300 to 25700 in the Hamersley Section	Medium	Adjacent	Low	
	Chainage 38000 to 38381 in the Tom Price section.	Medium	Adjacent	Low	
	Chainage 30300 in the Tom Price section.	Medium	Intersection	Medium	
Sewage Facility	Lotsearch area 5	Medium	Adjacent	Low	Heavy Metals, Micro-Organisms, Semi-Volatile Organic Compounds, Ammonia, Nitrates
	Lotsearch Area 5	Medium	Adjacent	Low	
	Lotsearch Area 6	Medium	Set Back	Low	
	Lotsearch Area 8	Medium	Set Back	Low	
	Lotsearch Area 8	Medium	Set Back	Low	

Land Use	Location	Likelihood of Land Parcel Contamination	Location Relative to Proposed Alignment	Risk of Contamination within the Alignment	Potential Contaminants of Concern
Mining Ancillary Operations	Lotsearch Area 3	Medium	Set Back	Low	Heavy Metals, Cyanide, Sulphides, Hydrocarbons
	Lotsearch Area 3	Medium	Set Back	Low	
	Lotsearch Area 3	Medium	Set Back	Low	
	Lotsearch Area 4	Medium	Set Back	Low	
	Lotsearch Area 6	Medium	Set Back	Low	
	Lotsearch Area 7	Medium	Set Back	Low	
	Lotsearch Area 7	Medium	Set Back	Low	
	Lotsearch Area 7	Medium	Adjacent	Low	
Lotsearch Area 8	Medium	Set Back	Low		

5. Naturally Occurring Asbestos

The potential presence of 'Naturally Occurring Asbestos (NOA) has been highlighted as a risk from early project discussions with the Client. Golder Associates Pty Ltd commented on the potential presence of asbestos based on the expected bedrock geology in their Karratha to Tom Price Road, Stage 4, Desktop and Field Reconnaissance Study report submitted to MRWA dated August 2020. However, it is important to note they provide no comment based on field observations during their field reconnaissance study.

Asbestos is a name given to a group of naturally occurring fibrous silicate minerals found in rock, sediment or soil. The term NOA distinguishes these natural occurrences from manufactured products that contain asbestos.

Asbestos and asbestiform minerals may form in a wide range of rock types, large accumulations of such minerals are associated with ultramafic rocks. Ultramafic rocks are typically dark rocks rich in magnesium and iron with relatively low silica and potassium and composed mostly of minerals such as olivine and pyroxene. Based on the anticipated geology summarised in Section 3, ultramafic rock is prevalent within the Hamersley group and therefore a further assessment of potential NOA is required.

5.1 Health Implications of NOA

While many types of mineral fibres inhaled at low concentrations have little effect on human health, others, depending on their fibrous habit and size, are decidedly harmful to the respiratory system. These are the asbestiform fibrous hydrated silicate minerals. Some occur naturally in both asbestiform and non-asbestiform forms, which have identical chemical compositions but different physical properties, morphology, and health consequences.

Most fibrous minerals encountered in Western Australia are serpentine or amphibole asbestiform minerals such as chrysotile, crocidolite and actinolite as shown in Figure 4.1 below but other fibrous minerals may be encountered that can also present risks for human health.

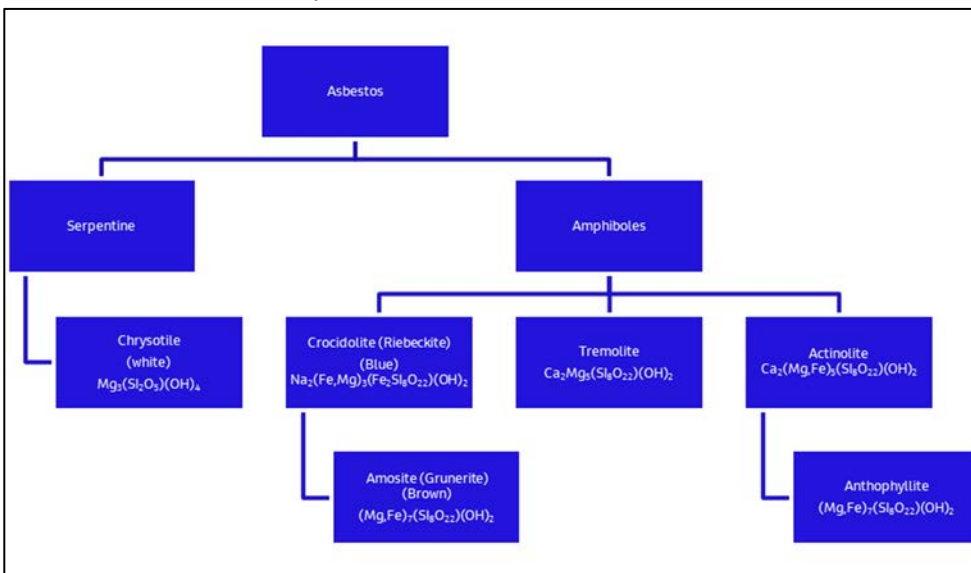


Figure 5-1: Most fibrous minerals encountered in Western Australia (DMIRS online resource¹, accessed May 2021), reference DMIRS, Guidance on fibrous mineral hazards.

¹ <https://www.dmp.wa.gov.au/Safety/Guidance-about-fibrous-mineral-6877.aspx>, accessed May 2021

5.2 Assessment Criteria

Fibrous minerals only present a health hazard when airborne. For infrastructure projects, this includes disturbance activities such as drilling, excavation, blasting, transporting minerals and crushing. Hence, the National Occupational Health and Safety Commission (1995) specifies that the occupational exposure standard should:

- Be defined as the time-weighted average (TWA) asbestos fibre concentration of the air breathed by a worker during a work shift; and,
- Not exceed 0.1 fibres per millilitre for all forms of mixtures of asbestos.

If there is a potential for fibrous minerals to be present on a site or within a development area (including potential borrow / quarry areas), a fibrous minerals management plan should be developed and made available to the Department of Mines, Industry Regulation and Safety upon request.

Assessment of NOA for the project is recommended to be undertaken in the following stages:

- Stage 1 - high-level qualitative desk study assessment based on the potential for NOA, considering a potential presence on account of mapped geological conditions and likely construction methods required to achieve the preliminary road alignment.
- Stage 2 - ground truthing and intrusive geotechnical investigation with laboratory testing to examine the potential for NOA within the construction/earthworks footprint.
- Stage 3 - If deemed to be required, development of an Asbestos Management Plan, bespoke to the activities of the project.

This assessment is considered to form part of the Stage 1 high-level qualitative desk study assessment. It is important to note that this high-level assessment is based upon published mapping only and that ground truthing and intrusive geotechnical investigation is required to confirm the assumptions made herein.

5.3 Stage 1 NOA Desk Study

5.3.1 Potential Presence of NOA based on Geological Units.

A summary of anticipated bedrock units with commentary as to the potential presence of NOA is summarised in Table 5-2 below. This information summarised is based on the review of the following sources:

- 1:250,000 Geological Series Map 'Pyramid' (GSWA, 2004, SF-50-7);
- 1:250,000 Geological Series Map 'Mount Bruce' (GSWA, 1996, SF 50-11);
- Kreiwaldt, MJB. 1:250,000 Explanatory Notes 'Pyramid', dated 01 January 1967;
- Kriewaldt, MJB. Explanatory Notes on the 'Pyramid' 1:250,000 geological sheet, dated 05 May 1965;
- Thorne, AM and Tyler, IM. 'Mount Bruce' 1:250,000 Explanatory Notes, 2nd edition, dated 26 June 1997.

Table 5-1 provides and explanation of the locations of the identified bedrock units.

Table 5-1: Potential presence of NOA based on anticipated geological units.

Bedrock Unit	Unit Description	Potential presence of NOA
Marra Mamba Iron Formation	<p>Ferruginous chert with prominent pinch and swell structure; jaspillite and ferruginous shale. The ferruginous cherts and jaspillites crop out as low mesas and hills covered with ferruginous gravel.</p>	<p>Haematite and crocidolite (blue asbestos) seams have been identified in this unit but no known occurrences have been recorded within the 1:250,000 Pyramid geological sheet (northern section of the Site).</p> <p>Magnetite concentrations are common on the surfaces of the chert lenses and thin seams of crocidolite are sometimes present. Seam of crocidolite at the top of the unit close to contact with the overlying Wittenoom Dolomite has been observed at the eastern end of the Mount Brockman syncline and on the northern side of the Mount Turner syncline.</p>
Wittenoom Formation	<p>Grey crystalline calcritic dolomite; with thin beds of chert and dolomitic shale in the upper part. This bedrock unit underlies the Fortescue Plain. The upper part of the Whittenoom Dolomite is well exposed along the scarp of the Hamersley Range but the lower part is covered.</p>	<p>No references to this formation containing NOA has been observed within the published literature.</p>
Mount Sylvia Formation	<p>Pale coloured fissile shale and dolomitic shale; with beds of jaspillite and dolomite</p>	<p>No references to these formations containing NOA has been observed within the published literature.</p>
Mount McRae Shale Formation	<p>Pale coloured fissile shale and dolomitic shale with beds of dark chert, yellow and blue dolomite and dolomite breccia.</p>	<p>It is important to note, however, that haematite may be present within these formations. Haematite can release polycyclic aromatic hydrocarbons (PAH) which is linked to chronic human health risks due to its carcinogenic effects. However, considering the duration of the works, this risk may be considered low.</p>
Brockman Iron Formation	<p>Thinly bedded jaspillite, chert and shale; with beds of black shale, yellow dolomitic shale and dolomite.</p> <p>This unit forms the Hamersley Ranges and is the dominant formation of the Hamersley Group both stratigraphically and topographically. The top of the Hamersley Range and many of the scarps are eroded into this formation. Jaspillites alternate with units of shale and dolomite in the lower part of the formation. The jaspillites form cliffs, with benches at their tops eroded into less resistant beds of shales and dolomite.</p>	<p>Microscopically, the jaspillites have fine laminae of magnetite, chert, carbonate, hematite and stilpnomelane. Haematite bodies and crocidolite seams are present, mainly in the lower part of the formation along with magnetite.</p> <p>Crocidolite occurs in bands, veins or cavity fillings and as bundles of fine acicular and curved crystals. The crocidolite is formed by crystallisation of material present in the original sediments under conditions of mid load metamorphism. Most of the Riebeckite is in 'mass fibre' form and is identified as a dark purplish-blue rock with pyrite crystals.</p>

5.3.2 NOA Risk Criteria and Summary

A desktop assessment of the potential presence of NOA along the project alignment is summarised below in **Table 5.3** based on review of available published information, with risk criteria attributed based on the probability of presence (refer Appendix A) and disturbance likelihood based on the preliminary road alignment / development corridor and anticipated earthworks.

The risk criteria used for the assessment is based on the below matrix presented as **Figure 5-2**.

Figure 5-2: Risk matrix for the potential presence and disturbance of NOA

Probability of Presence (likelihood):	Disturbance (Likelihood)		
	High	Medium	Low
High	High Risk	Moderate Risk	Moderate/Low Risk
Medium	Moderate Risk	Moderate Risk	Low Risk
Low	Moderate/Low Risk	Low Risk	Very Low Risk

Table 5-2: Desktop assessment risk summary of NOA across the Site

Project Section and Chainage (m)	Anticipated Geological Units	Description	Cuttings	Risk Justification	Disturbance (Likelihood)	Probability of presence (likelihood)	Risk Categorisation
Coolawanyah 0 - 34000	Alluvium and alluvial channel flow deposits, floodplain deposits, gilgai soils, colluvial wash. Marra Mamba Iron Formation	Marra Mamba Hills Footslopes	Some cuts anticipated to accommodate road alignment.	NOA may be present within surficial deposits (alluvium, colluvium etc) transported to the site, however, the potential for fibrous NOA within these deposits is assessed to be low. Some cuts are anticipated however published mapping indicates that these will mainly be through the natural superficial deposits and the Marra Mamba Iron Formation for which no known occurrences of crocidolite have been recorded within the 1:250,000 Pyramid geological sheet based on the explanatory notes.	Medium	Low	Low Risk
Coolawanyah 34000 – Hamersley 400	Alluvium and alluvial channel flow deposits, floodplain deposits. Wittenoon and Mount McRae / Mount Sylvia Formations	Fortescue River Valley	Minimal cut anticipated.	NOA may be present within surficial deposits transported to site as stated above. Asbestos is identified within the 1:250,000 scale Pyramid geological map, with Asbestos Creek running north to south and Asbestos Gorge located to the west of the Site. However, the potential presence within the creek is likely to be associated with the transport of minerals and washout of old tailings with the gorge extending to the Brockman Formation.	Low	Medium	Low Risk
Hamersley 400 - 12700	Alluvium and alluvial channel flow deposits,	Weelmurra Basin Flats	Cuttings through natural superficial materials and	NOA may be present within surficial deposits transported to site as stated above. Risk is elevated due to higher potential to	Low	Low	Very Low Risk

Project Section and Chainage (m)	Anticipated Geological Units	Description	Cuttings	Risk Justification	Disturbance (Likelihood)	Probability of presence (likelihood)	Risk Categorisation
	floodplain deposits, colluvial wash. Mount McRae / Mount Sylvia and Wittenoon Formations Channel Iron Deposits (CID) and calcrete present.		bedrock units is anticipated.	disturb bedrock but the probability of NOA has still been considered low based upon anticipated rock types.			
Hamersley 12700 – Tom Price 12000	Alluvium and alluvial channel flow deposits, floodplain deposits, colluvial wash and colluvium. Brockman Iron Formation, Mount McRae / Mount Sylvia Formations and Wittenoon Formation. CID and Calcrete.	Hamersley Range Hills	Significant cuts are anticipated through the Hamersley Range Hills, through potential Brockman Iron Formation ridges and/or a combination of Brockman Iron / Mount McRae / Mount Sylvia Shale chert and haematite. Typical excavation and blasting techniques are anticipated (which elevates risk of	Significant cuts are likely through the Hamersley Range and within the Brockman Iron Formation which may require blasting due to the strength of the jaspillites. Additionally, as summarised in Table 4.2 there is a known presence of crocidolite within the Brockman Iron Formation. Crocidolite deposits in the Wittenoon and Dales Gorge areas have been identified close to the contact with the underlying Mount McRae Shale. By 1962, an estimated total of 119,000 tonnes of crocidolite had been mined in this area by the Australian Blue Asbestos Ltd company (Kriewaldt, MJB. Explanatory Notes on the 'Pyramid' 1:250,000 geological sheet, dated 05 May 1965).	High	High	High Risk

Project Section and Chainage (m)	Anticipated Geological Units	Description	Cuttings	Risk Justification	Disturbance (Likelihood)	Probability of presence (likelihood)	Risk Categorisation
			airborne fibres if utilised).				
Tom Price 12000 - 38381	Alluvium and alluvial channel flow deposits, colluvial wash, Gilgai. Marra Mamba Iron Formation Calcrete and ferricrete.	Hamersley Plateau Flats	Minimal cut anticipated.	NOA may be present within surficial deposits (alluvium, colluvium etc) transported to the site, however, the potential for fibrous NOA within these deposits is assessed to be low. Some cuts are anticipated however published mapping indicates that these will mainly be through the natural superficial deposits and the Marra Mamba Iron Formation	Low	Medium	Low Risk

The risk assessment undertaken above and presented in **Appendix C** is preliminary, based on available published information and high-level discussions on the proposed road alignment route. This assessment is to be re-evaluated following a geotechnical investigation being undertaken along the alignment. The investigation to assess the potential for fibrous NOA can be undertaken in parallel with the geotechnical investigation to advise in the geotechnical design of the proposed scheme.

It must also be stated that a Site visit by a suitably qualified Geotechnical Engineer / Engineering Geologist is recommended to be undertaken which will assist in the qualitative assessment of the NOA risk. It will also enable the development of a suitable ground investigation that will appropriately test areas of potential risk associated with the proposed earthworks, i.e areas which may require cutting and borrow pits for locally reused materials.

Field identification of asbestos minerals should be considered provisional until verified by laboratory analysis. Laboratory analysis on air, soil, water, and bulk samples should be undertaken in a NATA accredited laboratory. Further recommendations on the type and quantity of samples should be discussed with a suitably qualified Geotechnical Engineer / Engineering Geologist once the proposed road corridor, areas of cut and potential borrow locations are further refined and the scope of appropriate geotechnical investigation for the project is proposed.

Appropriate HSE considerations for any proposed investigative works should be implemented due to the potential for NOA.

6. Heritage

6.1 Commonwealth Heritage

There are no Commonwealth Heritage List places within the 1 km buffer of the site.

6.2 National Heritage List

There are no National Heritage List places within the 1 km buffer of the site

6.3 State Heritage Register

There are no places on the State Heritage Register within the 1 km buffer of the site.

6.4 Aboriginal Heritage Places

Fifteen registered and fourteen lodged Aboriginal Heritage Places were identified within the 1 km buffer of the site. Details of these places are listed in **Table 5.1** below. Heritage surveys for MRDH4 are ongoing and preliminary results indicate that further sites will be identified.

Table 5.1: Aboriginal Heritage Places within a 1 km buffer of site.

Place ID	Name	Type	Status	Protected Area
21055	RTC – 03-08 Artefact Scatter	Artefacts Scatter	Registered Site	No
17694	Tunkawanna Creek	Artefacts Scatter	Registered Site	No
21057	RTC – 03-10 Artefact Scatter	Artefacts Scatter	Registered Site	No
21136	Balyeerina Pool	Historical, Mythological, Arch Deposit, Water Source	Lodged	No
21418	RTF04-01	Artefacts Scatter	Lodged	No
22431	RTF04-03	Artefacts Scatter	Lodged	No
21420	RTF04-03	Artefacts Scatter	Lodged	No
21419	RTF04-02	Artefacts Scatter	Lodged	No
21421	RTF04-04	Artefacts Scatter, Rockshelter	Lodged	No
24018	TRC 04-09	Artefacts Scatter, Quarry	Lodged	No
21075	TRC03-E1	Male Access Only	Lodged	No
19904	KTP/FS1	Artefacts Scatted	Registered Site	No
18173	Weelamurra Creek Ceremonial Ground	Artefacts Scatter, Ceremonial, Historical	Registered Site	No
38183	Weelamurra Wuntu	Ceremonial, Mythological, Water Source	Registered Site	No
21417	Lodged	Artefacts Scatter, Quarry	Lodged	No
17335	Mt Margaret 96- 1	Modified Tree	Registered Site	No
37920	S11-073	Artefacts Scatter, Man-Made Structure, Rockshelter	Registered Site	No
21062	RTC 03-04 Rockshelter Complex	Artefacts Scatter, Rockshelter	Registered Site	No
21414	RTC04-05	Artefacts Scatter	Lodged	No
21061	RTC 03-03 Rockshelter	Artefacts Scatter, Rockshelter	Registered Site	No
37886	Jurkanunha Marnta	Artefacts Scatter, Ceremonial, Historical, Mythological, Repository/Cache, Rockshelter, Skeletal Material/Burial,	Lodged	No

		Arch Deposit, Birth Place, Camp Meeting Place, Natural Feature, Plant Resource		
37670	Narraminju	Mythological	Registered Site	No
21064	RTC 03-11 Stone Artefact Scatter	Artefacts Scatter	Registered Site	No
21065	RTC 03-12 Stone Artefact Scatter	Artefacts Scatter	Registered Site	No
21412	RTC04-03	Artefacts Scatter	Lodged	No
19906	KTP/FS3	Artefacts Scatter	Lodged	No
21410	RTC04-01	Artefacts Scatter	Lodged	No
17332	Horseshoe Bore 02	Artefacts Scatter	Registered Site	No
19128	Tom Price Karratha Field Site 19	Artefacts Scatter	Registered Site	No
36017	S14-01	Artefacts Scatter, Grinding Patches/Grooves	Lodged	No
36019	S14-02	Artefacts Scatter, Grinding Patches/Grooves	Lodged	No

7. Summary of Findings and Recommendations

7.1 Findings

7.1.1 Contamination

Based on the information on potential contaminant sources reviewed in this report and considering the historical rural land uses in the area, it is unlikely that any significant contamination will be present within or adjacent to the Study Area. Potentially contaminating land uses identified within or adjacent to the study area included:

- Railway line (primarily used for transport of iron ore);
- Sewage facilities; and
- Ancillary infrastructure to mining operations

In almost every case these land uses were found to be either set back or adjacent to the alignment (i.e. outside of the disturbance footprint of the project) and were therefore considered low risk.

The alignment was however identified to cross the rail line at chainage 30300 within the southern Tom Price section. This location was assigned a Medium risk. Contaminants of potential concern (CoPCs) associated with the rail line include metals, hydrocarbons, solvents, creosote/phenols, asbestos fibres and pesticides/herbicides.

7.1.2 Naturally Occurring Asbestos (NOA)

The study area was split into five distinct sections based upon their geological units exhibited and ranked regarding project risk based upon the probability of NOA being present, as well as the likelihood of disturbance. The likelihood of disturbance was based upon the current road alignment and requirements for cutting or other disturbance (e.g. as opposed to filled sections). Of these, four sections were considered Low Risk, and one section, Hamersley to Tom Price (12700-12000), was considered High Risk. This section is defined by the Brockman Iron Formation, Mount McRae / Mount Sylvia Formations and Wittenoon Formation, of which the Brockman Iron Formation is considered being the highest risk. This is based on the both the mineral formation of the unit and the known presence of crocidolite from previous localised mining.

Significant cuts are likely through the Hamersley Range and within the Brockman Iron Formation which may require blasting because of the strength of the jaspillites and would exacerbate risks associated with airborne fibres.

7.1.3 Naturally Occurring Heavy Metals

Naturally occurring iron is likely to be encountered along the proposed alignment, particularly within the fluvial sedimentary deposits of the channel-iron deposits (CID) and the Banded Iron Formations within the Marra Mamba Iron and Brockman Iron formations.

7.1.4 Acid Sulfate Soils

In accordance with the Atlas of Australia, the Site predominantly resides in areas classified as Class C, with an extremely low probability of ASS occurrence (1-5%) in small localised areas. Exceptions apply to the central Hamersley Ranges which is categorised as low risk (6-70%) and notably localised areas to Fortescue River which is identified as high risk with a >70% change of occurrence between chainage 30,000 and 31,200 of the Coolawayna Section.

7.2 Recommendations

7.2.1 Contamination

As there is considered to be a generally low likelihood of contamination or contamination impacts within the Study Area, extensive intrusive investigations and detailed investigations are not necessary along the entire alignment prior to commencement of the proposed development works. However, it is recommended that targeted shallow soil sampling be completed at chainage 30300 in the Tom Price section once the alignment has been defined to assess the potential contamination risk associated with the intersection of the proposed alignment with the existing railway line. These samples should be analysed for the identified contaminants of potential concern outlines in **Table 4.1**.

Furthermore, if evidence of contamination is identified during construction activities (i.e. 'unexpected finds'), additional intrusive investigations and detailed site assessment may be required. In order to manage potential environmental impacts associated with the proposed works, it is recommended that a contamination unexpected finds protocol is incorporated into the project construction environmental management plan (CEMP).

In the event that identified contaminated soil is required to be excavated and disposed (off-site) during the proposed construction works, then any such waste soil should be classified and removed in accordance with Government of Western Australia DWER *Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)* (DEWR, 2019).

7.2.2 Naturally Occurring Heavy Metals

Once a detailed scope of works along the alignment and areas where disturbed soils may require relocation or are likely to be removed from the site have been confirmed, considerations for characterisation can be addressed. In general:

- Disturbed soils (with elevated naturally occurring metals) are not expected to pose a risk to human health or the environment where they are to be re-used within the project alignment in the immediate vicinity of the works (e.g. within a few hundred metres);
 - In terms of risks to construction workers, iron is generally considered to be of low toxicity (no national criteria are applicable for iron concentrations in soil related to the protection of human health), and it is expected that standard construction management techniques for minimising dusts (i.e. wetting down) would also be sufficient for the protection of human health.
- Disturbed soils that are required to be removed for re-use in distant areas of the project alignment (e.g. in different sections) should be characterised by sampling and laboratory analysis in accordance with applicable guidance to ensure they are suitable for re-use;
- Disturbed soils that are required to be removed off-site for disposal or for other uses should be characterised by sampling and laboratory analysis in accordance with should be classified and removed in accordance with Government of Western Australia Department of Water and Environmental Regulations *Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)* (DEWR, 2019), or applicable re-use criteria.

7.2.3 Naturally Occurring Asbestos (NOA)

For the Hamersley to Tom Price (12700-12000) which was considered high risk, it is recommended that targeted soil and rock sampling be undertaken with the locations and frequency yet to be determined. The locations and frequency will depend on the proposed road alignment, the anticipated depth of cut and the proposed re-use of the material. It must be noted that the aim of the investigation should not be to prove the

presence of asbestos along the site but only to address any human health concerns for those during construction (elevated risk) and subsequent road users.

Due to the early phase of the MRDH4 project, it is inappropriate to identify specific mitigation measures. However, once the proposed road alignment is finalised and further investigations have been undertaken, an Asbestos Management Plan should be developed which clearly outlines the aims and scope of the investigation within low risk and high-risk areas.

For any proposed investigation works which break the ground, appropriate HSE considerations should be implemented due to the potential presence of NOA.

7.2.4 Acid Sulfate Soils

Based on the high-risk categorisation of potential ASS between chainage 30,000 and 31,200 of the Coolawayna Section, it is recommended ASS testing in accordance with the WA Department of Water and Environmental Regulation guidance and the National Acid Sulfate Soils Sampling and Identification Methods Manual (2018) should be undertaken localised to the Fortescue River and any other existing river or creek crossings which intersect the long linear site. Testing is required to both assess Potential Acid Sulfate Soils (PASS) and Actual Acid Sulfate Soils (AASS), in order to qualify the risk appropriately and formalise mitigation strategies should these materials be disturbed during the works. Additionally, based on our experience, ASS testing should be undertaken within all areas of cut as this material will be inherently disturbed and evaluation for potential re-use and stockpiling must be considered.

8. References

Lotsearch, 2021. Lotsearch Enviro Lite Report, Manuwarra Red Dog Highway Alignment, WA (Part 1). Reference LS019693 EL. 19 April 2021.

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Lotsearch, 2021. Lotsearch Enviro Lite Report, Manuwarra Red Dog Highway Alignment, WA (Part 10). Reference LS019702 EL. 19 April 2021.

NEPC (2013). National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM), National Environmental Protection Council 2013.

Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, *National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual*, Department of Agriculture and Water Resources, Canberra ACT.

WA DER (2014). Assessment and Management of Contaminated Sites. Perth, Western Australia.

WA DER (2017). Identification, Reporting and Classification of Contaminated Sites in Western Australia. Perth, Western Australia.

WA DWER (2019). Landfill Waste Classification and Waste Definitions 1996 (as amended 2019). Joondalup, Western Australia.

Appendix A. Lotsearch™ Reports – Parts 1 to 10



LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Date: 19 Apr 2021 13:45:07

Reference: LS019693 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features.

You should obtain independent advice before you make any decision based on the information within the report.

The detailed terms applicable to use of this report are set out at the end of this report.

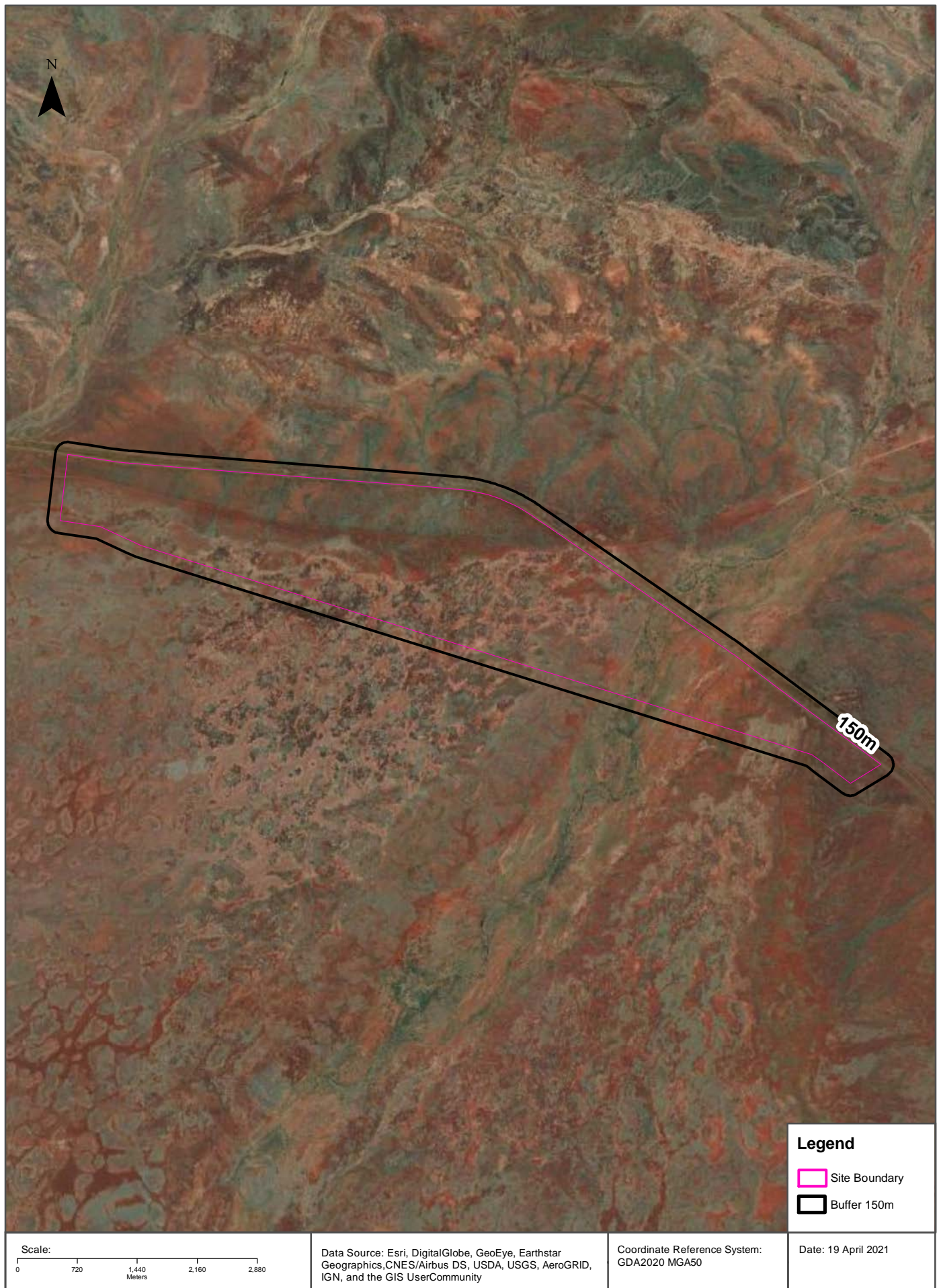
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	5	5	10
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	2	2	3
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	2	2	2
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	5	6	7
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2018 - 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

DWER Licences and Works Approvals

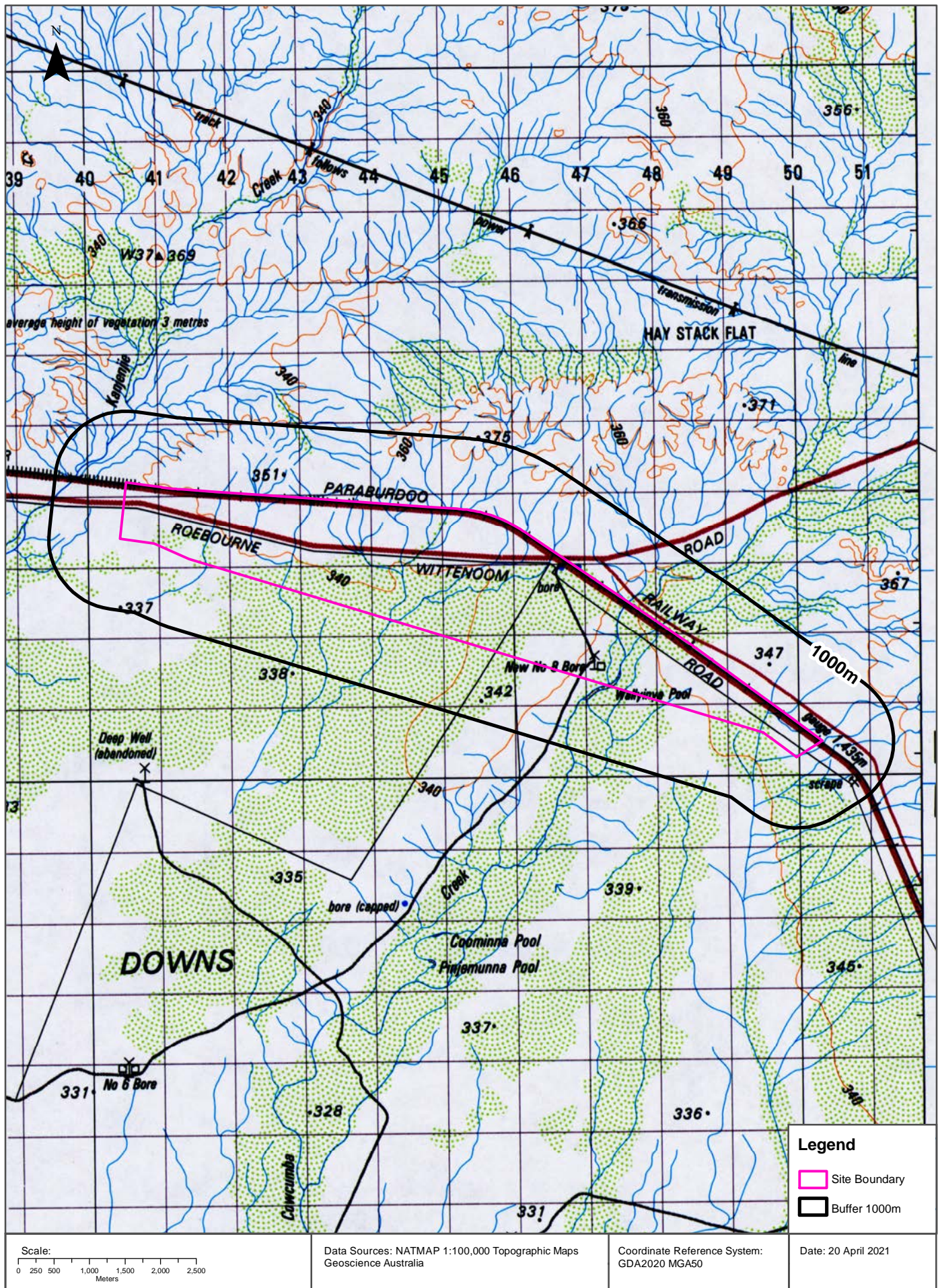
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
N/A	No records in buffer								

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

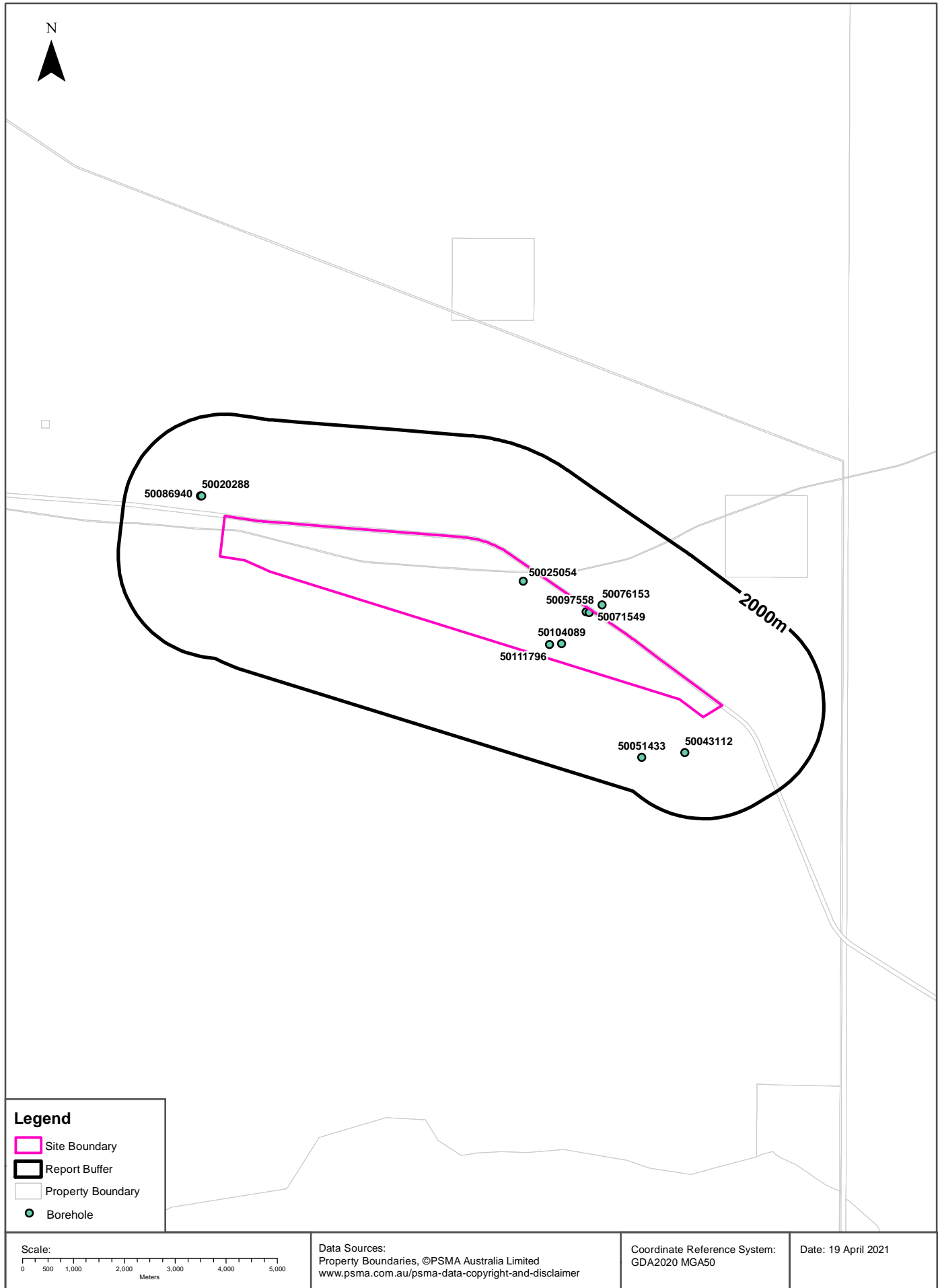
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50097558	70812563	Department of Water and Environmental Regulation	Water supply, Exploration or research	Unknown	8/15/2000	84.50	343.61	NGS	0m	Onsite
50025054	70810067	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		345.87	NGS	0m	Onsite
50071549	70812569	Department of Water and Environmental Regulation	Water supply	Unknown	8/15/2000	83.40	343.54	NGS	0m	Onsite
50104089	70810072	Department of Water and Environmental Regulation	Unknown	Unknown			342.84	NGS	0m	Onsite
50111796	70810739	Department of Water and Environmental Regulation	Unknown	Unknown			345.17	NGS	0m	Onsite
50076153	70813047	Department of Water and Environmental Regulation	Water supply	Unknown	3/23/2002	90.00	344.35	NGS	204m	East
50020288	70813055	Department of Water and Environmental Regulation	Monitoring	Unknown	4/7/2002		332.75	NGS	596m	West
50086940	70813052	Department of Water and Environmental Regulation	Water supply	Unknown	4/6/2002	90.00	332.81	NGS	615m	West
50043112	70810069	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		345.67	NGS	788m	South East
50051433	70810737	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		344.72	NGS	1313m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

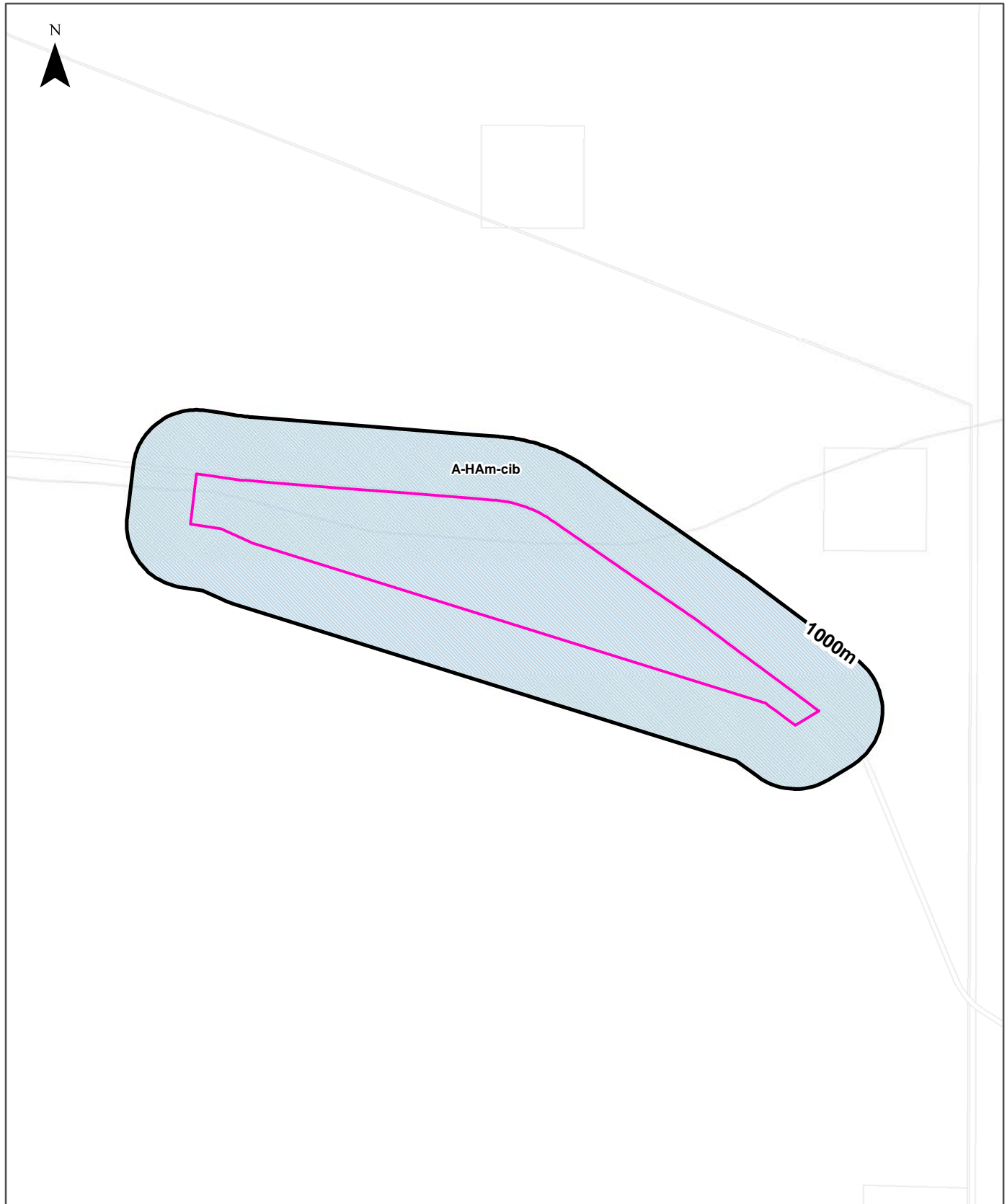
Bore ID	Driller's Log	Distance	Direction
No related drill log data			

Groundwater Boreholes Data Source: Bureau of Meteorology

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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Legend		Linear Geological Structures		
Site Boundary	Report Buffer	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed
Property Boundary	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, exposed
				Fold axial trace, concealed

<p>Scale:</p> <p>0 450 900 1,800 2,700 3,600 4,500 Meters</p>	<p>Data Sources:</p> <p>Property Boundaries, ©PSMA Australia Limited www.pdma.com.au/psma-data-copyright-and-disclaimer</p>	<p>Coordinate Reference System:</p> <p>GDA2020 MGA50</p>	<p>Date: 19 April 2021</p>
-------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------	----------------------------

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	Hammersley Group	Hammersley Group, lower	Marra Mamba Iron Formation	Neoarchean	Neoarchean	2629	2597	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

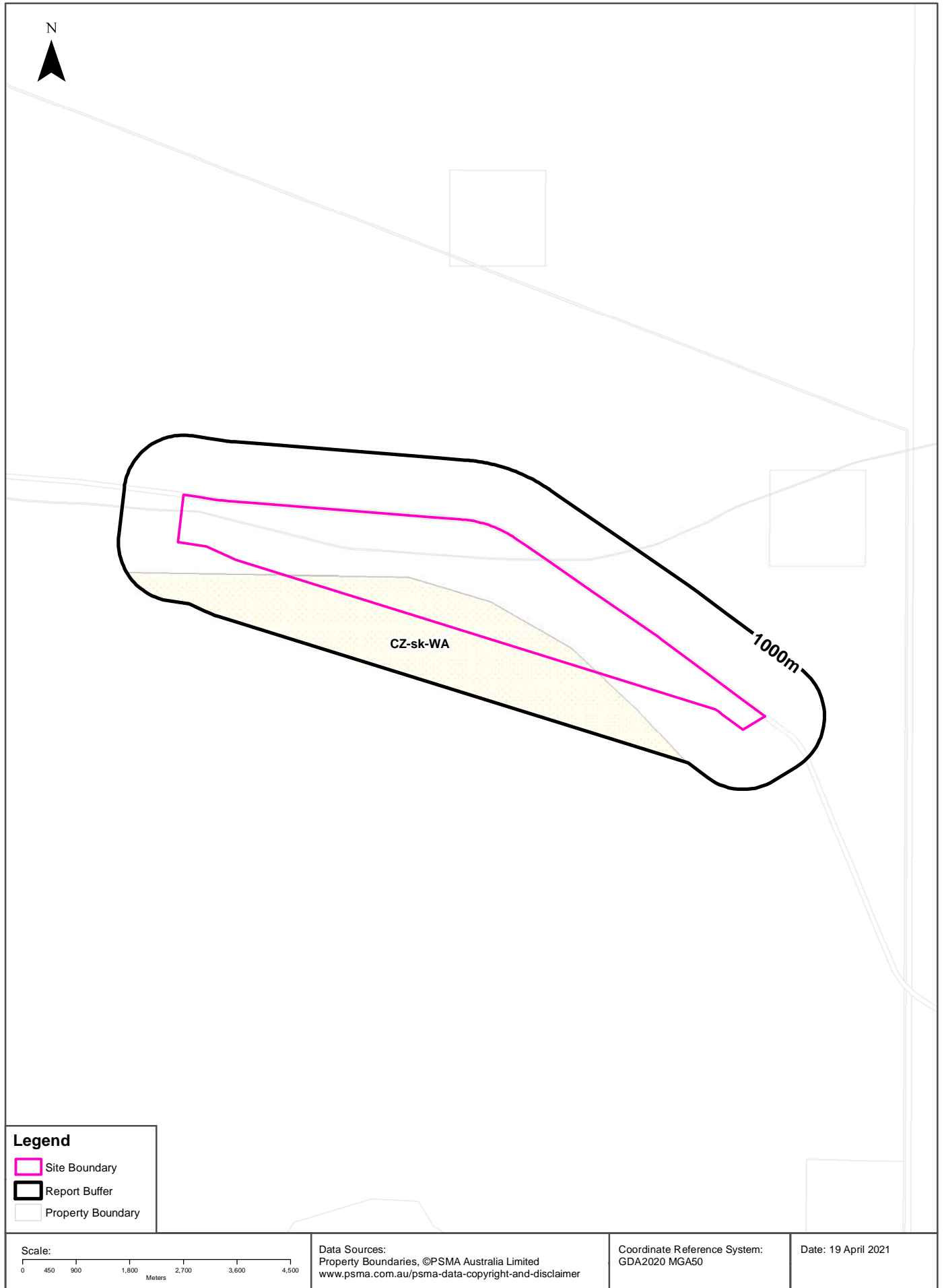
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

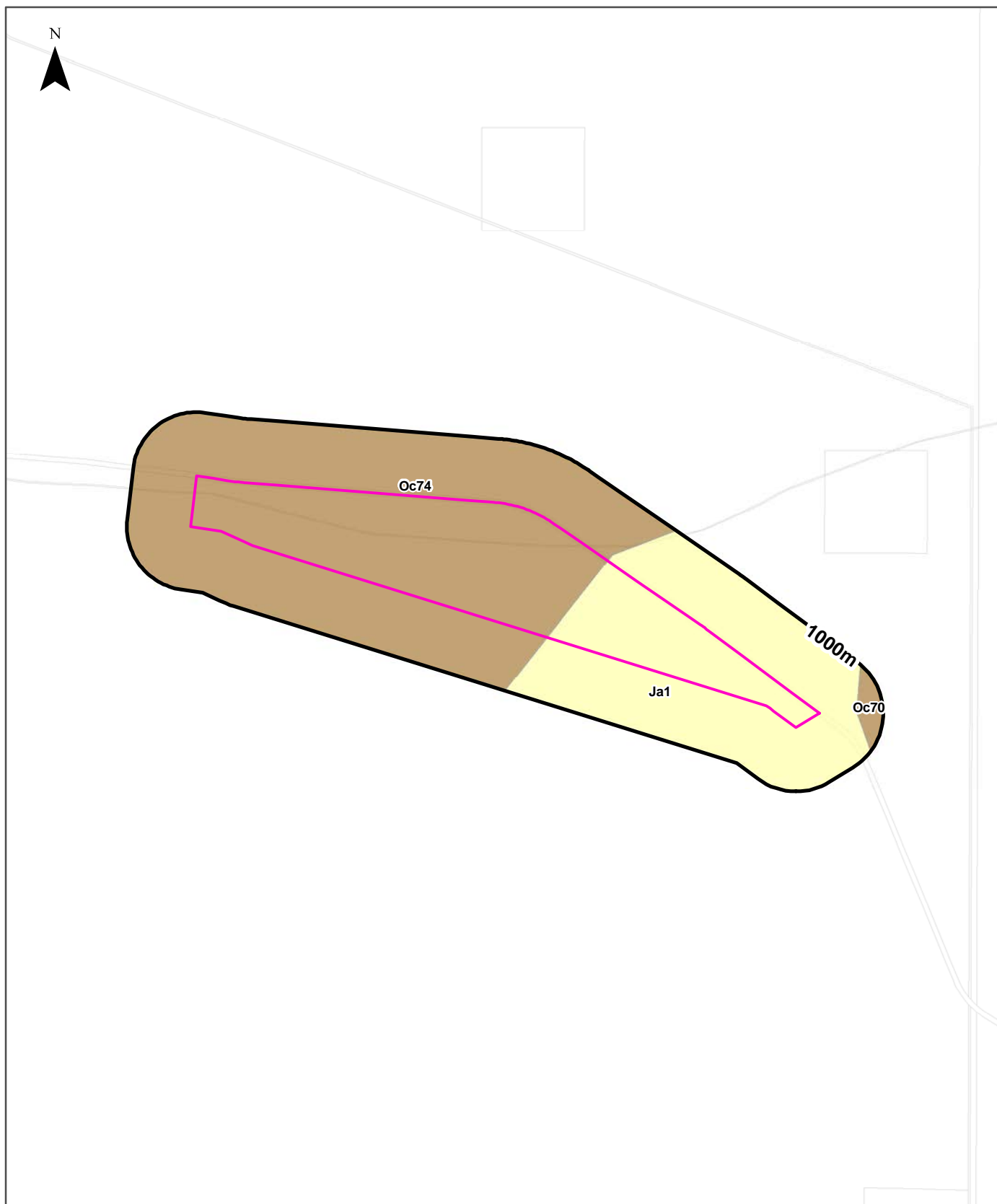
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
CZ-sk-WA	Valley-fill deposits	Alluvial and lacustrine sand, silt, mud and calcrete in major paleovalleys; Mesozoic at depth			Cenozoic	Holocene	66	0	0m

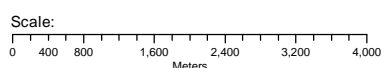
Geology Data Source: WA Department of Mines and Petroleum

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Legend

Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol	
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake	



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

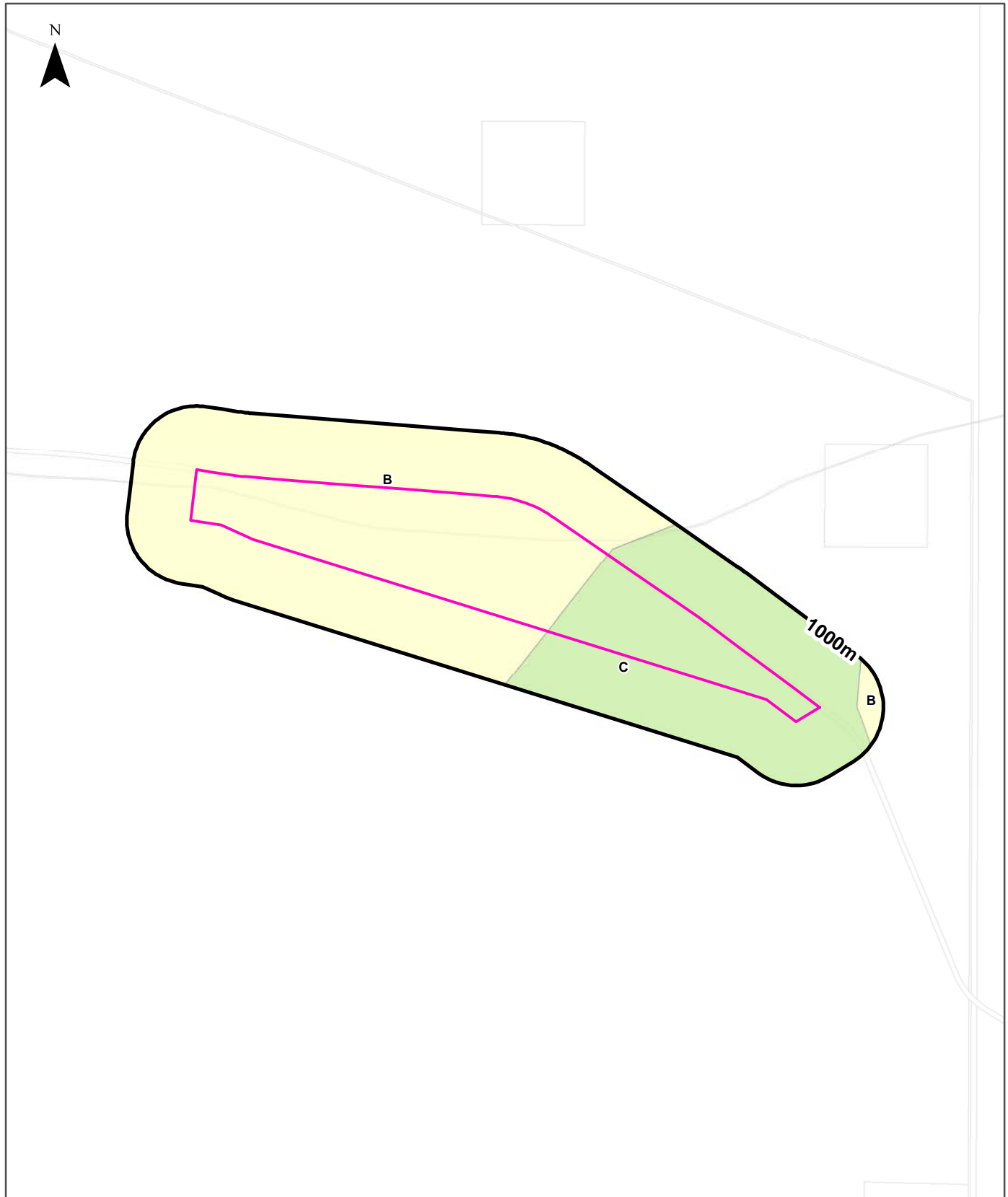
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Ja1	Kandosol	Extensive valley plains largely associated with the Fortescue River: chief soils are earthy clays (Uf6.71) along with some (Ug5.38), (Um5.5), and (Dr2.33) soils. Small areas of calcrete (kunkar) with (Um5.11) soils occur also.	0m
Oc74	Sodosol	Dissected pediments with low stony hills as in unit Oc70, and with some residuals capped by ironstone gravels and underlain by pallid zones to 30 ft; pediments have a gravel veneer of coarse rock fragments: hard alkaline and neutral red soils (Dr2.33 and Dr2.32) are dominant with some (Um5.52) on pediments and rock outcrop, and there are gravelly loams (KS-Um5.51) and sands (KS-Uc5.21) overlying duricrust at shallow depths on the residuals.	0m
Oc70	Sodosol	Dissected pediments and low stony hills associated with cherts, jaspilites, and iron ore formations; much coarse surface gravel: the chief soils are hard alkaline red soils (Dr2.33) along with some (Dr2.32) and (Um5.52) soils.	571m

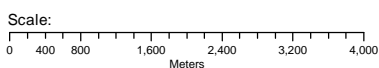
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
B	Low Probability of occurrence. 6-70% chance of occurrence.	0m
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

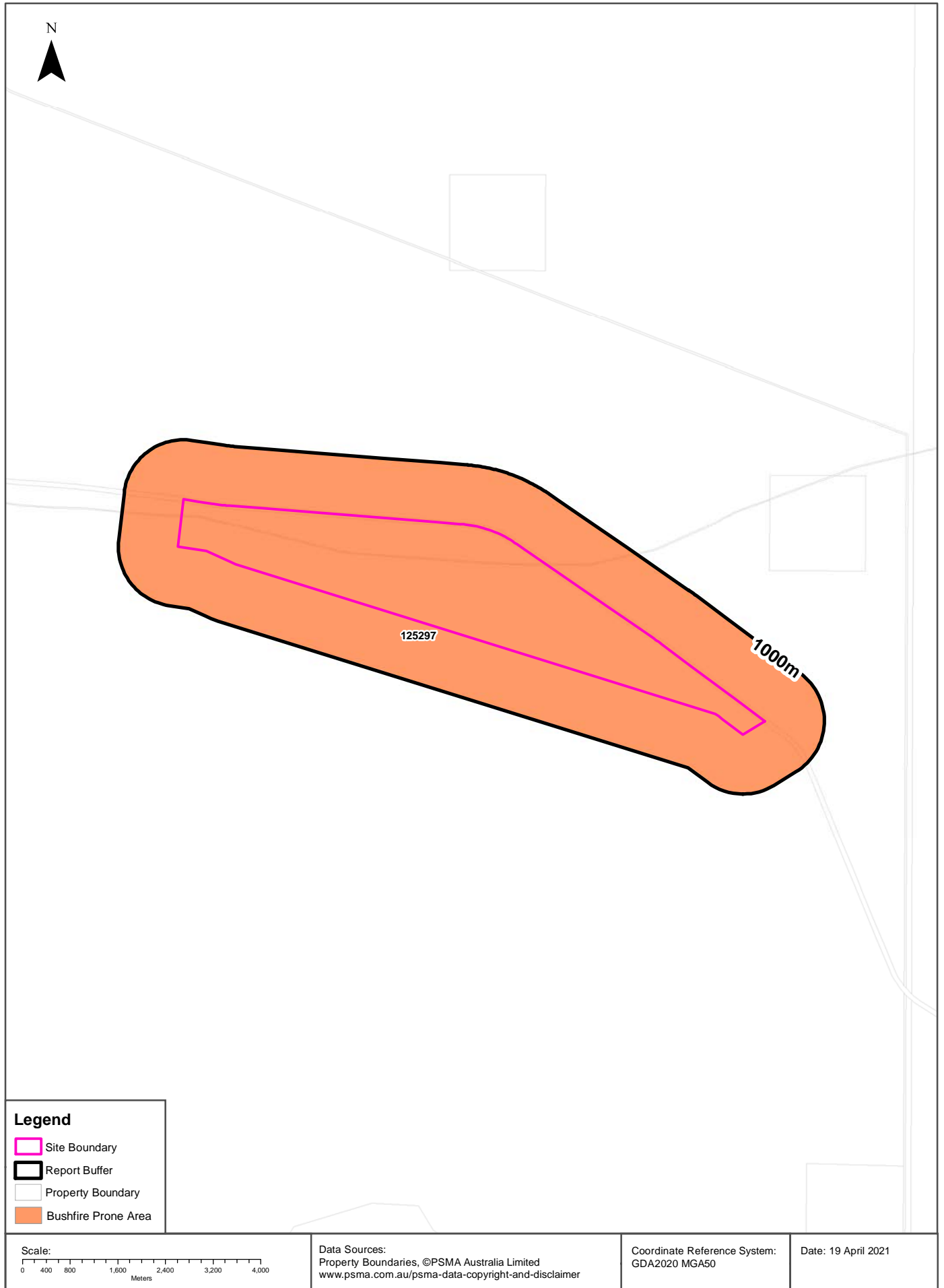
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Bushfire Prone Areas

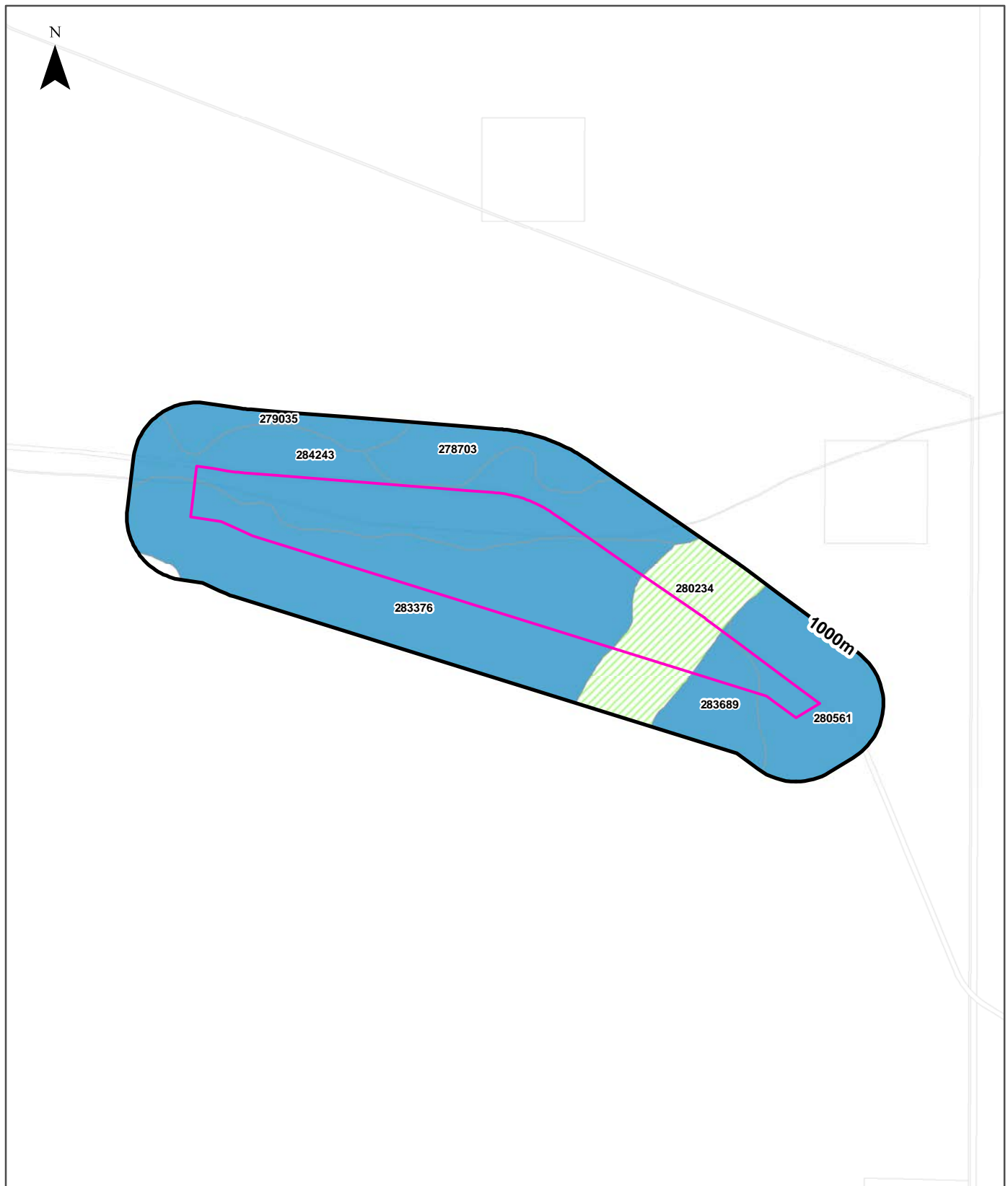
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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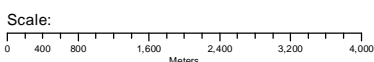
Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Manuwarrah Red Dog Highway Alignment, WA (Part 1)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
280561	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
284243	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
283376	Terrestrial		Low potential GDE - from national assessment	8	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
283689	Terrestrial		Low potential GDE - from national assessment	8	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280234	Terrestrial		Known GDE - from regional studies	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Riparian vegetation		0m	Onsite
278703	Terrestrial		Low potential GDE - from national assessment	9	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		2m	North East
279035	Terrestrial		Low potential GDE - from national assessment	8	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		170m	North

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology

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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 1)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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Address: Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Date: 19 Apr 2021 14:16:41

Reference: LS019694 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

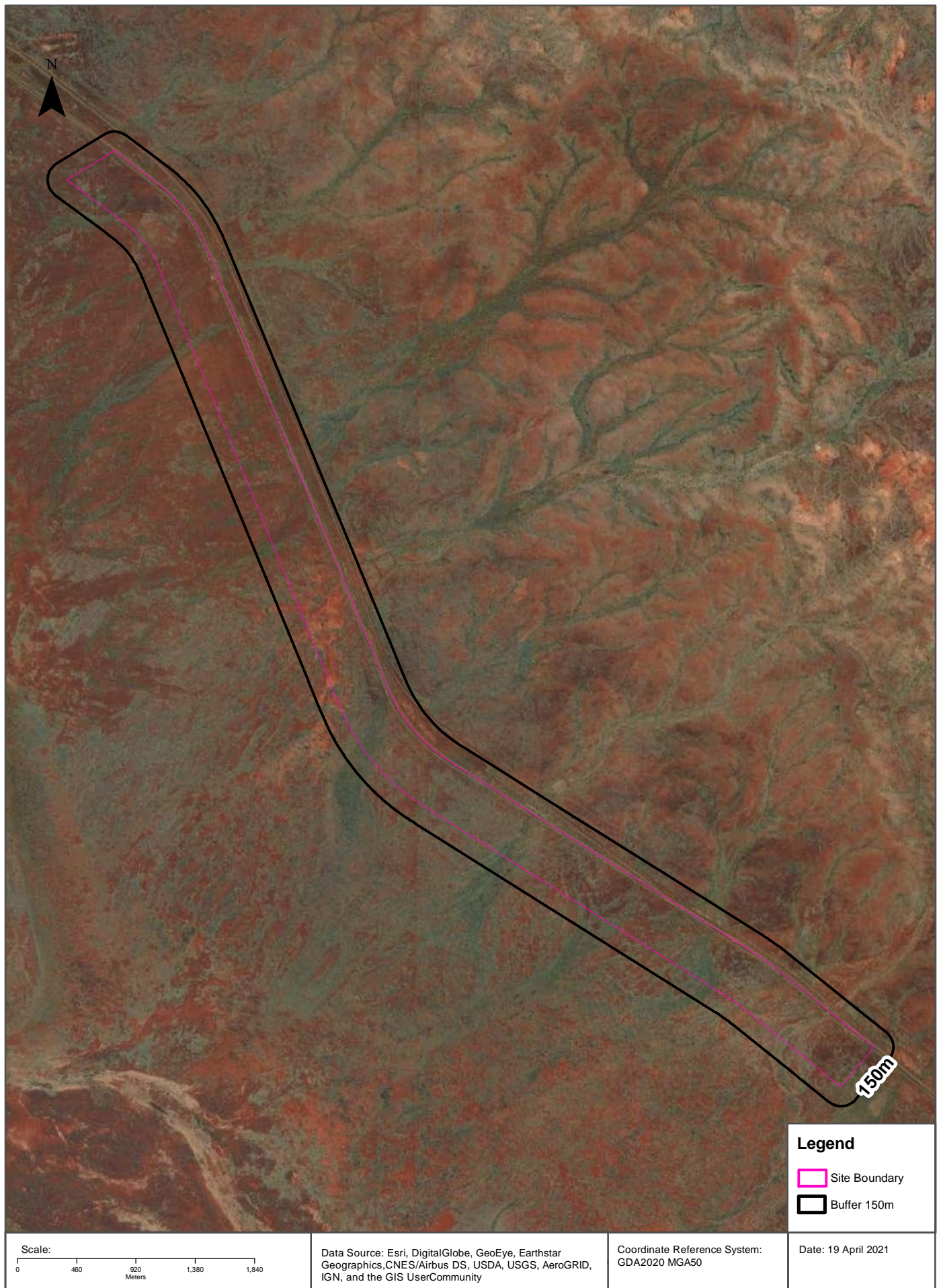
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	0	7
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	2	2
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	2	2
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	3	3	5
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia

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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia

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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

DWER Licences and Works Approvals

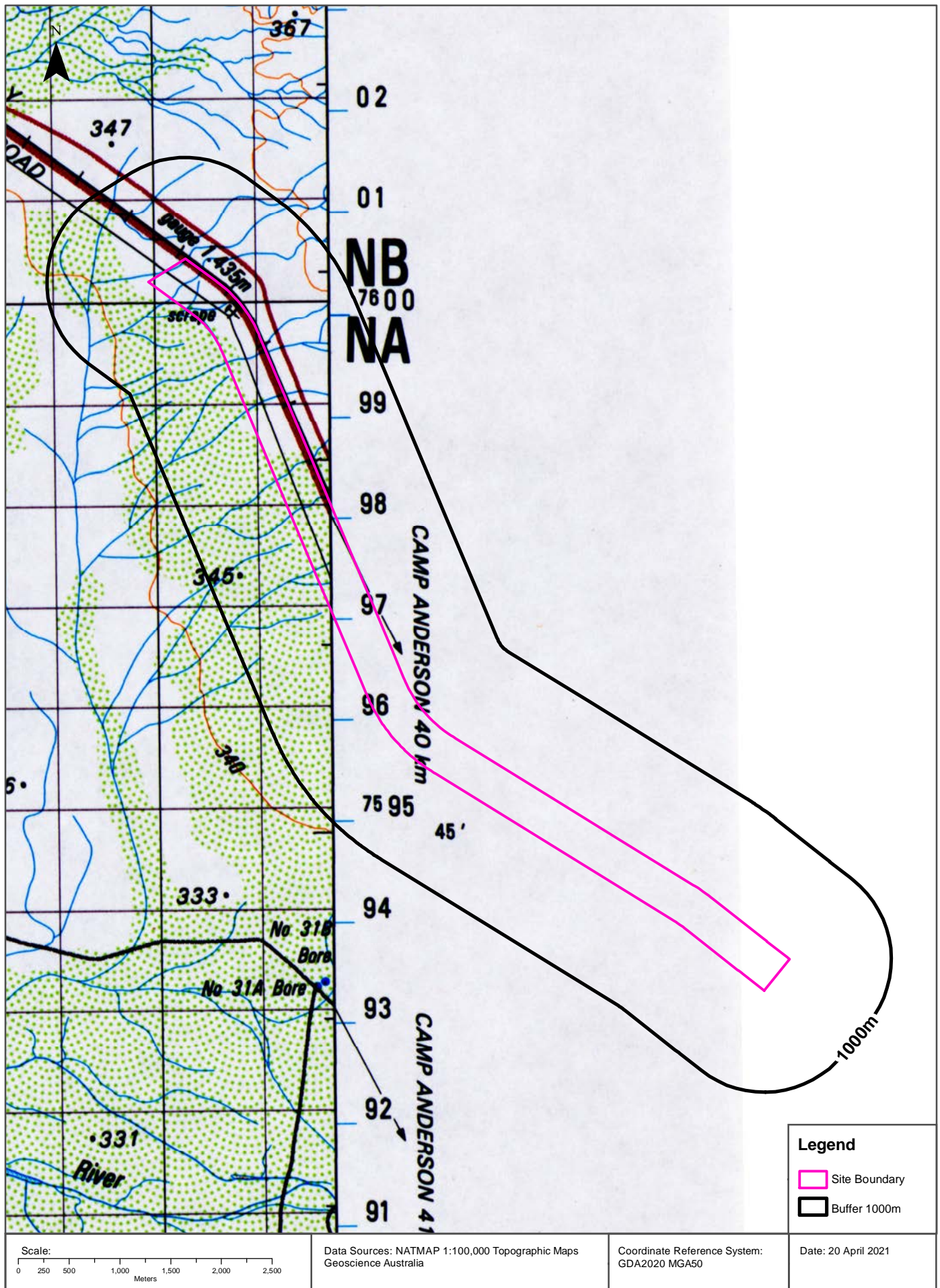
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

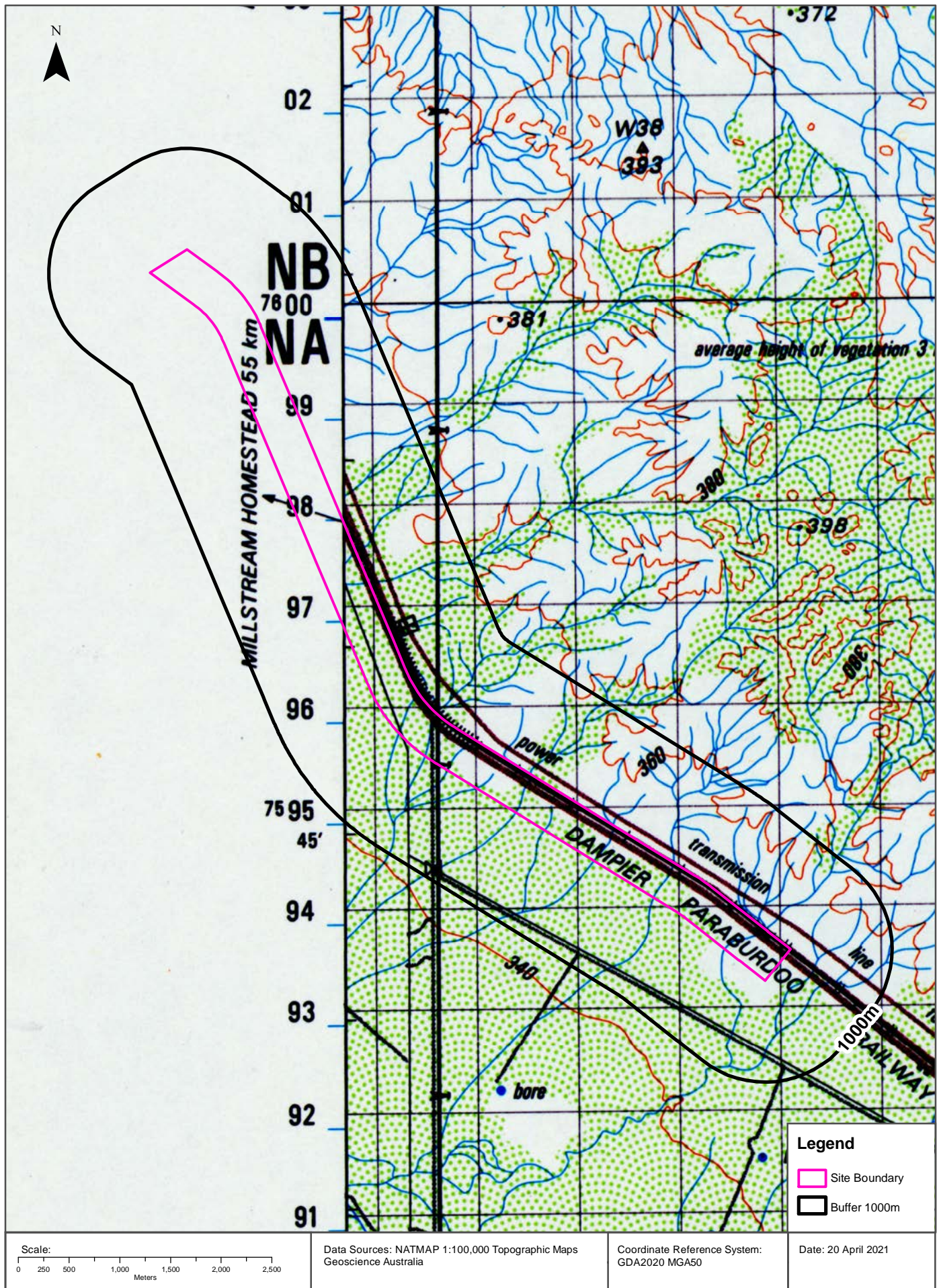
Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
N/A	No records in buffer								

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

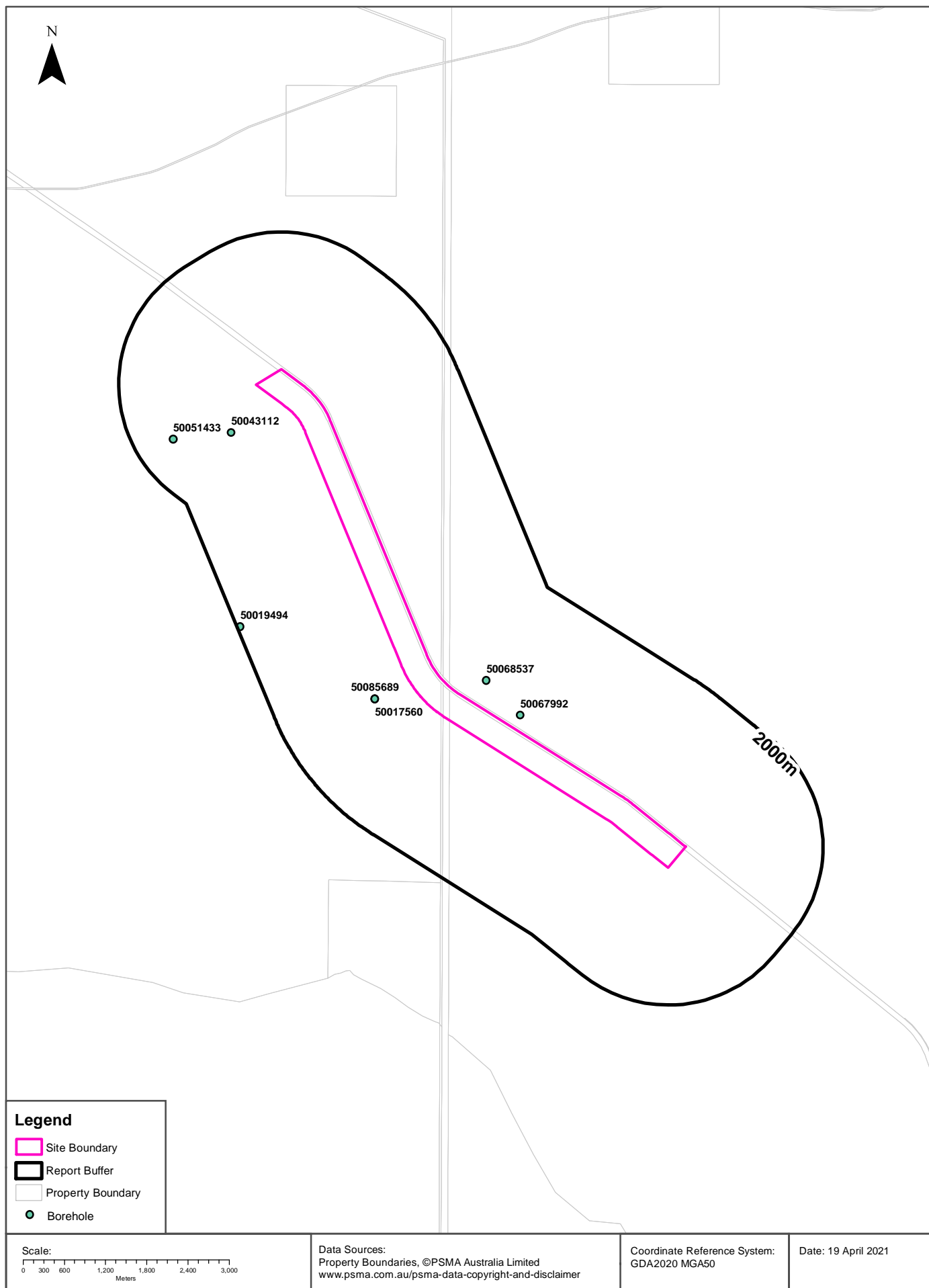
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50067992	70810259	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		352.56	NGS	213m	South East
50068537	70810258	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		356.59	NGS	380m	South East
50085689	70830006	Department of Water and Environmental Regulation	Monitoring	Unknown	5/11/1976	38.56	344.99	NGS	564m	South West
50017560	70810071	Department of Water and Environmental Regulation	Monitoring	Unknown	10/15/1976		344.55	NGS	564m	South West
50043112	70810069	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		345.67	NGS	776m	North West
50051433	70810737	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		344.72	NGS	1444m	North West
50019494	70810738	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		339.12	NGS	1953m	West

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

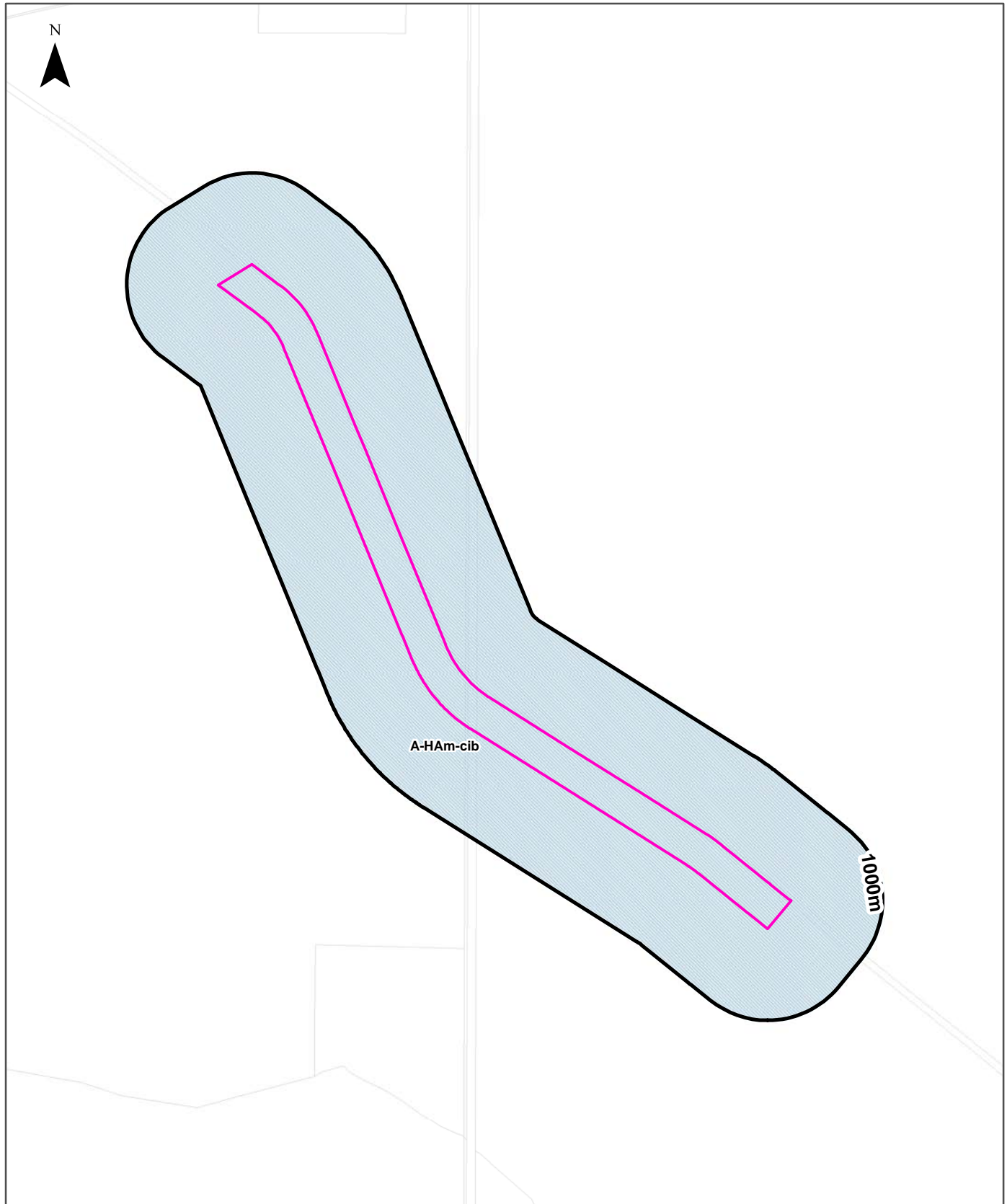
Bore ID	Driller's Log	Distance	Direction
50085689	0.00m-22.00m Tertiary 22.00m-43.50m Wthrd marra mamba iron fm	564m	South West

Groundwater Boreholes Data Source: Bureau of Meteorology

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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Legend		Linear Geological Structures		
Site Boundary	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed	Fold axial trace, exposed
Report Buffer	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, concealed
Property Boundary				
Scale: 		Data Sources: Property Boundaries, ©PSMA Australia Limited www.pdma.com.au/psma-data-copyright-and-disclaimer		Coordinate Reference System: GDA2020 MGA50
				Date: 19 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	Hammersley Group	Hammersley Group, lower	Marra Mamba Iron Formation	Neoarchean	Neoarchean	2629	2597	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

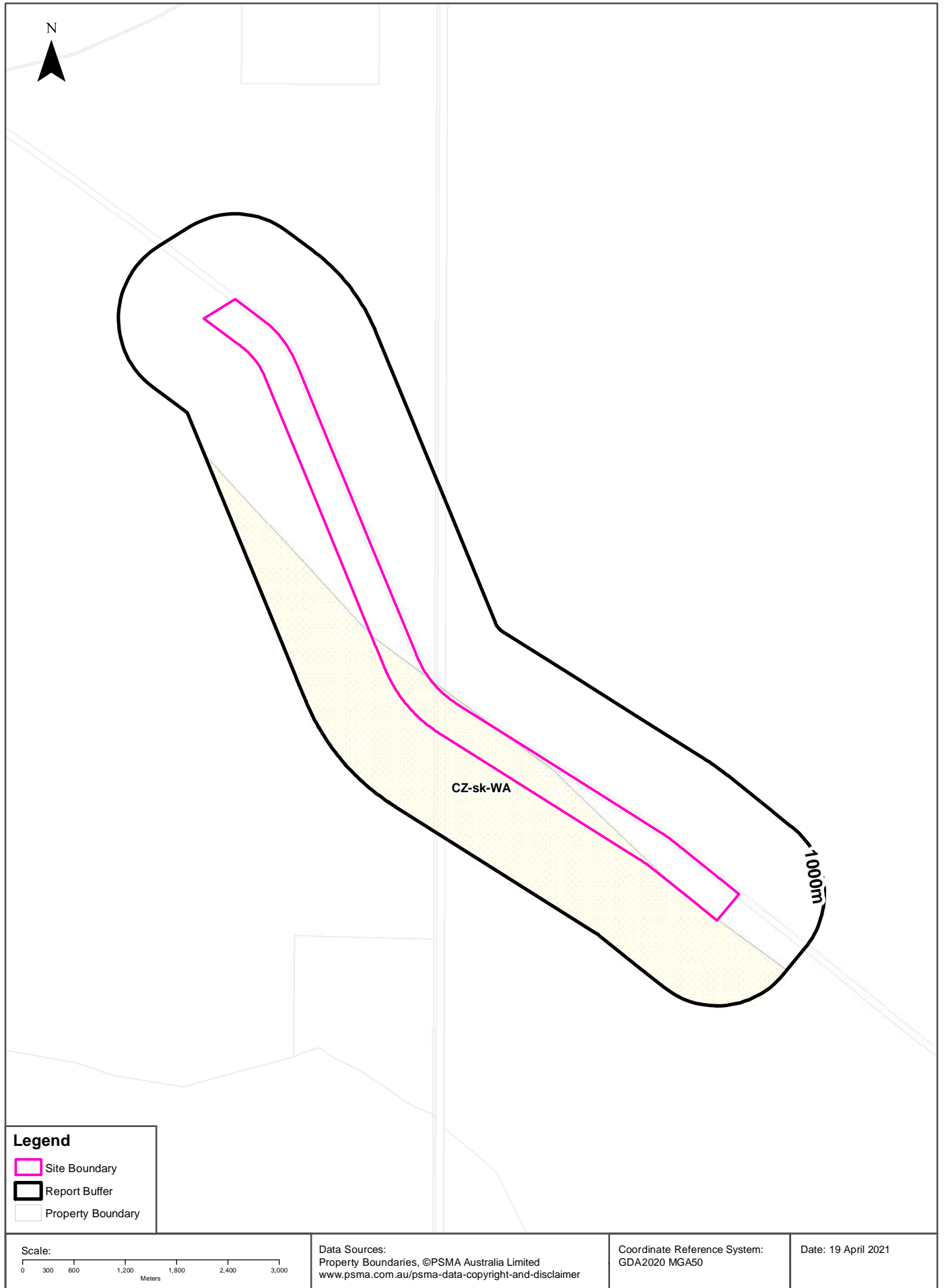
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

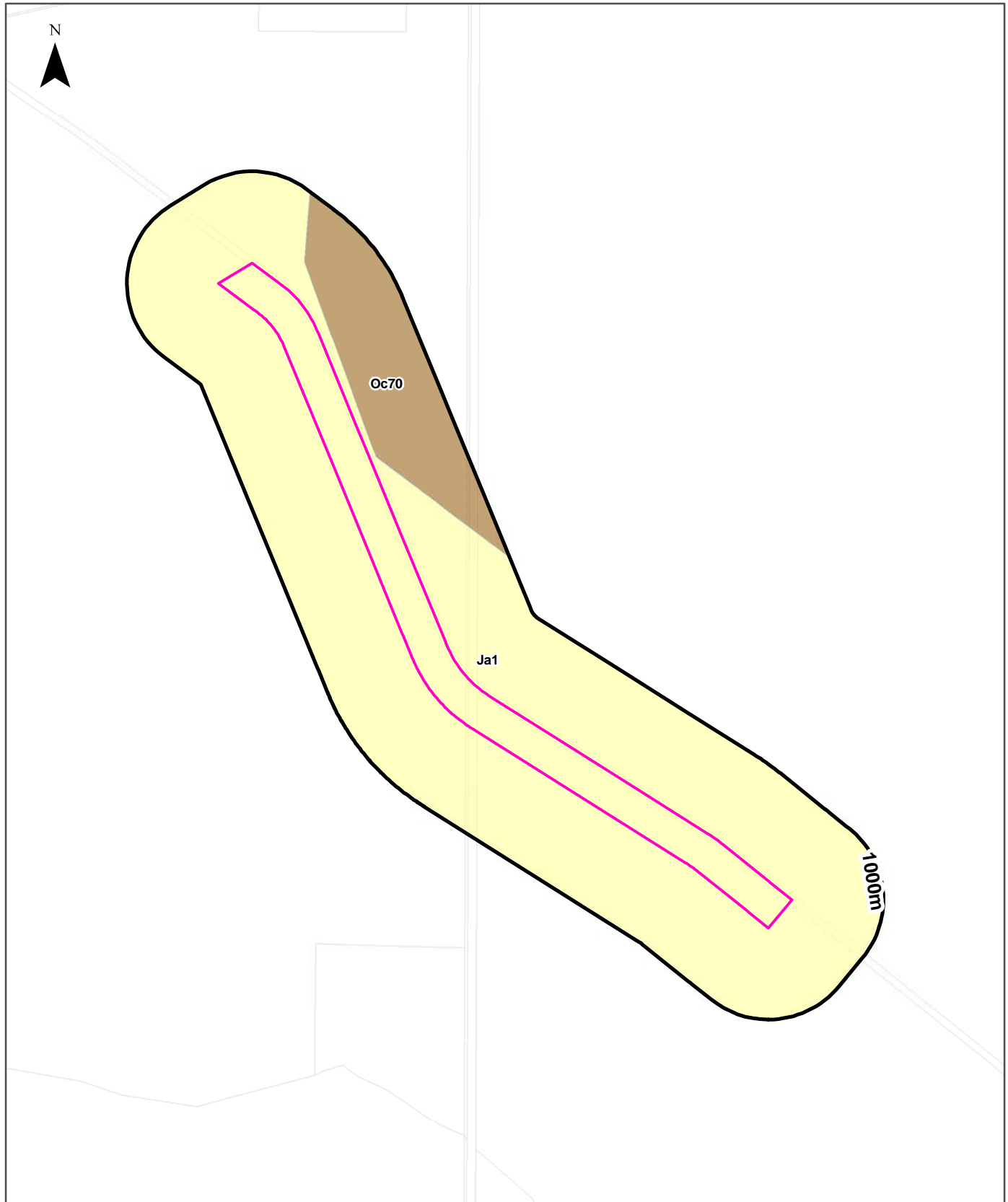
Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
CZ-sk-WA	Valley-fill deposits	Alluvial and lacustrine sand, silt, mud and calcrete in major paleovalleys; Mesozoic at depth			Cenozoic	Holocene	66	0	0m

Geology Data Source: WA Department of Mines and Petroleum

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Atlas of Australian Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Legend		Australian Soil Classification Orders					
Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		
Scale: 		Data Sources: Property Boundaries, ©PSMA Australia Limited www.pasma.com.au/psma-data-copyright-and-disclaimer		Coordinate Reference System: GDA2020 MGA50		Date: 19 April 2021	

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

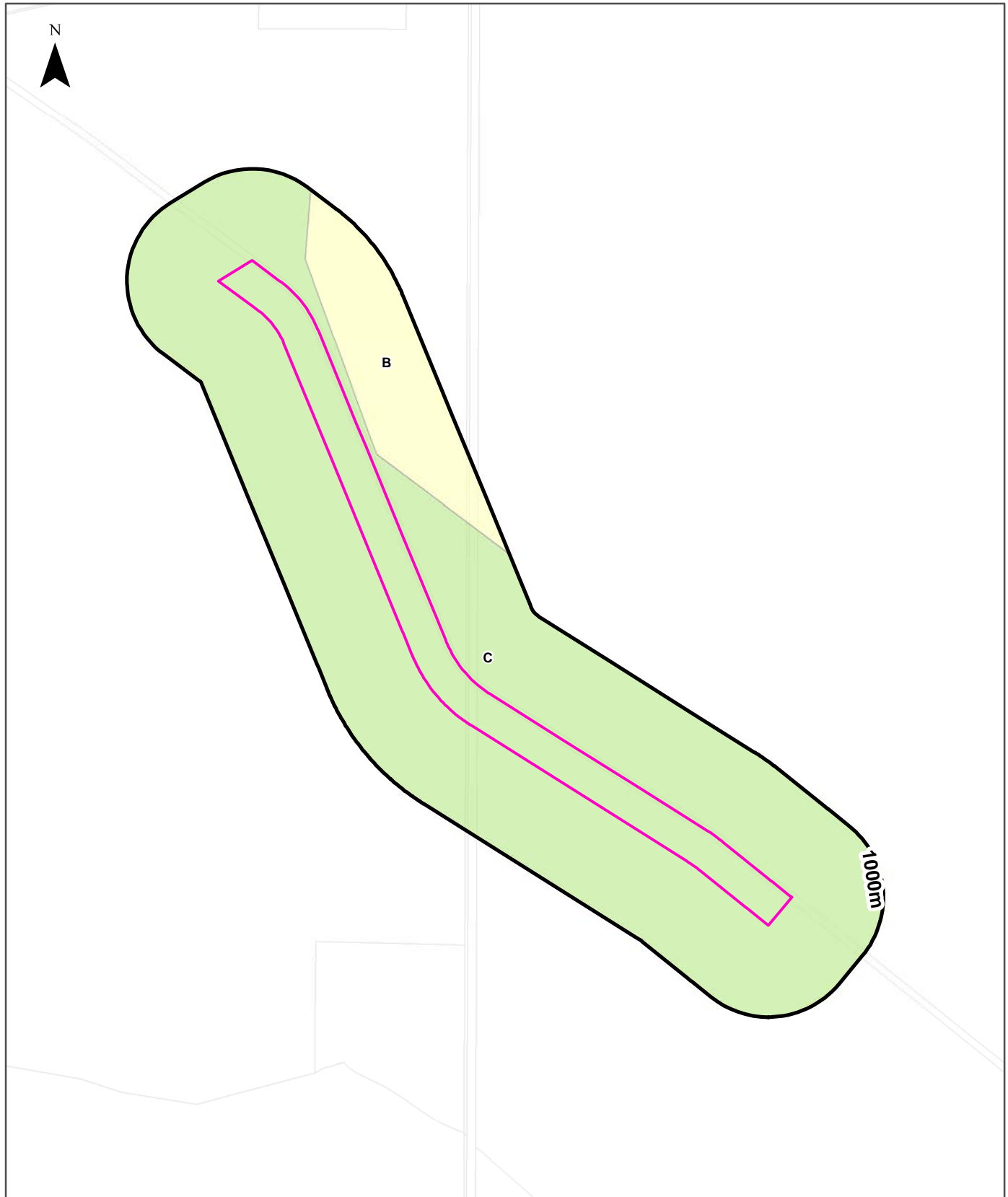
Map Unit Code	Soil Order	Map Unit Description	Distance
Ja1	Kandosol	Extensive valley plains largely associated with the Fortescue River: chief soils are earthy clays (Uf6.71) along with some (Ug5.38), (Um5.5), and (Dr2.33) soils. Small areas of calcrete (kunkar) with (Um5.11) soils occur also.	0m
Oc70	Sodosol	Dissected pediments and low stony hills associated with cherts, jaspilites, and iron ore formations; much coarse surface gravel: the chief soils are hard alkaline red soils (Dr2.33) along with some (Dr2.32) and (Um5.52) soils.	68m

Atlas of Australian Soils Data Source: ABARES

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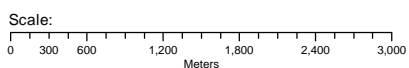
Atlas of Australian Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m
B	Low Probability of occurrence. 6-70% chance of occurrence.	71m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

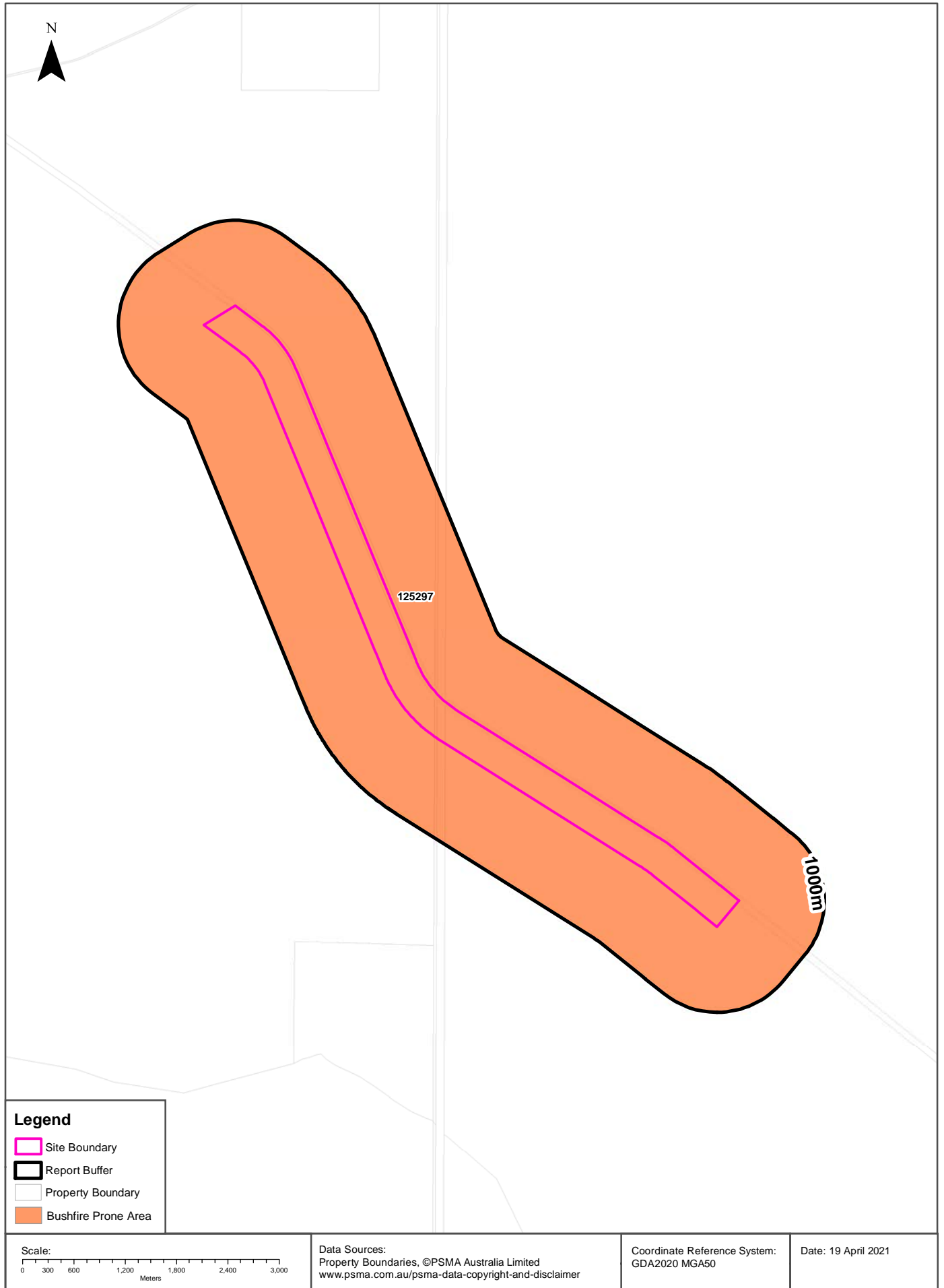
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Bushfire Prone Areas

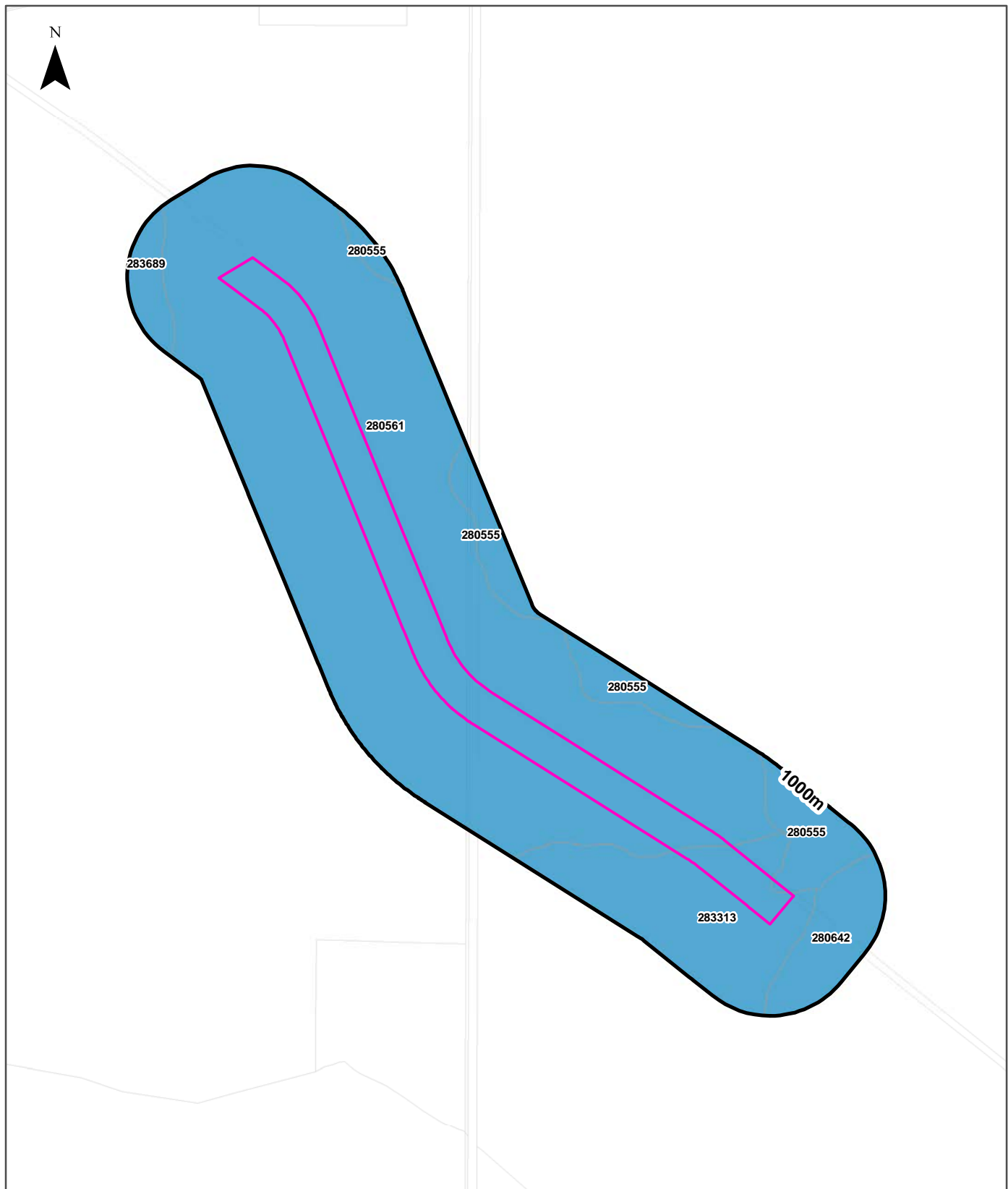
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

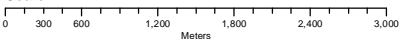
Manuwarrah Red Dog Highway Alignment, WA (Part 2)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



Data Sources:
Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
GDA2020 MGA50

Date: 19 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
280555	Terrestrial		Low potential GDE - from national assessment	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		0m	Onsite
280561	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
283313	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280642	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		223m	South East
283689	Terrestrial		Low potential GDE - from national assessment	8	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		602m	West

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 2)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Date: 19 Apr 2021 14:36:12

Reference: LS019695 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

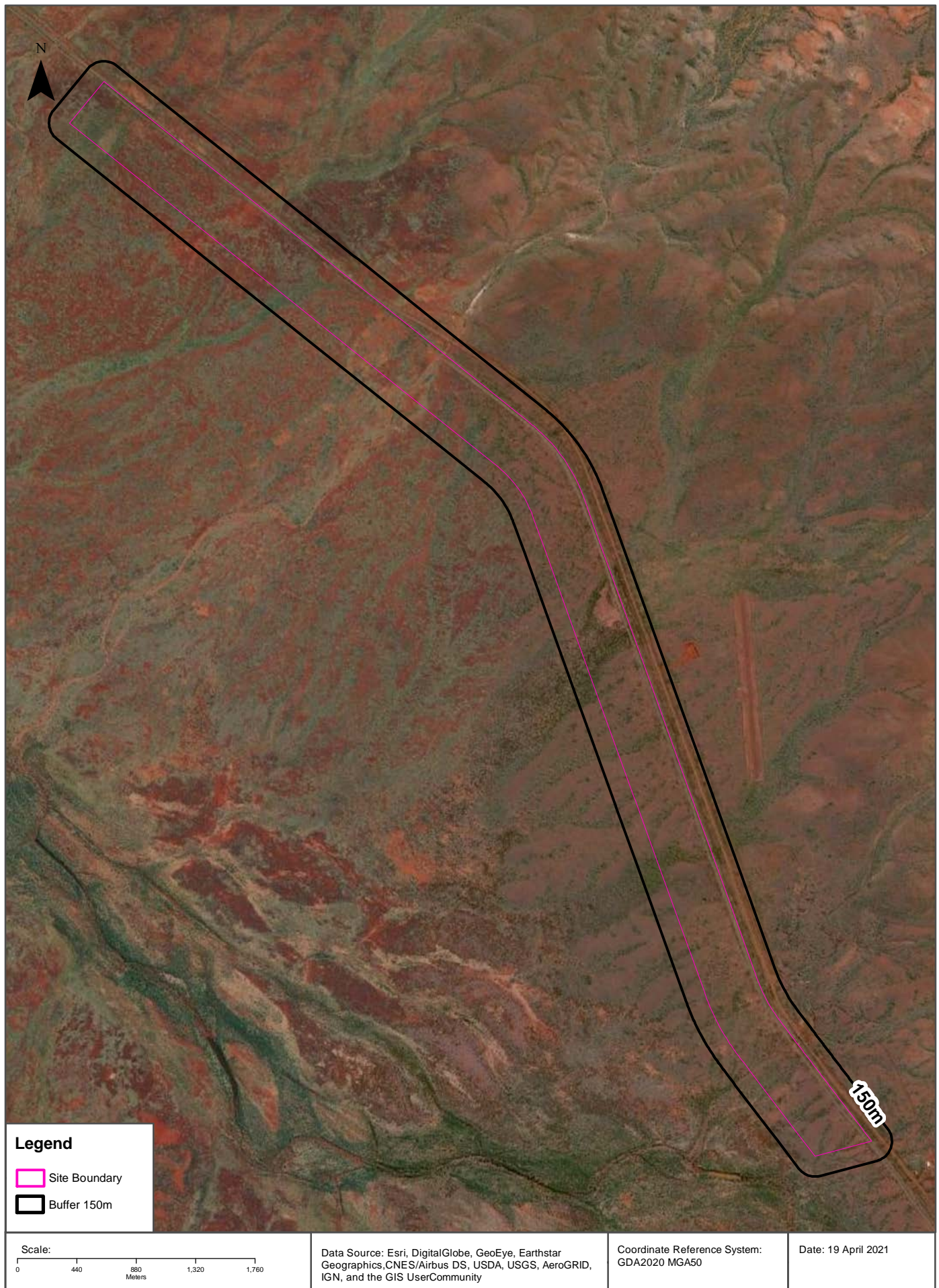
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	3
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	2	5	9
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	1	1
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	2
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	3	5	7
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

DWER Licences and Works Approvals

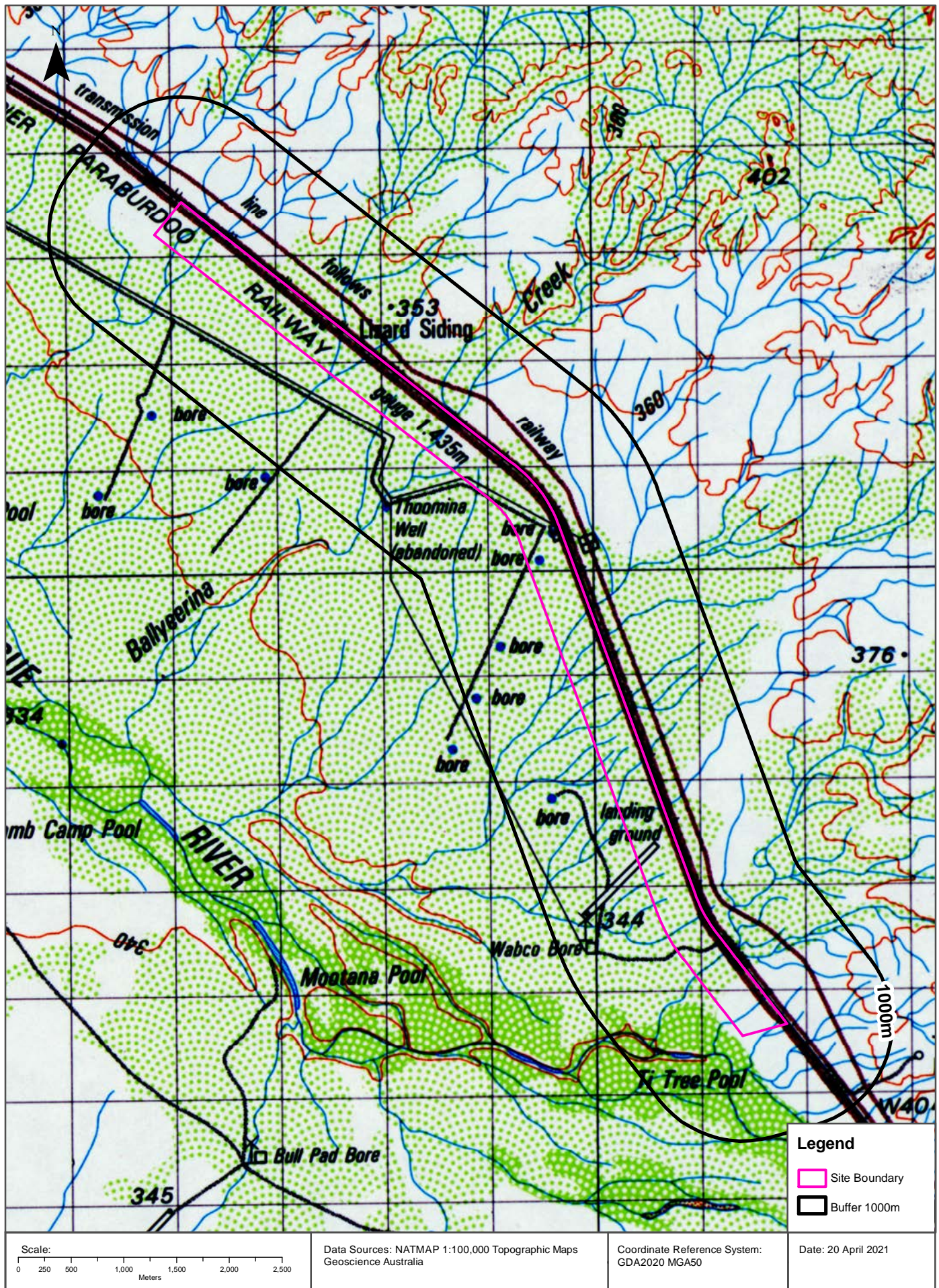
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

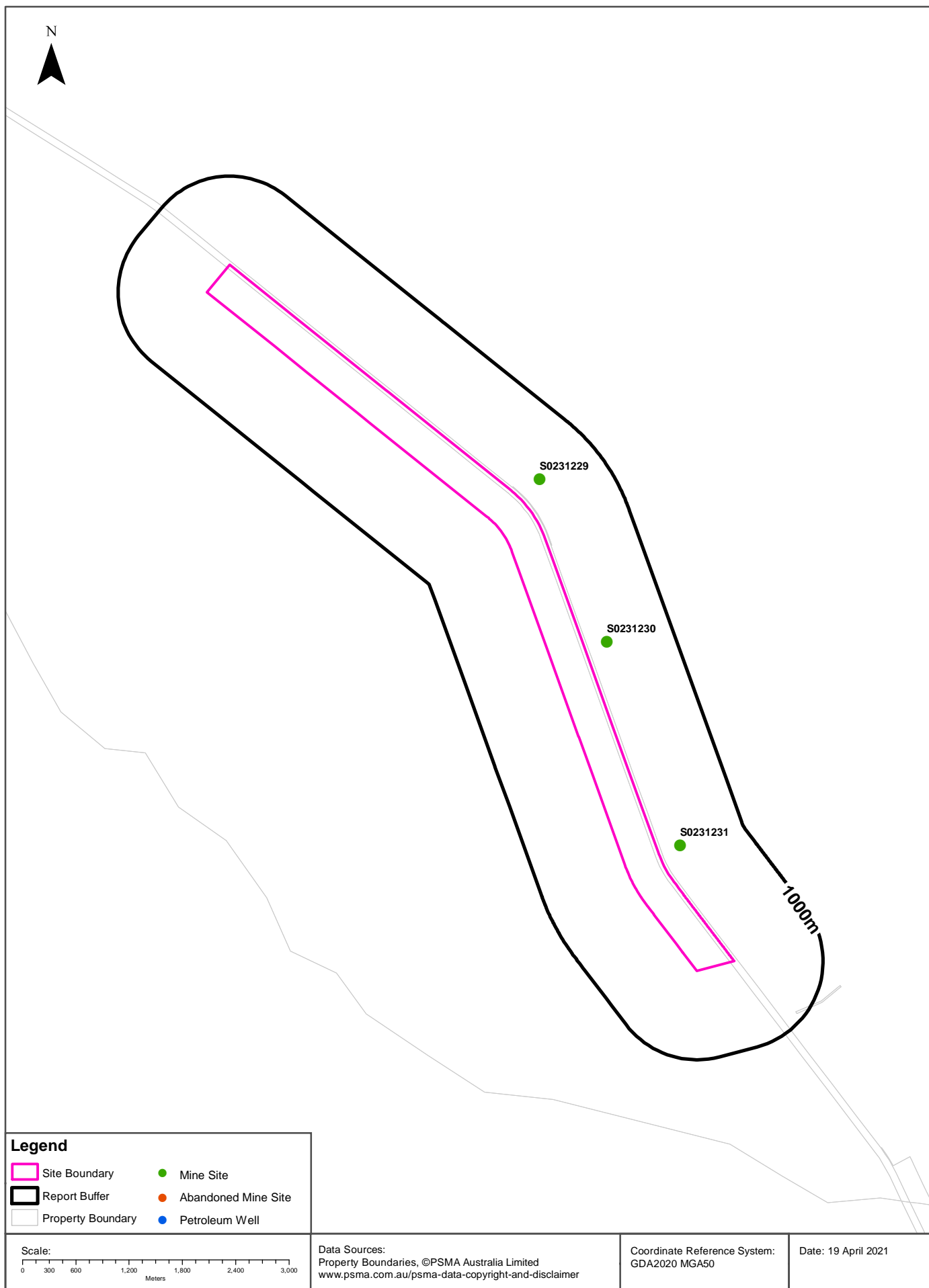
Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Mine Sites and Petroleum Wells

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0231231	Borrow Pit BP175 L47/47	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	259m	South East
S0231230	Borrow Pit BP173 L47/47	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	262m	South East
S0231229	Borrow Pit BP171 L47/47	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	313m	North

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

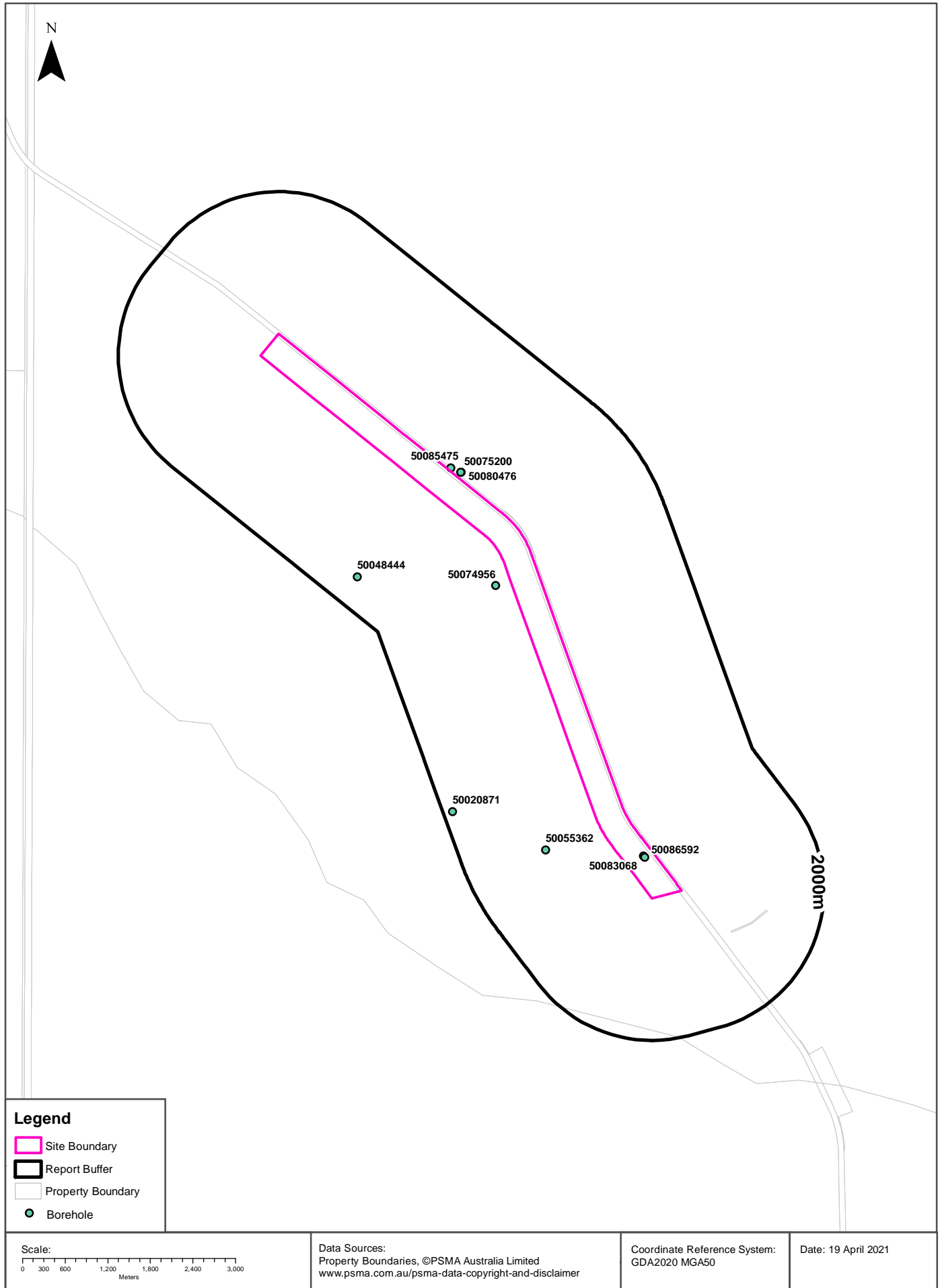
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50086592	70812541	Department of Water and Environmental Regulation	Water supply, Exploration or research	Unknown	7/27/2000	58.00	347.02	NGS	0m	Onsite
50083068	70812546	Department of Water and Environmental Regulation	Exploration or research, Water supply	Unknown	8/12/2000	66.00	347.54	NGS	0m	Onsite
50085475	70812547	Department of Water and Environmental Regulation	Water supply, Exploration or research	Unknown	8/11/2000	71.00	354.02	NGS	41m	North
50080476	70812544	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/28/2000	6.00	354.09	NGS	81m	North
50075200	70812562	Department of Water and Environmental Regulation	Water supply, Exploration or research	Unknown	8/10/2000	70.00	354.33	NGS	86m	North
50074956	70830012	Department of Water and Environmental Regulation	Monitoring	Unknown	7/14/1976	42.74	351.81	NGS	219m	North
50055362	70810229	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1954		344.82	NGS	829m	South
50048444	70810228	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		346.83	NGS	1579m	West
50020871	70830011	Department of Water and Environmental Regulation	Unknown	Unknown	7/15/1976		339.14	NGS	1868m	South

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

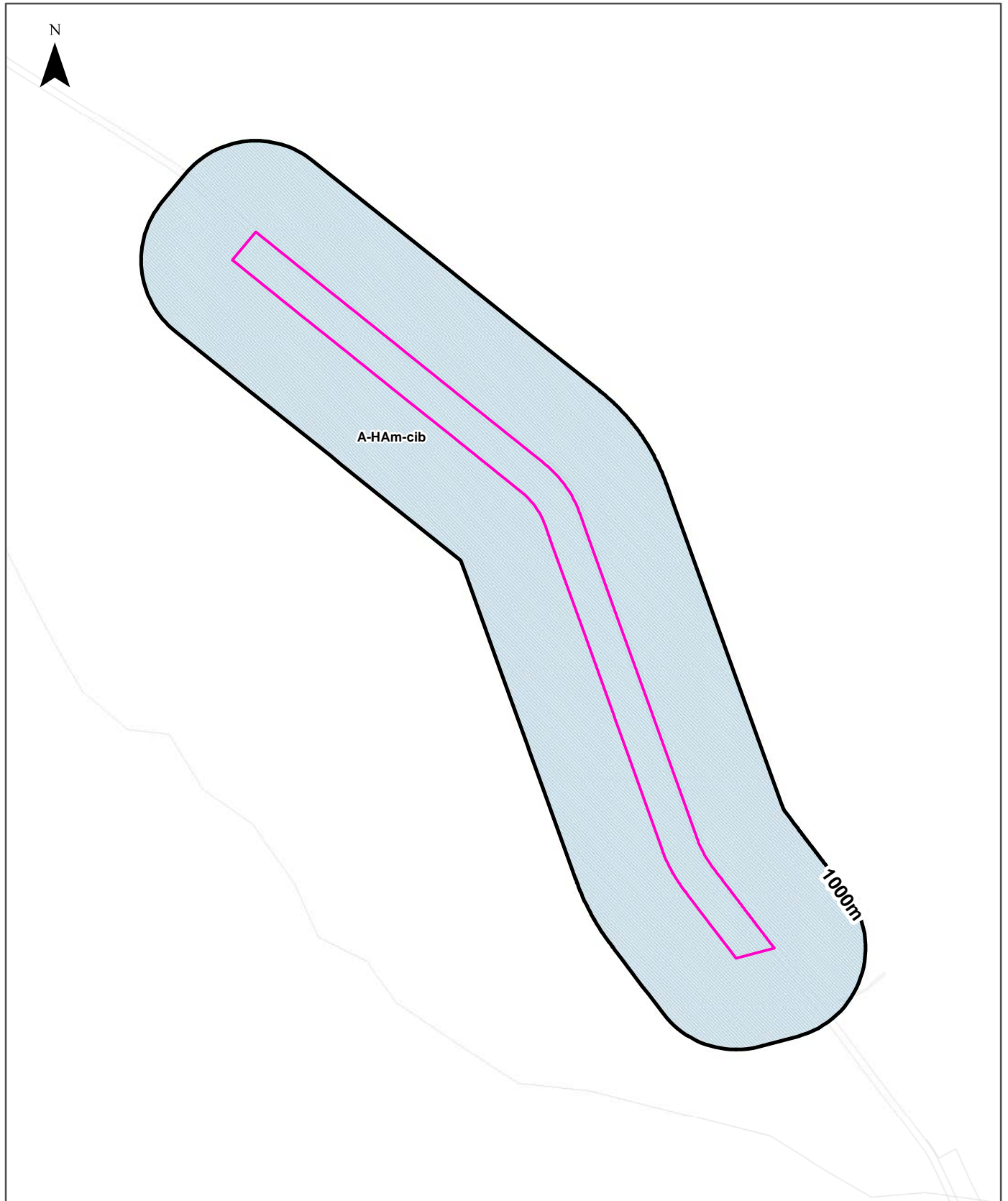
Bore ID	Driller's Log	Distance	Direction
50074956	0.00m-15.60m Tertiary 15.60m-42.74m Wthrd marra mamba iron fm	219m	North
50020871	0.00m-48.00m Tertiary 48.00m-61.87m Wthrd marra mamba iron fm	1868m	South

Groundwater Boreholes Data Source: Bureau of Meteorology

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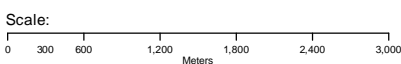
Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Legend

Site Boundary	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed	Fold axial trace, exposed
Report Buffer	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, concealed
Property Boundary				



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	Hammersley Group	Hammersley Group, lower	Marra Mamba Iron Formation	Neoarchean	Neoarchean	2629	2597	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

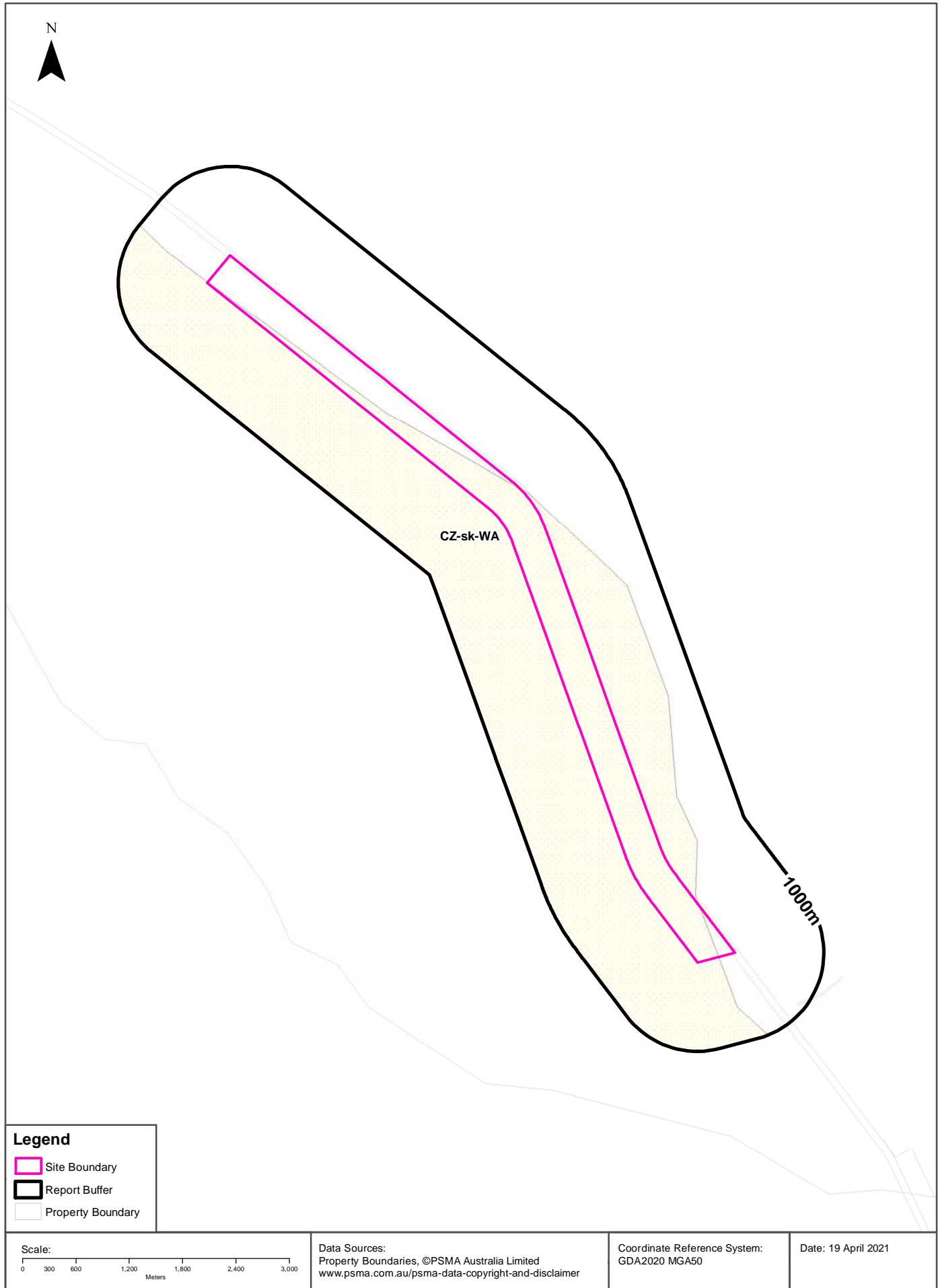
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

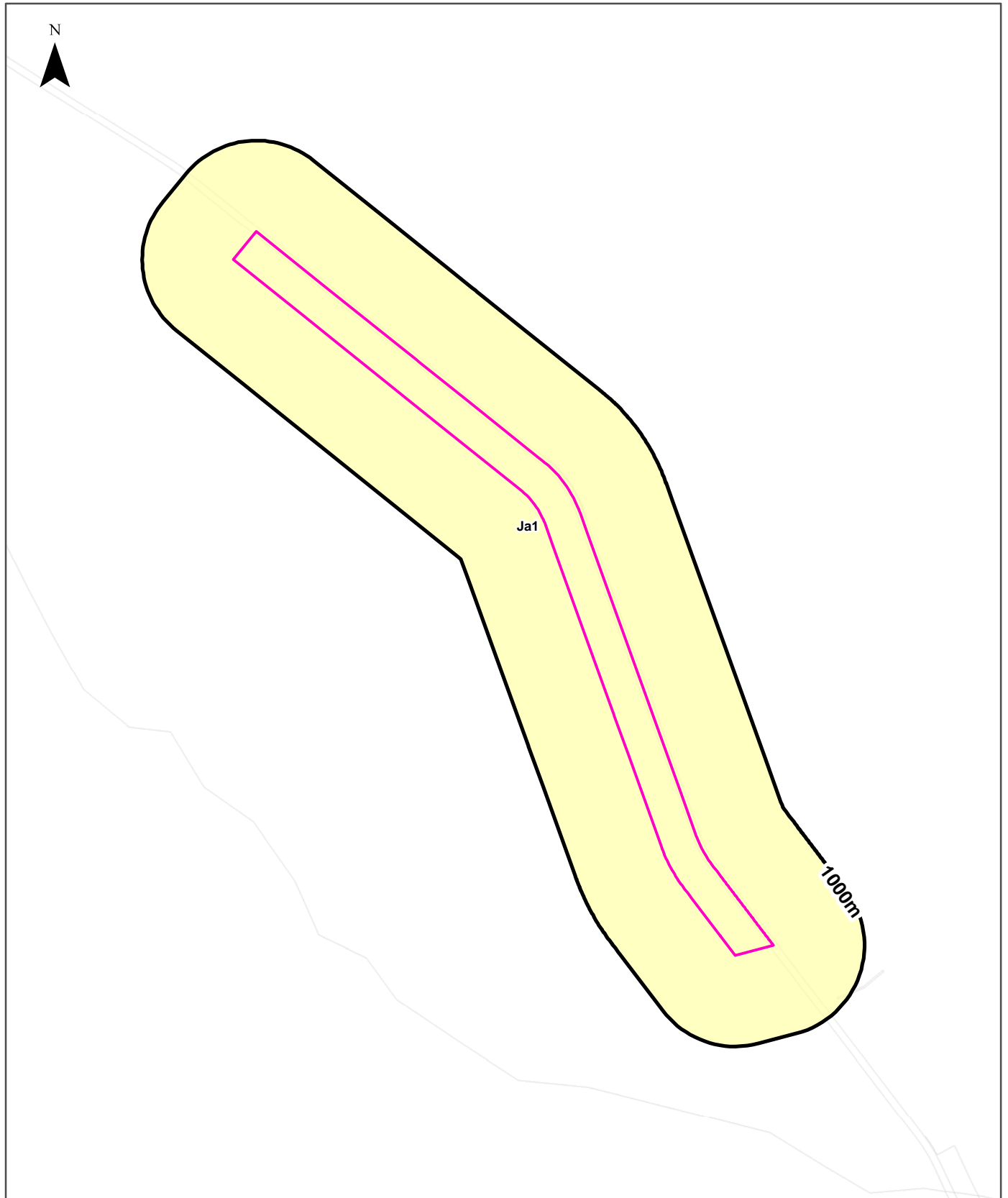
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
CZ-sk-WA	Valley-fill deposits	Alluvial and lacustrine sand, silt, mud and calcrete in major paleovalleys; Mesozoic at depth			Cenozoic	Holocene	66	0	0m

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders				
Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol	
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake	
Scale: 		Data Sources: Property Boundaries, ©PSMA Australia Limited www.pasma.com.au/psma-data-copyright-and-disclaimer		Coordinate Reference System: GDA2020 MGA50		Date: 19 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

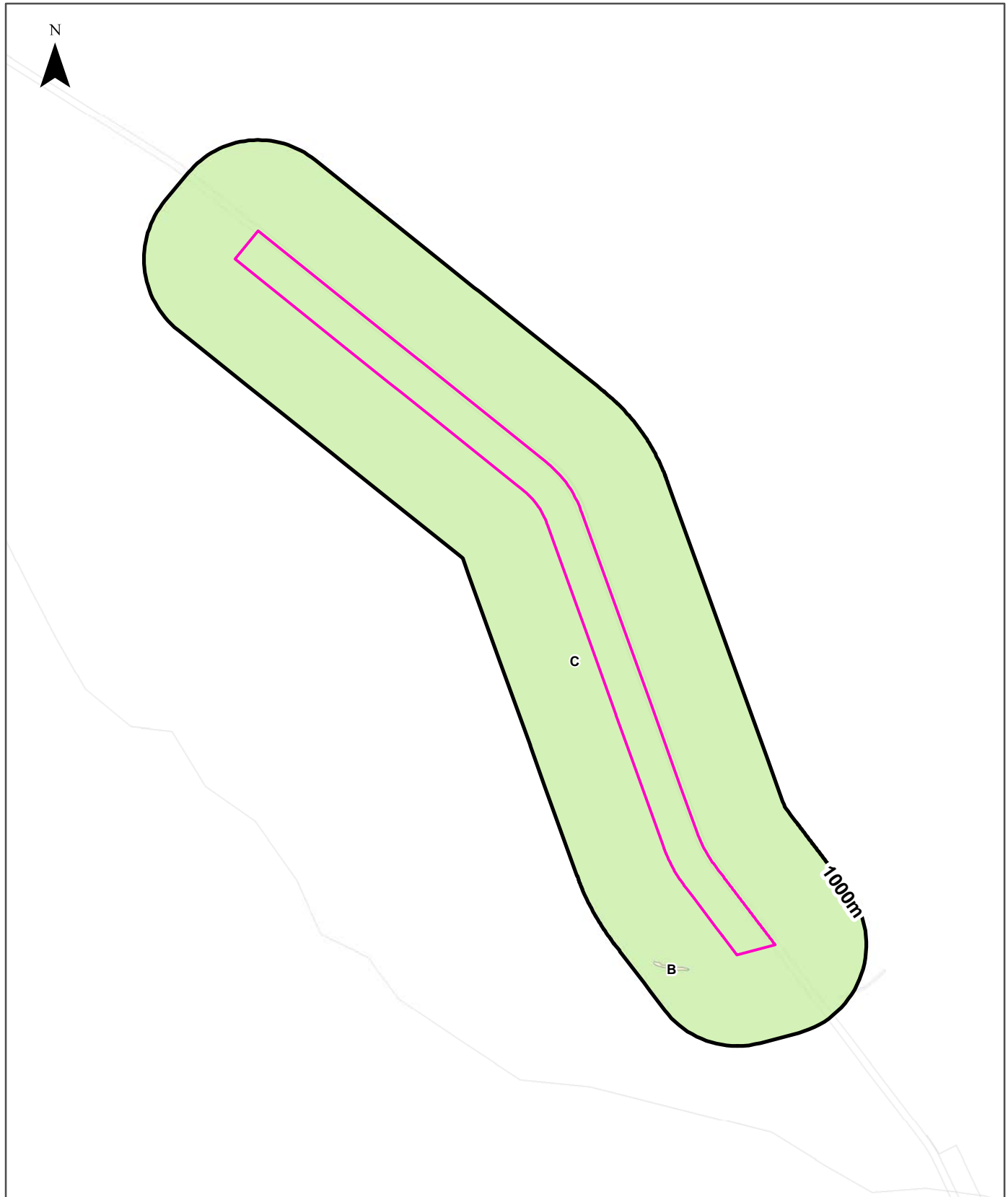
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Ja1	Kandosol	Extensive valley plains largely associated with the Fortescue River: chief soils are earthy clays (Uf6.71) along with some (Ug5.38), (Um5.5), and (Dr2.33) soils. Small areas of calcrete (kunkar) with (Um5.11) soils occur also.	0m

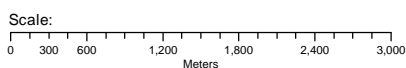
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m
B	Low Probability of occurrence. 6-70% chance of occurrence.	517m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

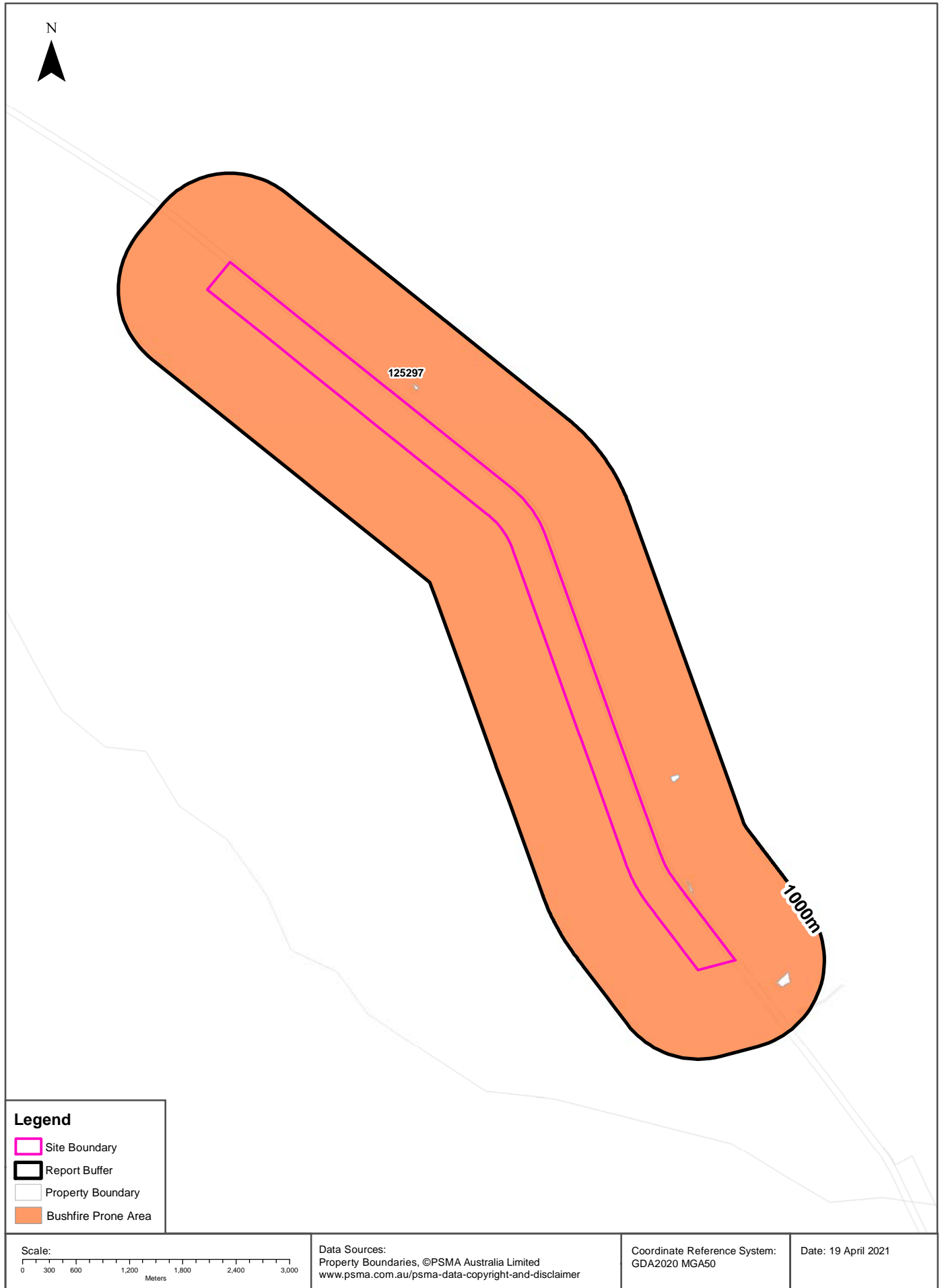
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Bushfire Prone Areas

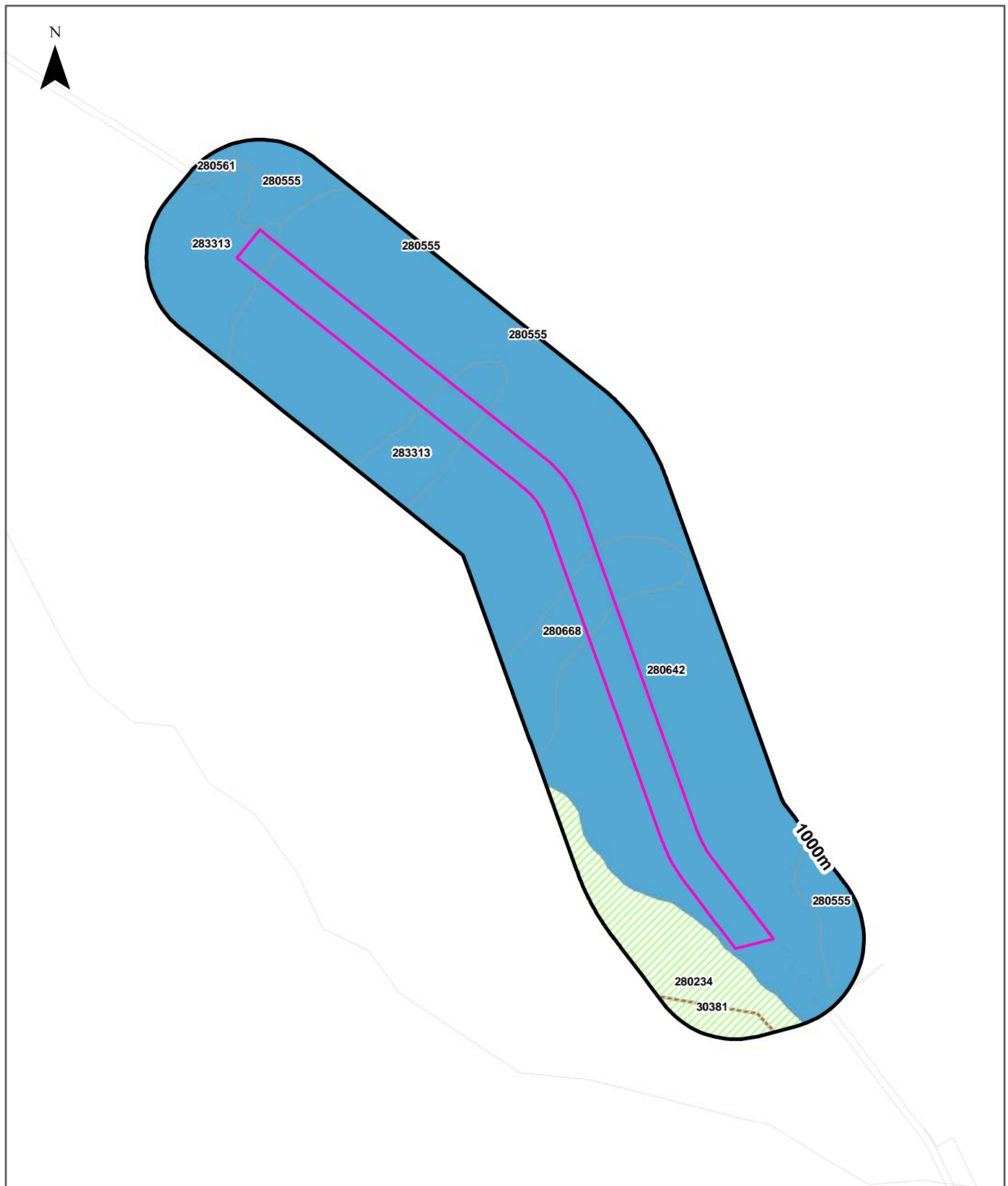
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

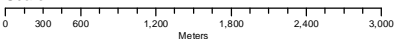
Manuwarrah Red Dog Highway Alignment, WA (Part 3)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



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Coordinate Reference System:
GDA2020 MGA50

Date: 19 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
280642	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280668	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
283313	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280555	Terrestrial		Low potential GDE - from national assessment	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		31m	North East
280234	Terrestrial		Known GDE - from regional studies	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Riparian vegetation		68m	West
30381	Aquatic	FORTESCUE RIVER	High potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	River		650m	South East
280561	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		671m	North West

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 3)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH
LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Date: 19 Apr 2021 15:12:04

Reference: LS019696 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	2
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	1	18
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	2	2	2
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	1	1
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	2	3	3
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	8	8	10
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia

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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia

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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

DWER Licences and Works Approvals

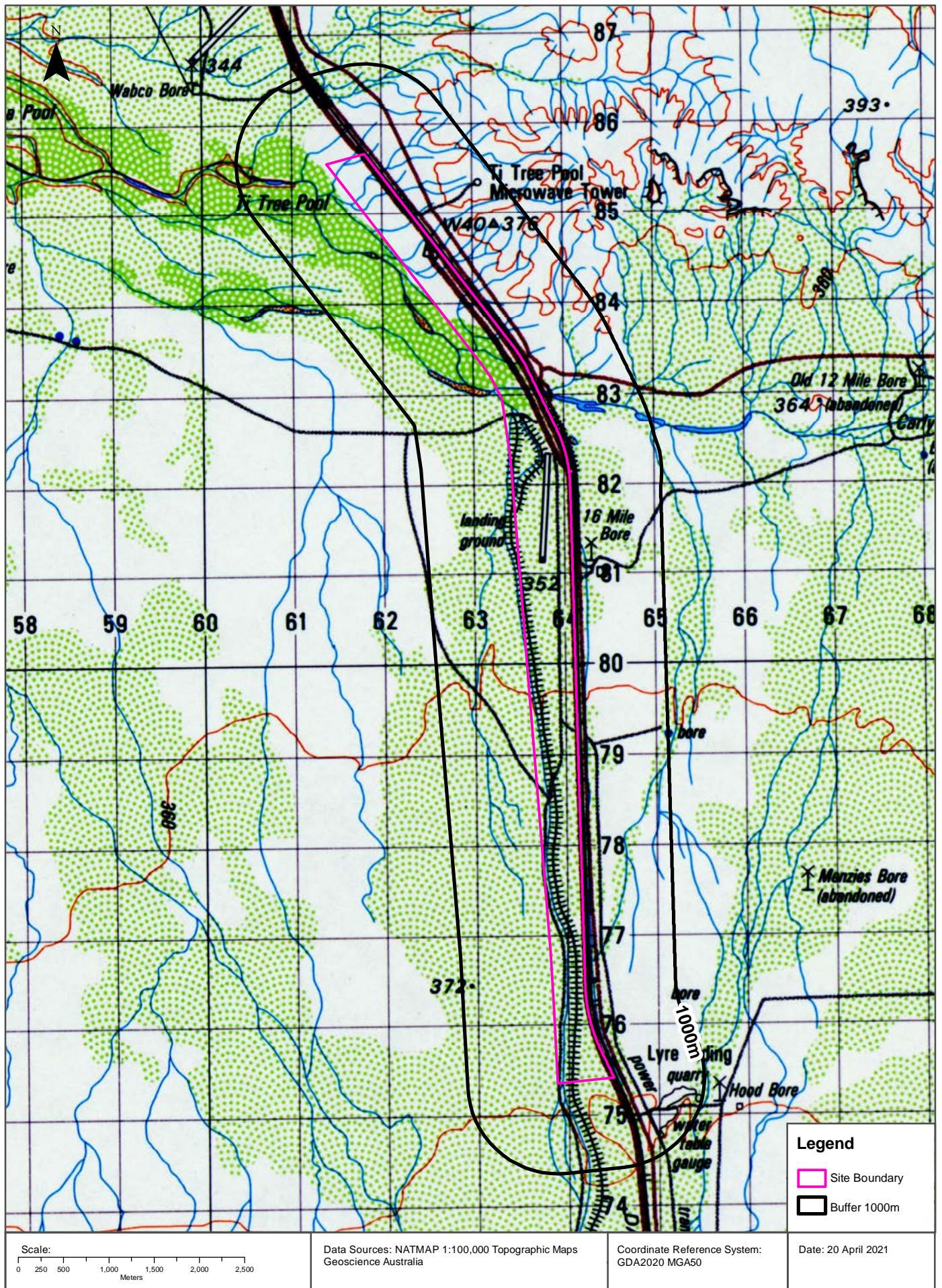
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

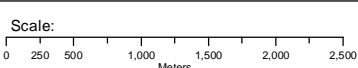
Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Legend

- Site Boundary
- Buffer 1000m



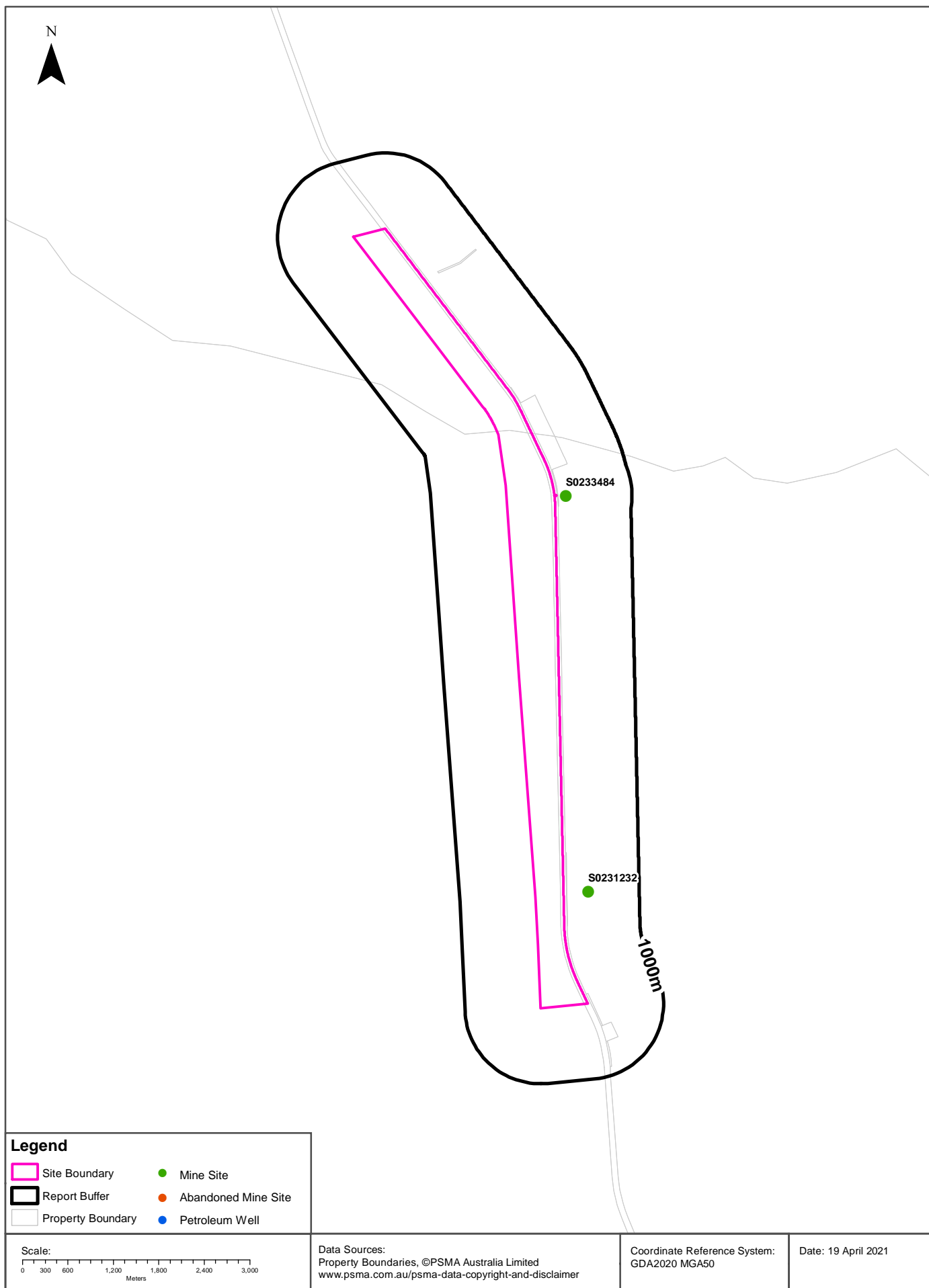
Data Sources: NATMAP 1:100,000 Topographic Maps
Geoscience Australia

Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Mine Sites and Petroleum Wells

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0233484	Temporary Concrete Batching Plant Laydown Area	Infrastructure	Handling-loading-storage	Proposed	CONSTRUCTION MATERIALS	J03943	Hammersley Iron Rail / Rio Tinto - Robe River	126m	North East
S0231232	Borrow Pit BP186 L47/47	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hammersley Iron Rail / Rio Tinto - Robe River	329m	South

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

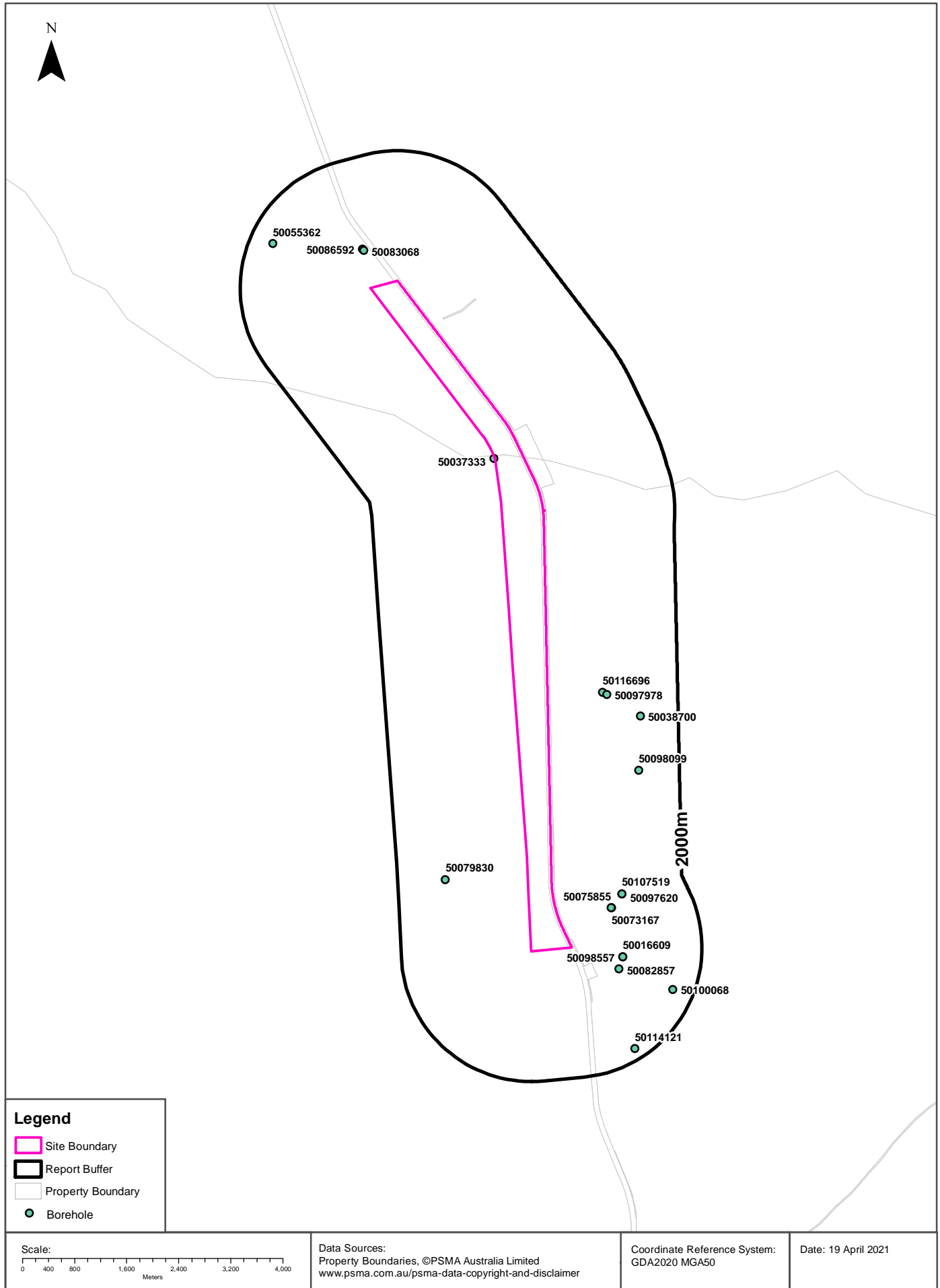
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50037333	70810231	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		348.14	NGS	16m	North
50083068	70812546	Department of Water and Environmental Regulation	Exploration or research, Water supply	Unknown	8/12/2000	66.00	347.54	NGS	582m	North
50086592	70812541	Department of Water and Environmental Regulation	Water supply, Exploration or research	Unknown	7/27/2000	58.00	347.02	NGS	604m	North
50082857	70819011	Department of Water and Environmental Regulation	Monitoring	Functioning	5/15/1975	71.00	274.45	NGS	799m	South
50098557	70810245	Department of Water and Environmental Regulation	Unknown	Unknown	4/15/1975		376.74	NGS	801m	South
50016609	70810246	Department of Water and Environmental Regulation	Unknown	Unknown	4/15/1975		376.74	NGS	801m	South
50075855	70812545	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/28/2000	6.00	374.34	NGS	807m	South
50073167	70812568	Department of Water and Environmental Regulation	Water supply	Unknown	8/9/2000	65.40	374.34	NGS	814m	South
50116696	70818062	Department of Water and Environmental Regulation	Monitoring	Functioning			359.18	TOC	845m	South East
50097978	70830016	Department of Water and Environmental Regulation	Monitoring	Functioning	8/15/1982	38.00	358.88	NGS	911m	South East
50097620	70830017	Department of Water and Environmental Regulation	Monitoring	Functional	8/15/1982	52.00	371.62	TOC	1043m	South
50107519	70818063	Department of Water and Environmental Regulation	Unknown	Unknown			371.62	TOC	1043m	South
50079830	70810250	Department of Water and Environmental Regulation	Exploration or research	Unknown	6/15/1975	51.50	369.50	TOC	1264m	South
50098099	70810243	Department of Water and Environmental Regulation	Monitoring	Unknown	5/15/1975	66.90	362.76	NGS	1378m	South East
50038700	70810240	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	1/1/1900		362.56	NGS	1420m	South East

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50055362	70810229	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1954		344.82	NGS	1642m	North West
50100068	70810235	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	6/30/1935		379.96	NGS	1683m	South East
50114121	70810242	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		383.69	NGS	1836m	South

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

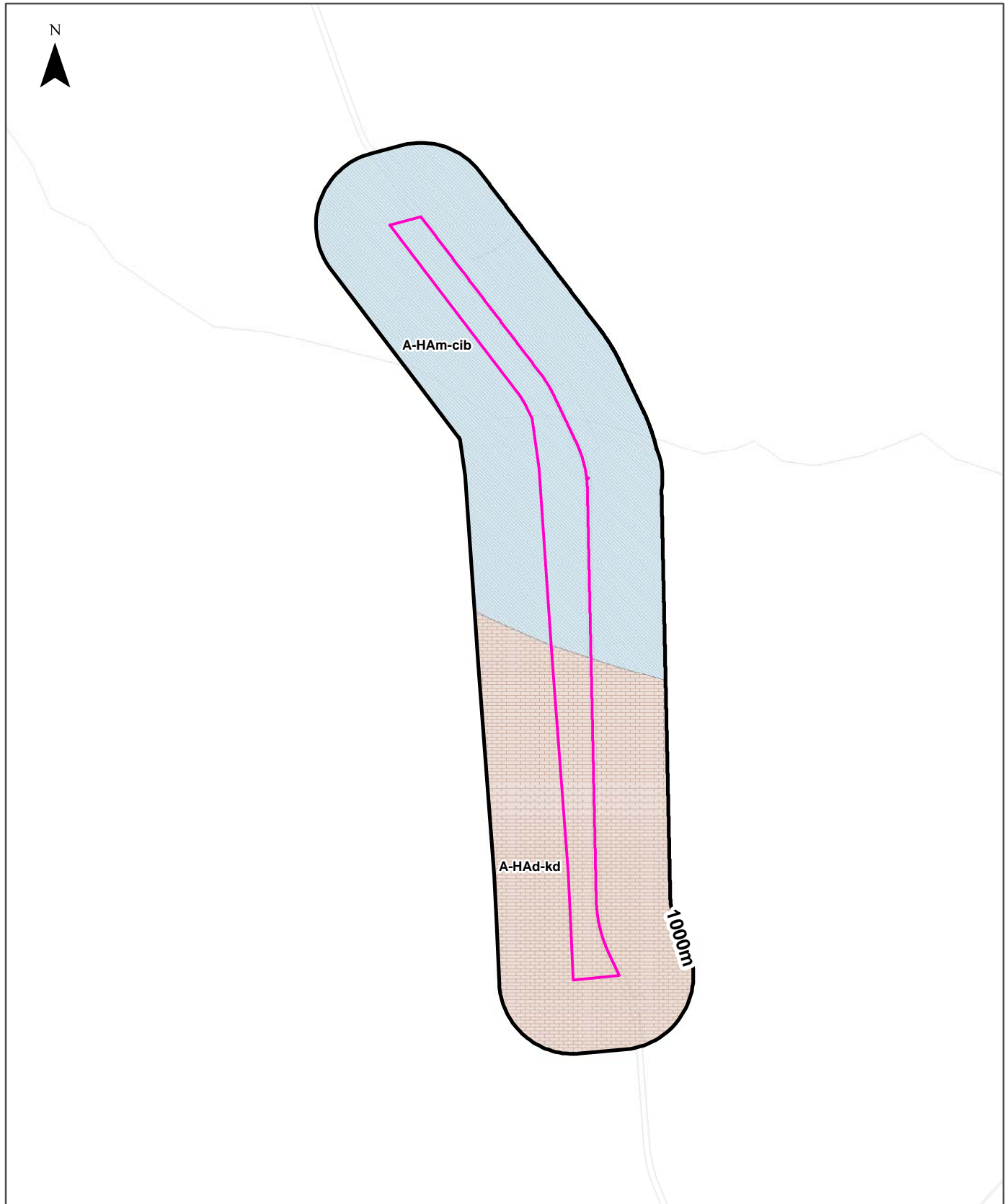
Bore ID	Driller's Log	Distance	Direction
50016609	0.00m-74.00m Quaternary 74.00m-85.00m ? proterozoic	801m	South
50097978	0.00m-69.00m Tertiary 69.00m-73.98m Not logged 73.98m-74.00m ? proterozoic	911m	South East
50097620	0.00m-84.00m Tertiary 84.00m-86.00m Proterozoic	1043m	South
50079830	0.00m-57.00m Quaternary 57.00m-61.00m ? wthrd wittenoom dolomite	1264m	South
50098099	0.00m-74.00m Quaternary 74.00m-76.00m Withrd wittenoom dolomite	1378m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

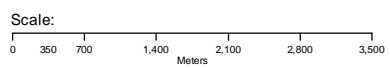
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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Legend		Linear Geological Structures		
Site Boundary	Report Buffer	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed
Property Boundary	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, exposed
				Fold axial trace, concealed



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone	Hamersley Group	Hamersley Group, lower	Wittenoom Formation	Neoarchean	Neoarchean	2597	2504	0m
A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	Hamersley Group	Hamersley Group, lower	Marra Mamba Iron Formation	Neoarchean	Neoarchean	2629	2597	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

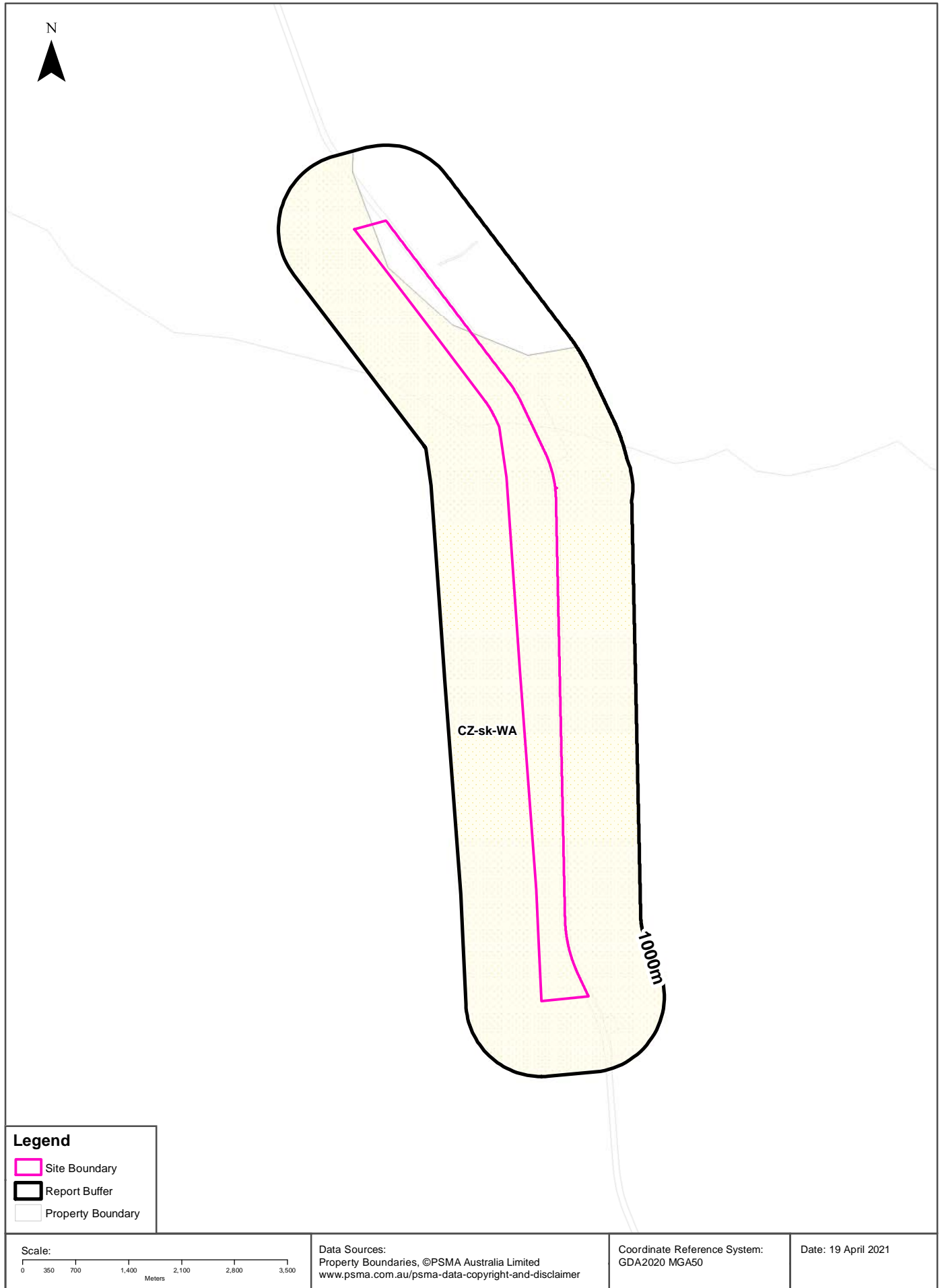
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

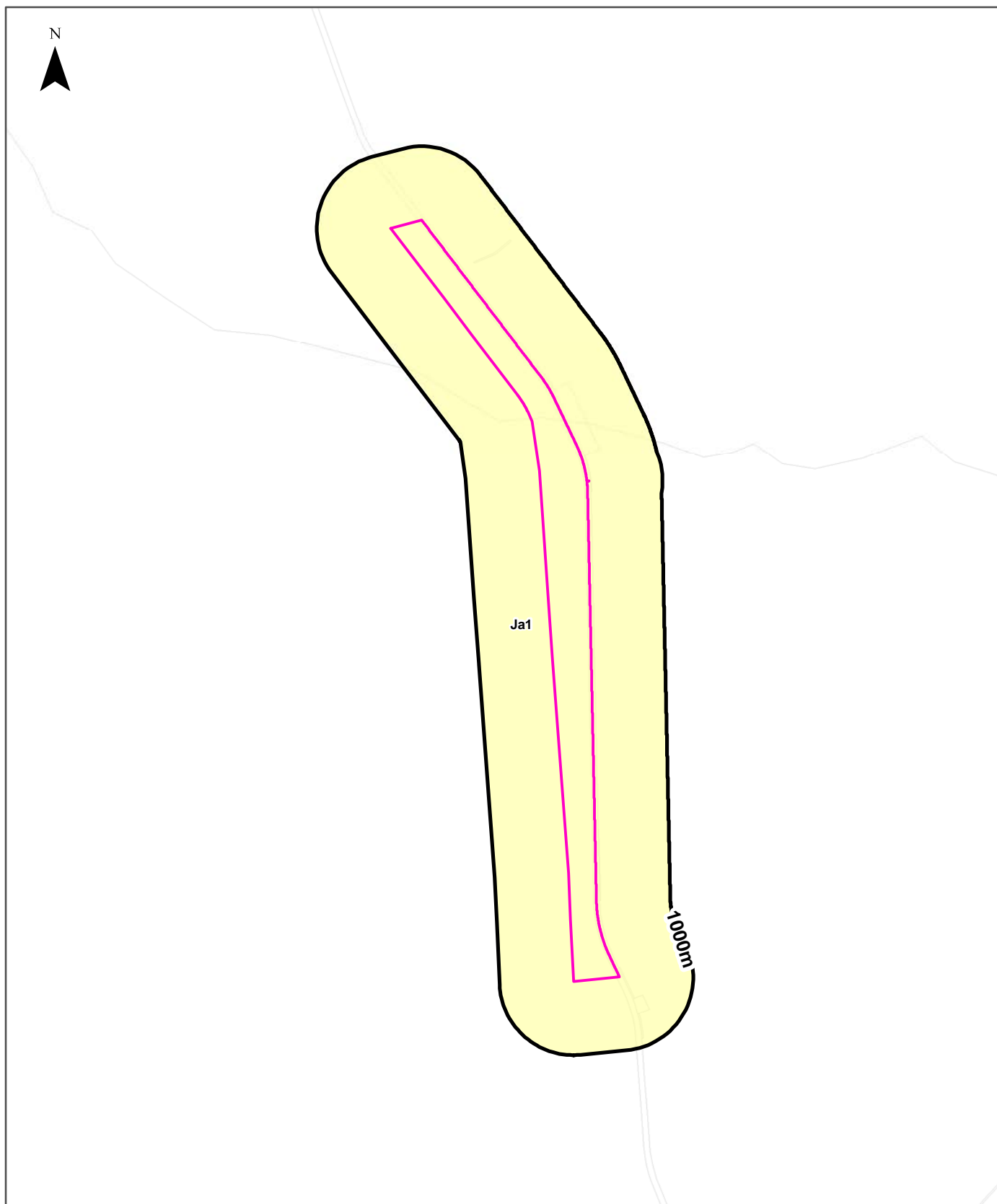
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
CZ-sk-WA	Valley-fill deposits	Alluvial and lacustrine sand, silt, mud and calcrete in major paleovalleys; Mesozoic at depth			Cenozoic	Holocene	66	0	0m

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthrosol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		
Scale: 		Data Sources: Property Boundaries, ©PSMA Australia Limited www.pdma.com.au/psma-data-copyright-and-disclaimer		Coordinate Reference System: GDA2020 MGA50		Date: 19 April 2021	

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

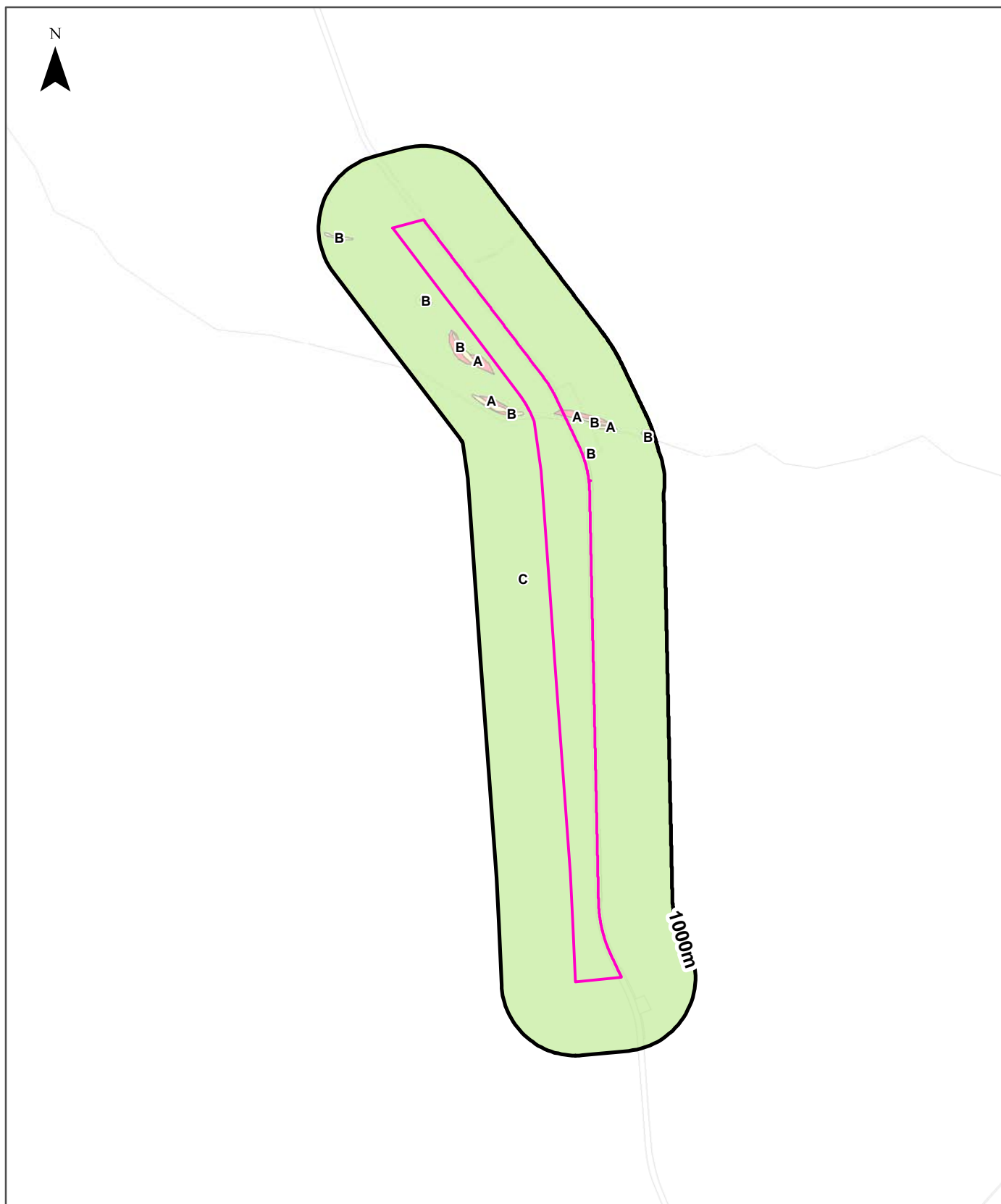
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Ja1	Kandosol	Extensive valley plains largely associated with the Fortescue River: chief soils are earthy clays (Uf6.71) along with some (Ug5.38), (Um5.5), and (Dr2.33) soils. Small areas of calcrete (kunkar) with (Um5.11) soils occur also.	0m

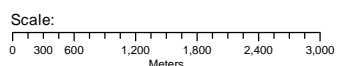
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Date: 19April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
A	High Probability of occurrence. >70% chance of occurrence.	0m
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m
B	Low Probability of occurrence. 6-70% chance of occurrence.	32m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

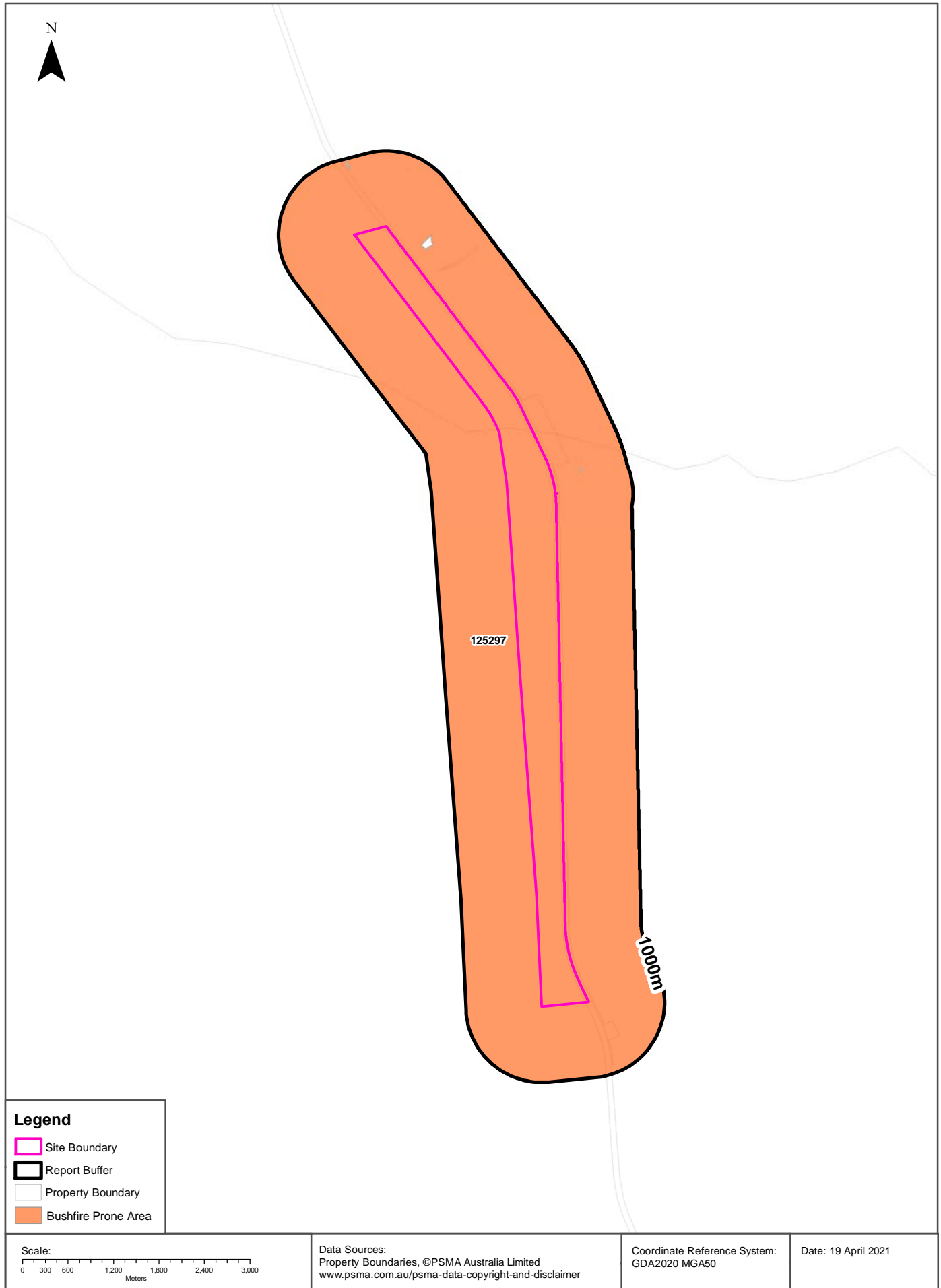
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Bushfire Prone Areas

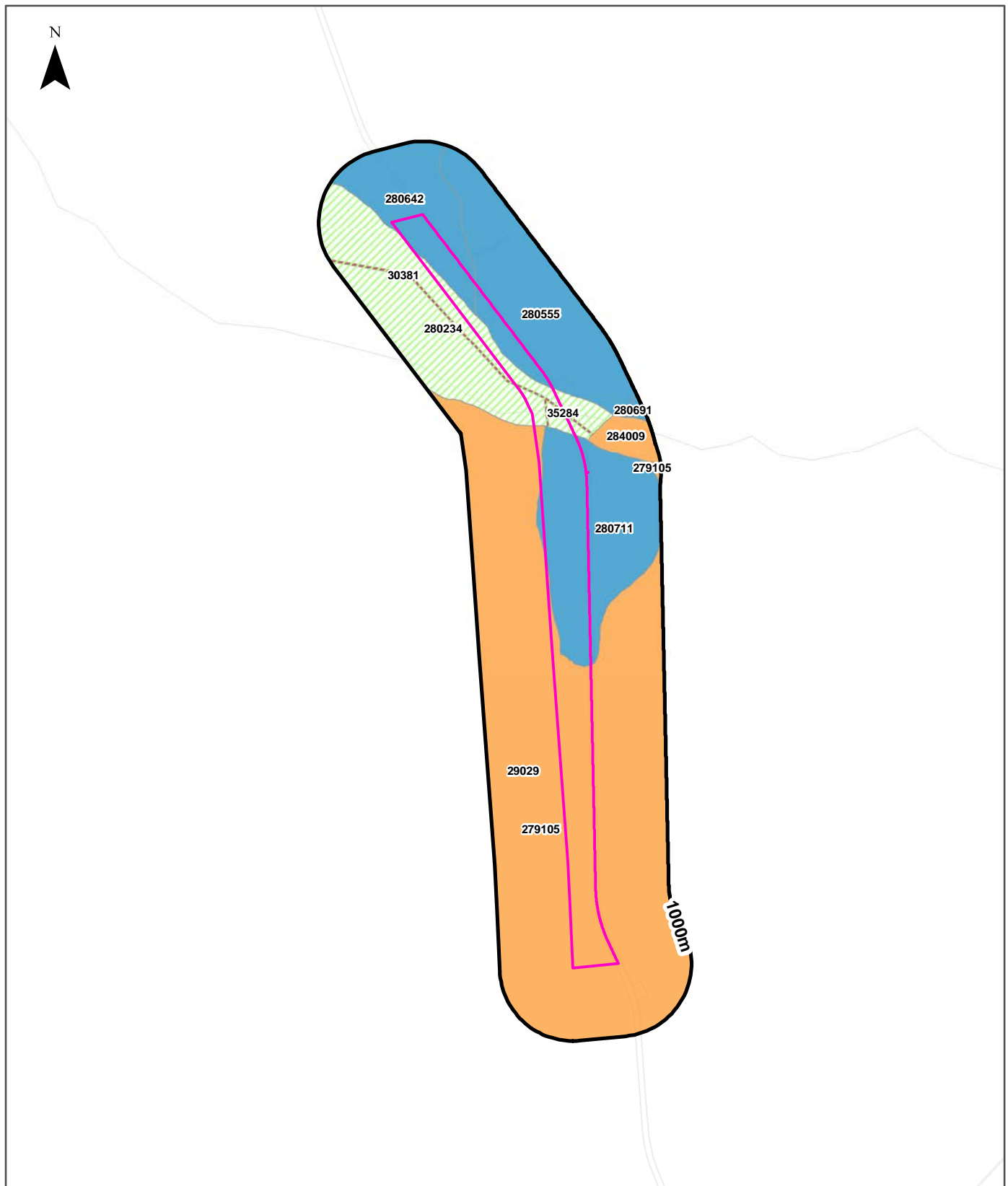
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

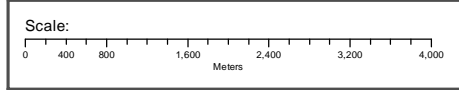
Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Manuwarrah Red Dog Highway Alignment, WA (Part 4)



Legend	
Site Boundary	Low potential GDE - from national assessment
Report Buffer	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment
High potential GDE - from regional studies	Known GDE - from regional studies
Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
	Unclassified potential GDE - from regional studies



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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
280555	Terrestrial		Low potential GDE - from national assessment	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		0m	Onsite
29029	Aquatic	WEELUMURRA CREEK	High potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	River		0m	Onsite
35284	Aquatic	FORTESCUE RIVER	High potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	River		0m	Onsite
280642	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280711	Terrestrial		Low potential GDE - from national assessment	9	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
279105	Terrestrial		Moderate potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
30381	Aquatic	FORTESCUE RIVER	High potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	River		0m	Onsite
280234	Terrestrial		Known GDE - from regional studies	10	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Riparian vegetation		0m	Onsite
284009	Terrestrial		Moderate potential GDE - from national assessment	8	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		135m	North East
280691	Terrestrial		Low potential GDE - from national assessment	9	Narrow range of hills and dissected plateaus on basalt and sedimentary rocks.	Vegetation		592m	North East

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology

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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 4)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Date: 19 Apr 2021 15:43:42

Reference: LS019697 EL

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The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

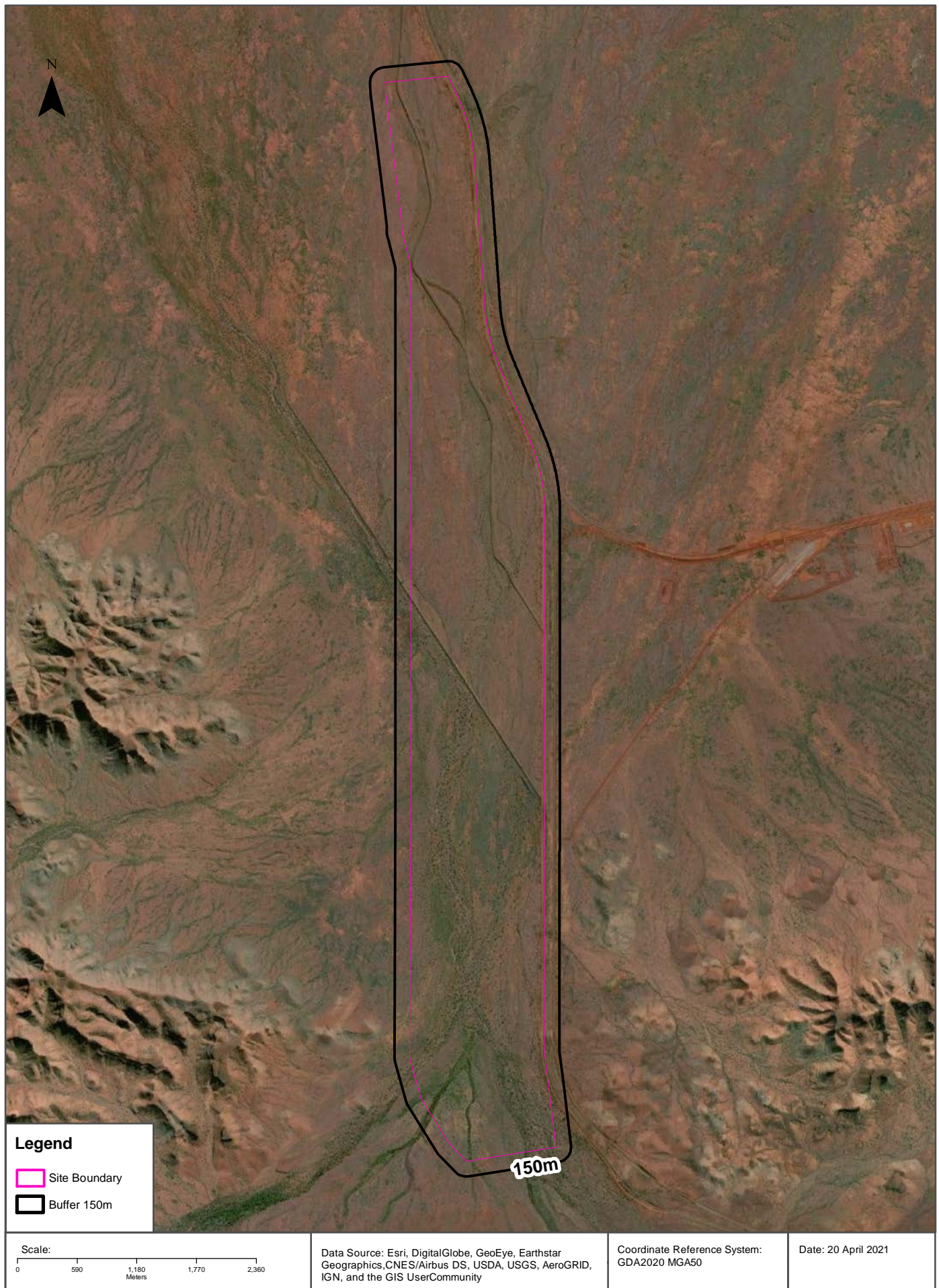
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	2	2	2
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	1	2	28
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	3	3	3
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	5	6	9
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia

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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia

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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Defence 3 Year Regional Contamination Investigation Program

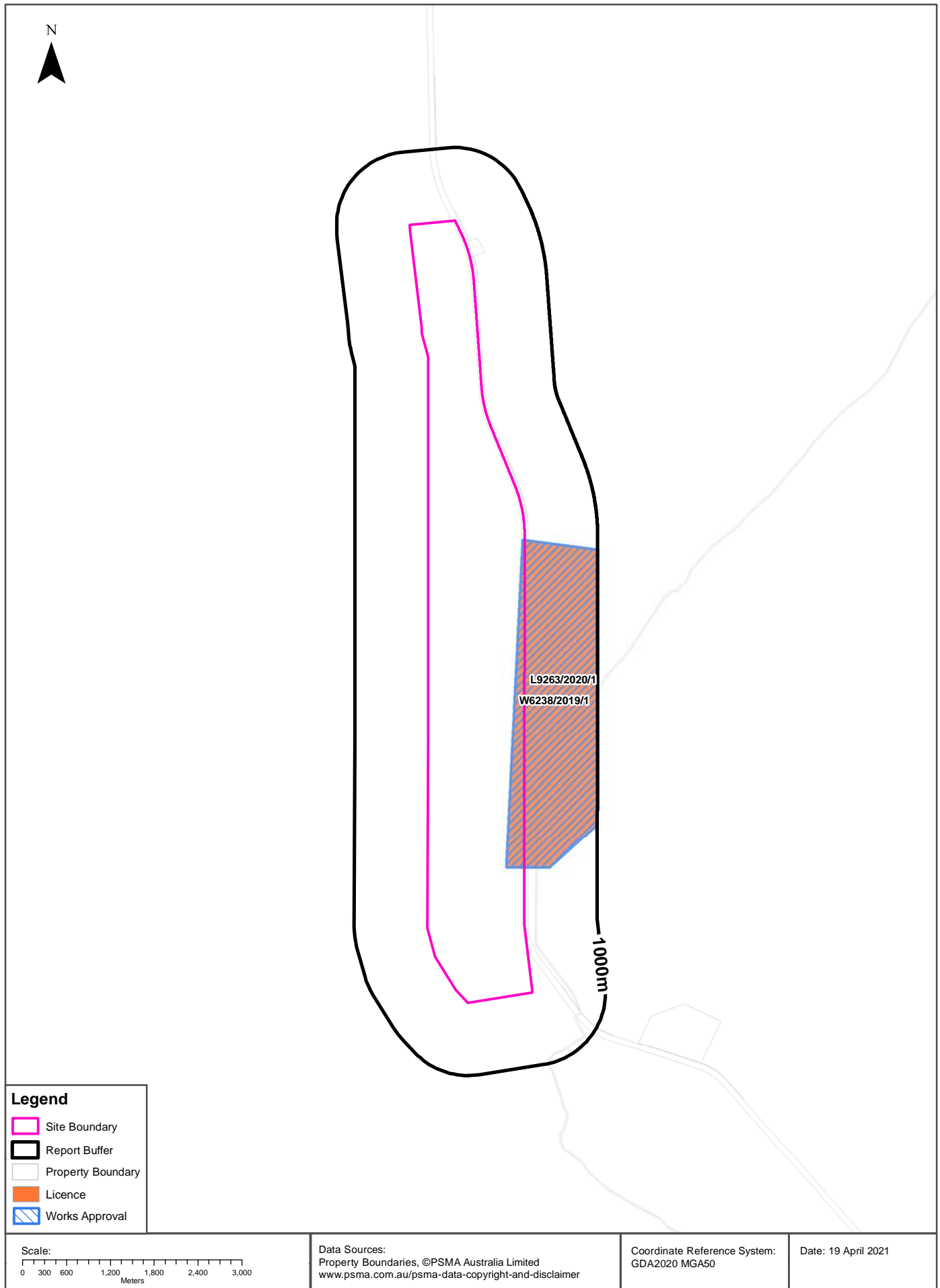
Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

DWER Licences and Works Approvals

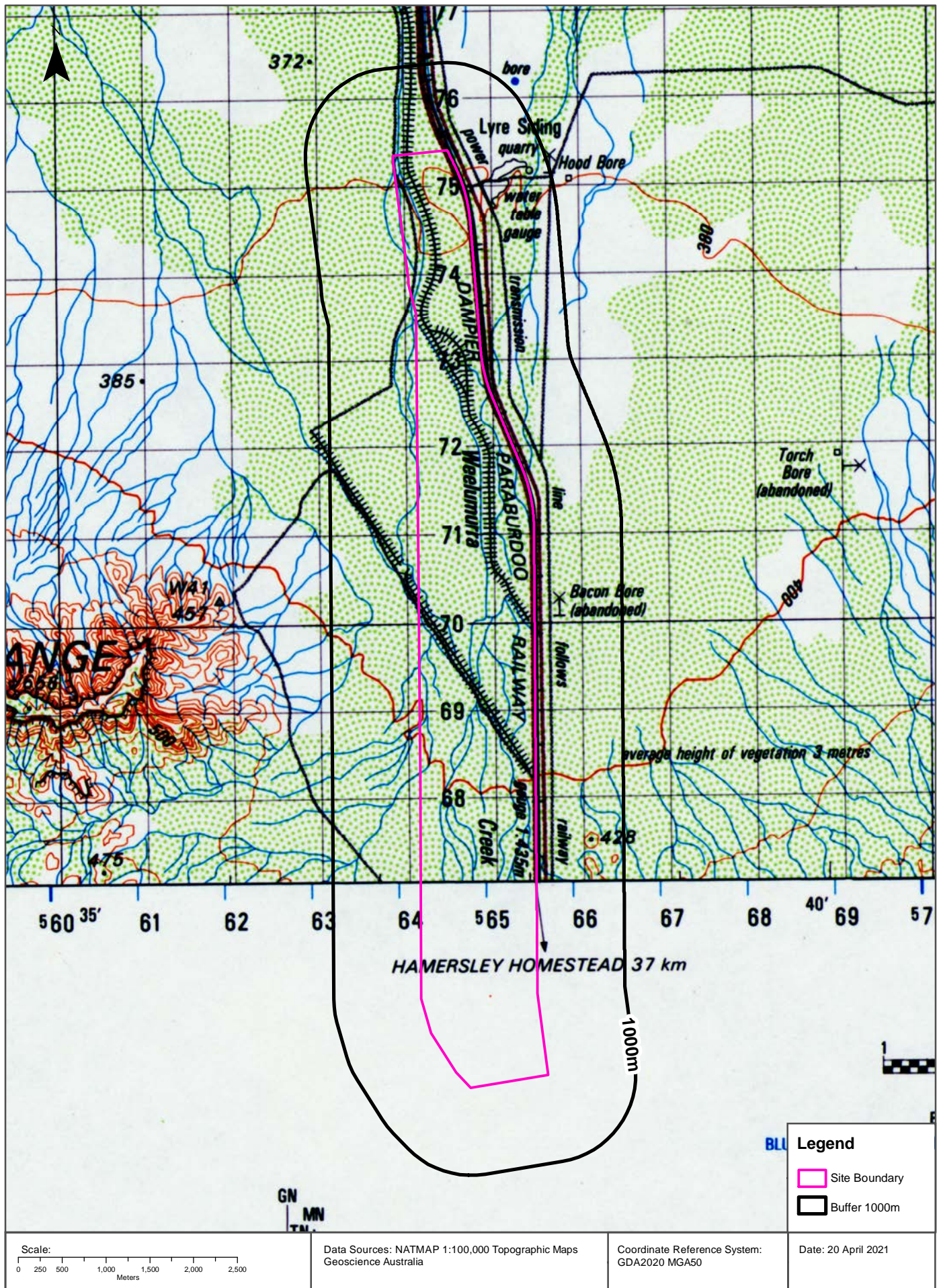
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
L9263/2020/1	Licence	Pilbara Iron Pty Ltd	Koodaideri Railway Project	Miscellaneous Licence for Railway 7 (L7SA)	Ashburton Shire	2020-12-17	2020-12-18	2040-12-17	12 - Screening of material 54 - Sewage facility	Premise Match	0m	Onsite
W6238/2019/1	Works approval	Pilbara Iron Pty Ltd	Koodaideri Railway Project	Miscellaneous Licence for Railway 7 (L7SA)	Ashburton Shire	2019-08-05	2019-08-06	2022-08-05	12 - Screening of material 54 - Sewage facility	Premise Match	0m	Onsite

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
N/A	No records in buffer								

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

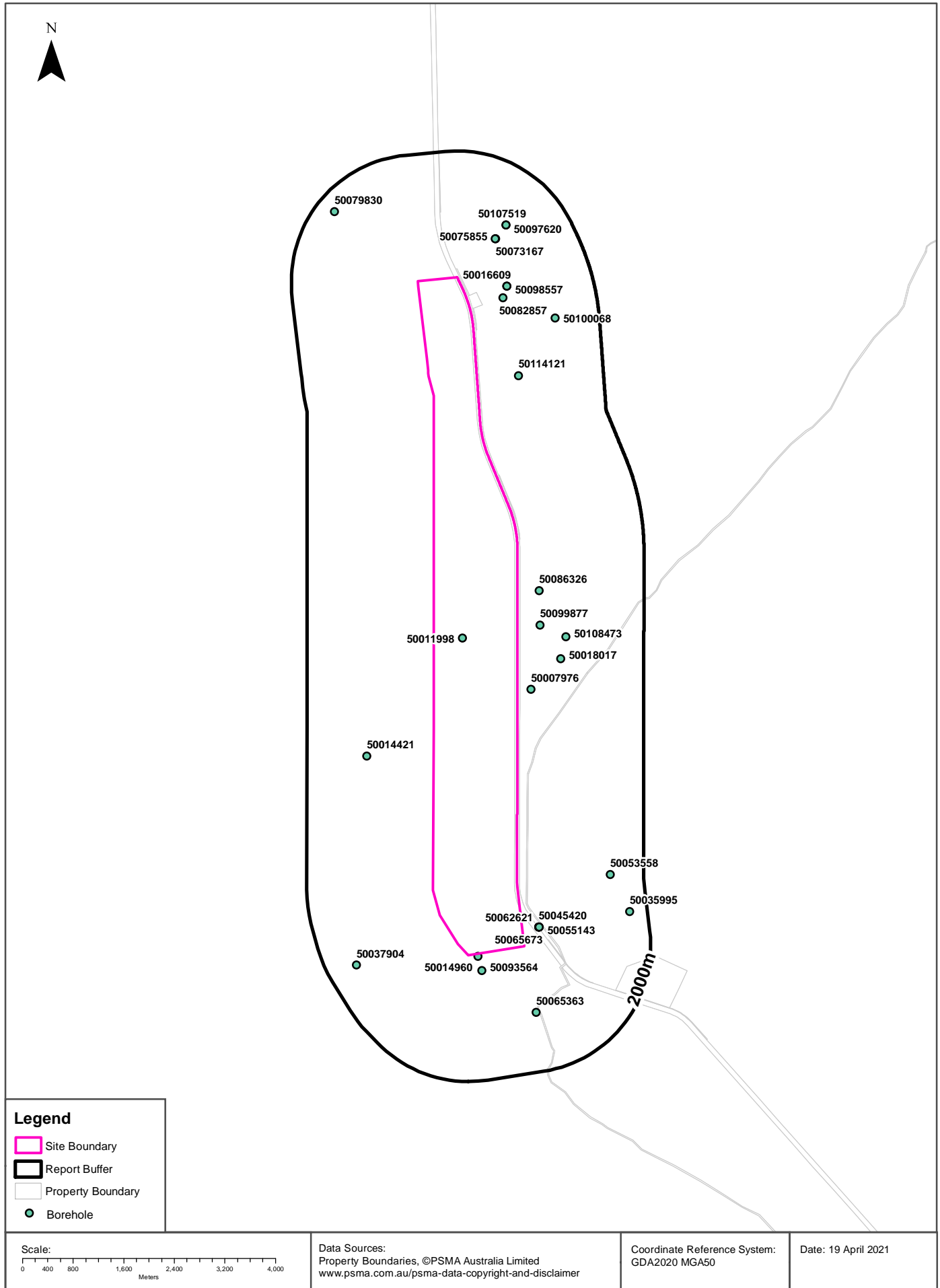
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50011998	70800370	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	0m	Onsite
50014960	70810187	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1970		421.89	NGS	47m	South
50007976	70810238	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		402.99	NGS	217m	South East
50045420	70810183	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	269m	South
50062621	70810182	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	269m	South
50065673	70810184	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	269m	South
50055143	70810181	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	275m	South
50064048	70810185	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	276m	South
50093564	70810186	Department of Water and Environmental Regulation	Unknown	Unknown	10/12/1975	28.00	425.15	TOC	280m	South
50086326	70810247	Department of Water and Environmental Regulation	Monitoring	Unknown	5/15/1975	58.21	395.91	TOC	350m	North East
50099877	70810237	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	6/30/1935		398.87	NGS	360m	East
50082857	70819011	Department of Water and Environmental Regulation	Monitoring	Functioning	5/15/1975	71.00	274.45	NGS	553m	North
50114121	70810242	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		383.69	NGS	658m	North
50098557	70810245	Department of Water and Environmental Regulation	Unknown	Unknown	4/15/1975		376.74	NGS	664m	North
50016609	70810246	Department of Water and Environmental Regulation	Unknown	Unknown	4/15/1975		376.74	NGS	664m	North

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50018017	70810239	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		399.75	NGS	689m	East
50108473	70800361	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	773m	East
50075855	70812545	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/28/2000	6.00	374.34	NGS	857m	North
50073167	70812568	Department of Water and Environmental Regulation	Water supply	Unknown	8/9/2000	65.40	374.34	NGS	863m	North
50014421	70810249	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		414.15	NGS	1052m	South West
50065363	70810178	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		427.48	NGS	1067m	South
50097620	70830017	Department of Water and Environmental Regulation	Monitoring	Functional	8/15/1982	52.00	371.62	TOC	1127m	North
50107519	70818063	Department of Water and Environmental Regulation	Unknown	Unknown			371.62	TOC	1127m	North
50100068	70810235	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	6/30/1935		379.96	NGS	1308m	North
50053558	70810180	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		429.14	NGS	1477m	South East
50037904	70810188	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		426.87	NGS	1537m	South
50079830	70810250	Department of Water and Environmental Regulation	Exploration or research	Unknown	6/15/1975	51.50	369.50	TOC	1714m	North
50035995	70810758	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		441.57	NGS	1721m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

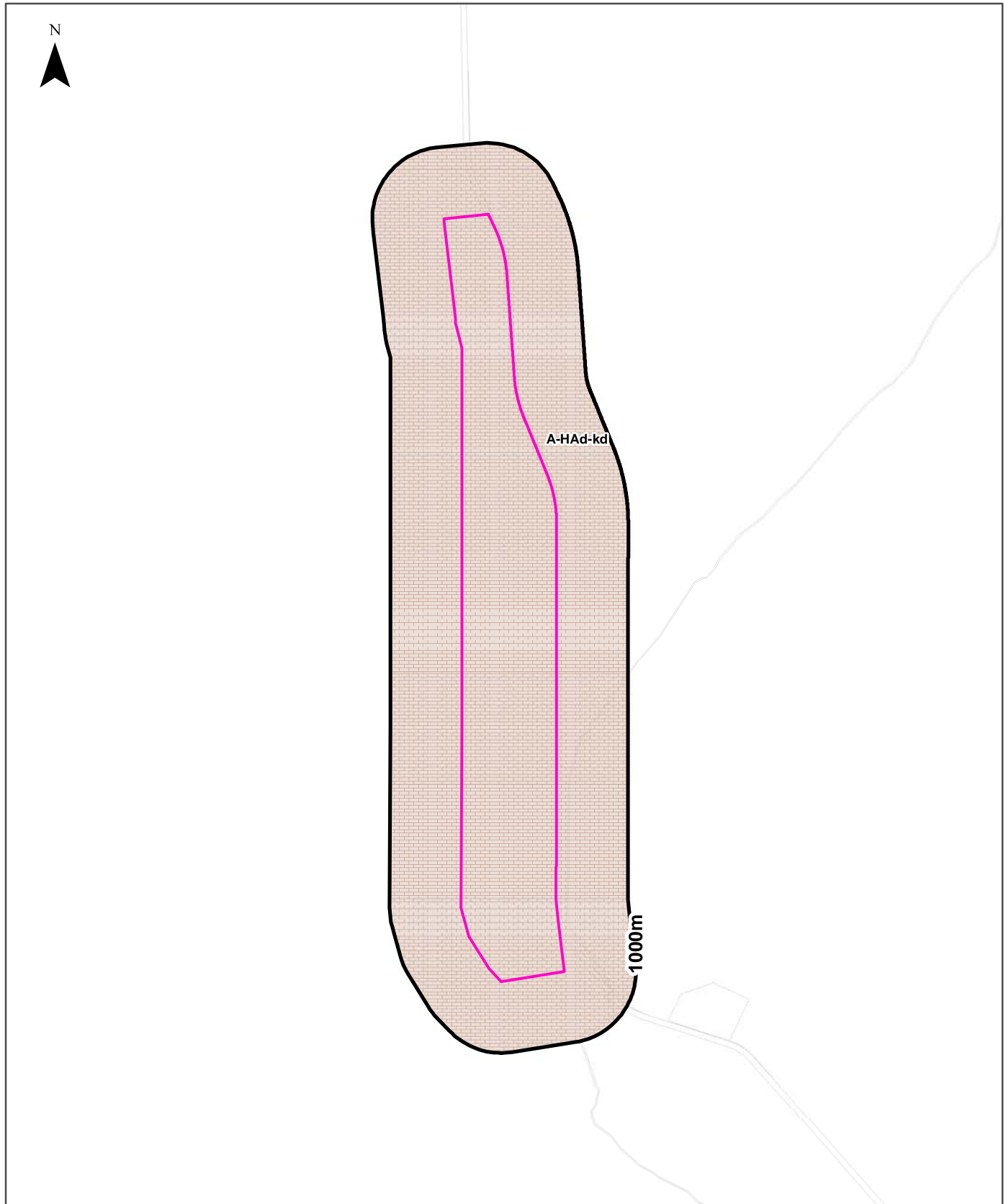
Bore ID	Driller's Log	Distance	Direction
50093564	0.00m-29.00m Tertiary 29.00m-69.00m Proterozoic	280m	South
50086326	0.00m-65.00m Quaternary 65.00m-67.41m Proterozoic	350m	North East
50016609	0.00m-74.00m Quaternary 74.00m-85.00m ? proterozoic	664m	North
50097620	0.00m-84.00m Tertiary 84.00m-86.00m Proterozoic	1127m	North
50079830	0.00m-57.00m Quaternary 57.00m-61.00m ? wthrd wittenoom dolomite	1714m	North

Groundwater Boreholes Data Source: Bureau of Meteorology

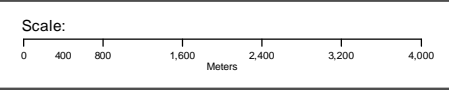
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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Legend		Linear Geological Structures		
Site Boundary	Report Buffer	Major fault, exposed	Major fault, concealed	Fold axial trace, exposed
Property Boundary	Fault, exposed	Fault, concealed	Major strike-slip fault, exposed	Fold axial trace, concealed
		Strike-slip fault, exposed		



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 19 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone	Hammersley Group	Hammersley Group, lower	Wittenoom Formation	Neoarchean	Neoarchean	2597	2504	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

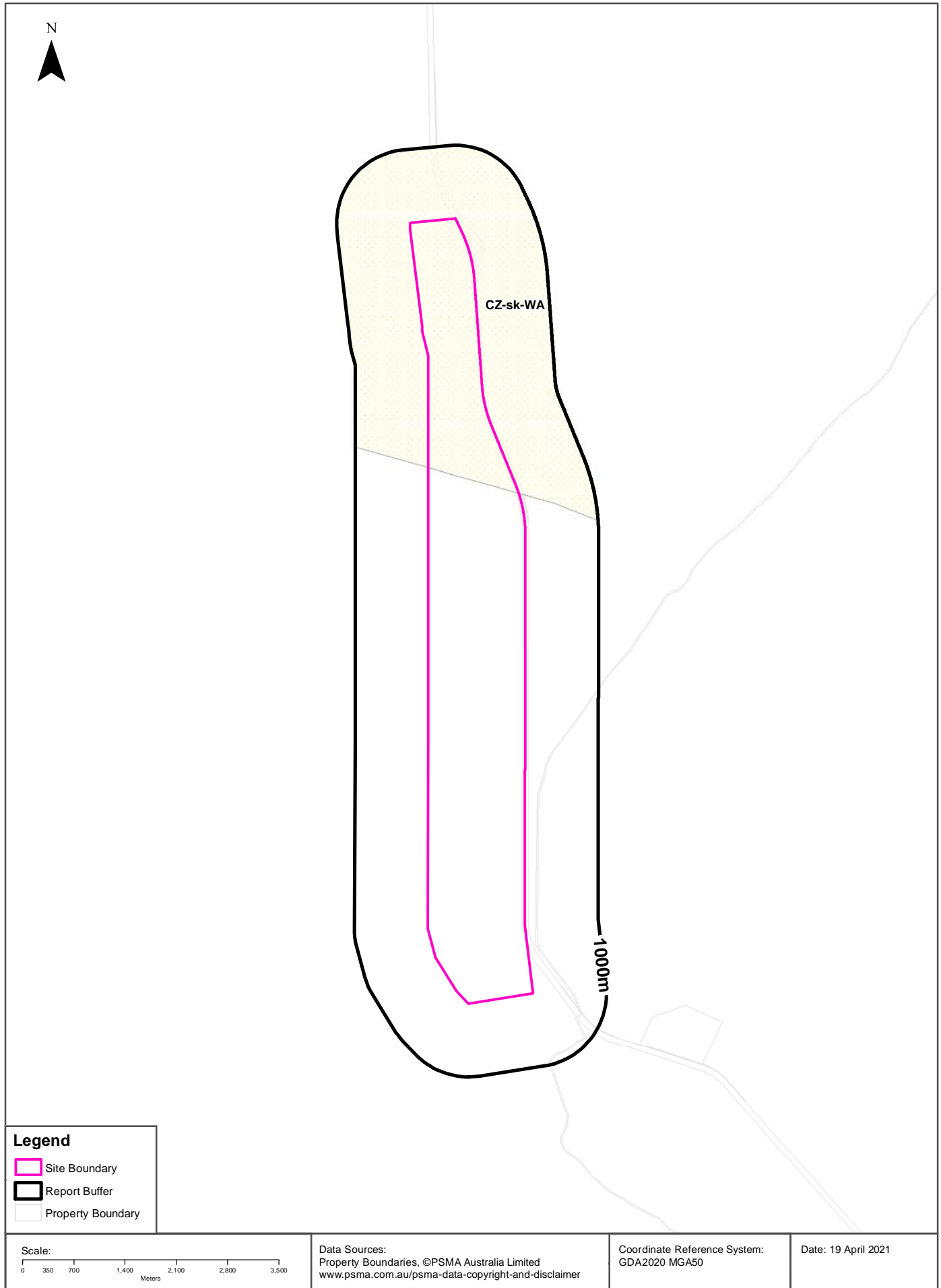
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

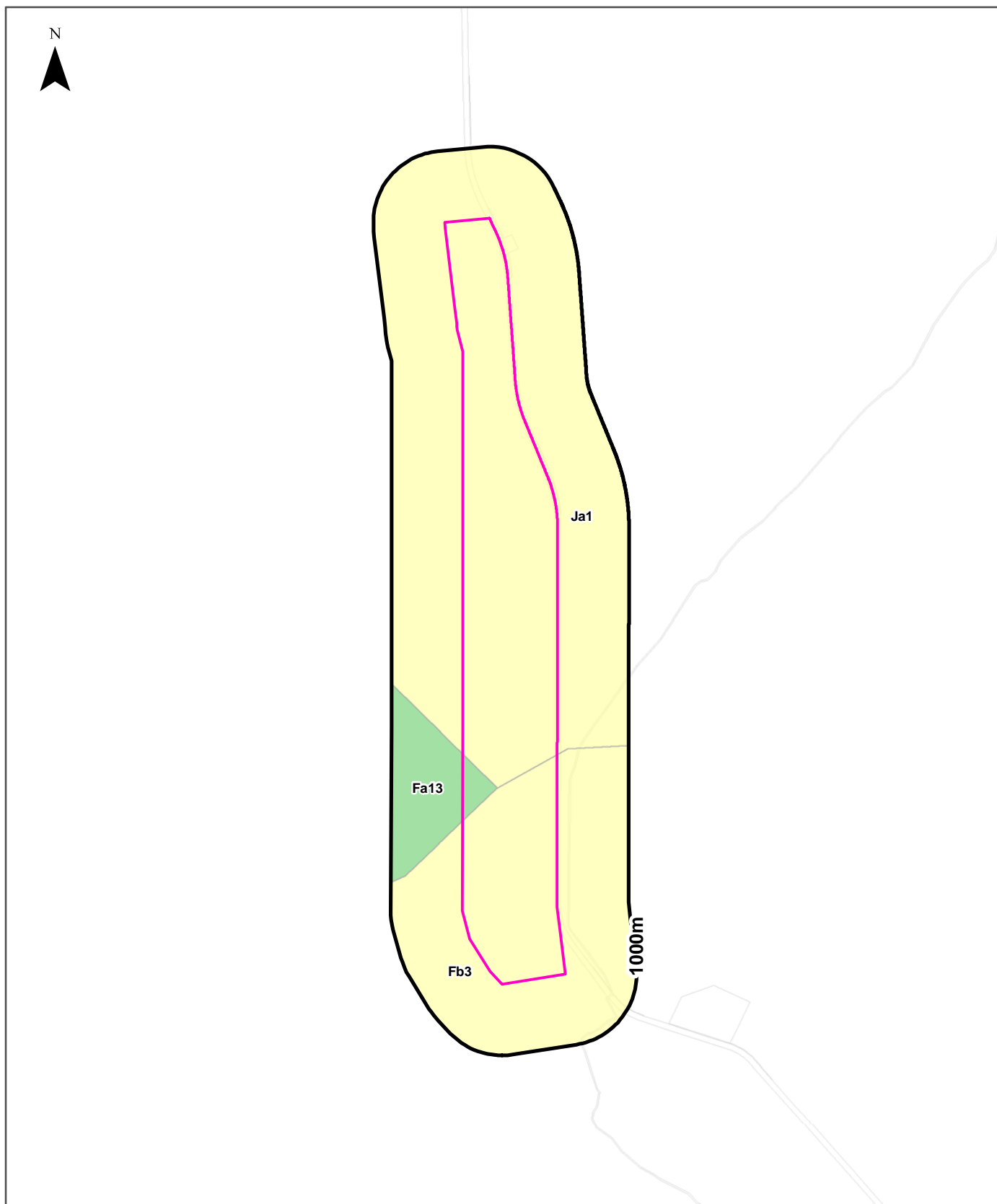
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

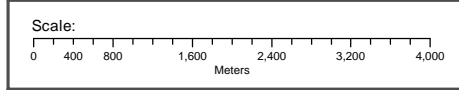
Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
CZ-sk-WA	Valley-fill deposits	Alluvial and lacustrine sand, silt, mud and calcrete in major paleovalleys; Mesozoic at depth			Cenozoic	Holocene	66	0	0m

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		



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Date: 19 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

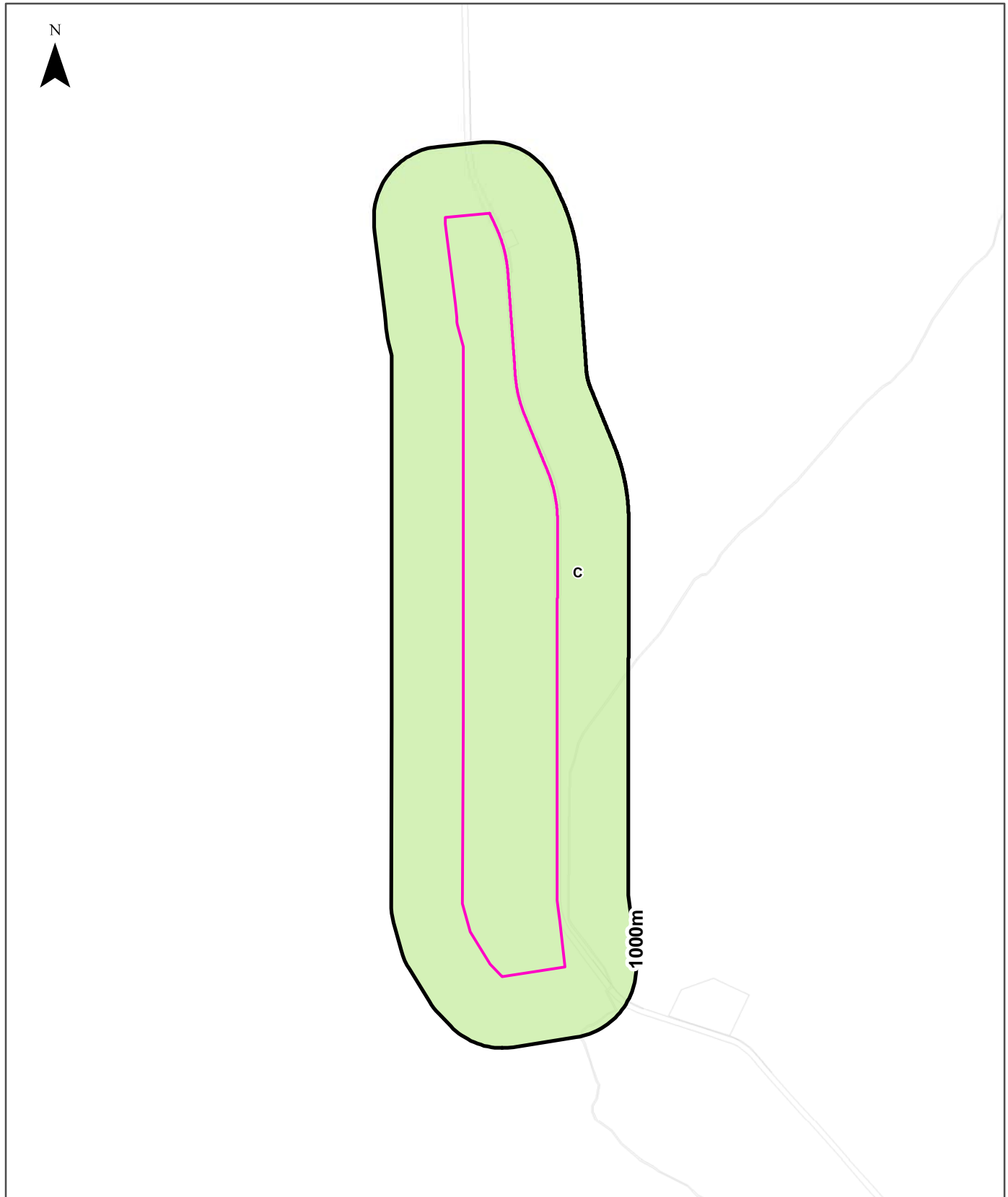
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Fa13	Tenosol	Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.	0m
Fb3	Kandosol	High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.	0m
Ja1	Kandosol	Extensive valley plains largely associated with the Fortescue River: chief soils are earthy clays (Uf6.71) along with some (Ug5.38), (Um5.5), and (Dr2.33) soils. Small areas of calcrete (kunkar) with (Um5.11) soils occur also.	0m

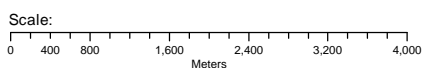
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Coordinate Reference System:
 GDA2020 MGA50

Date: 19April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

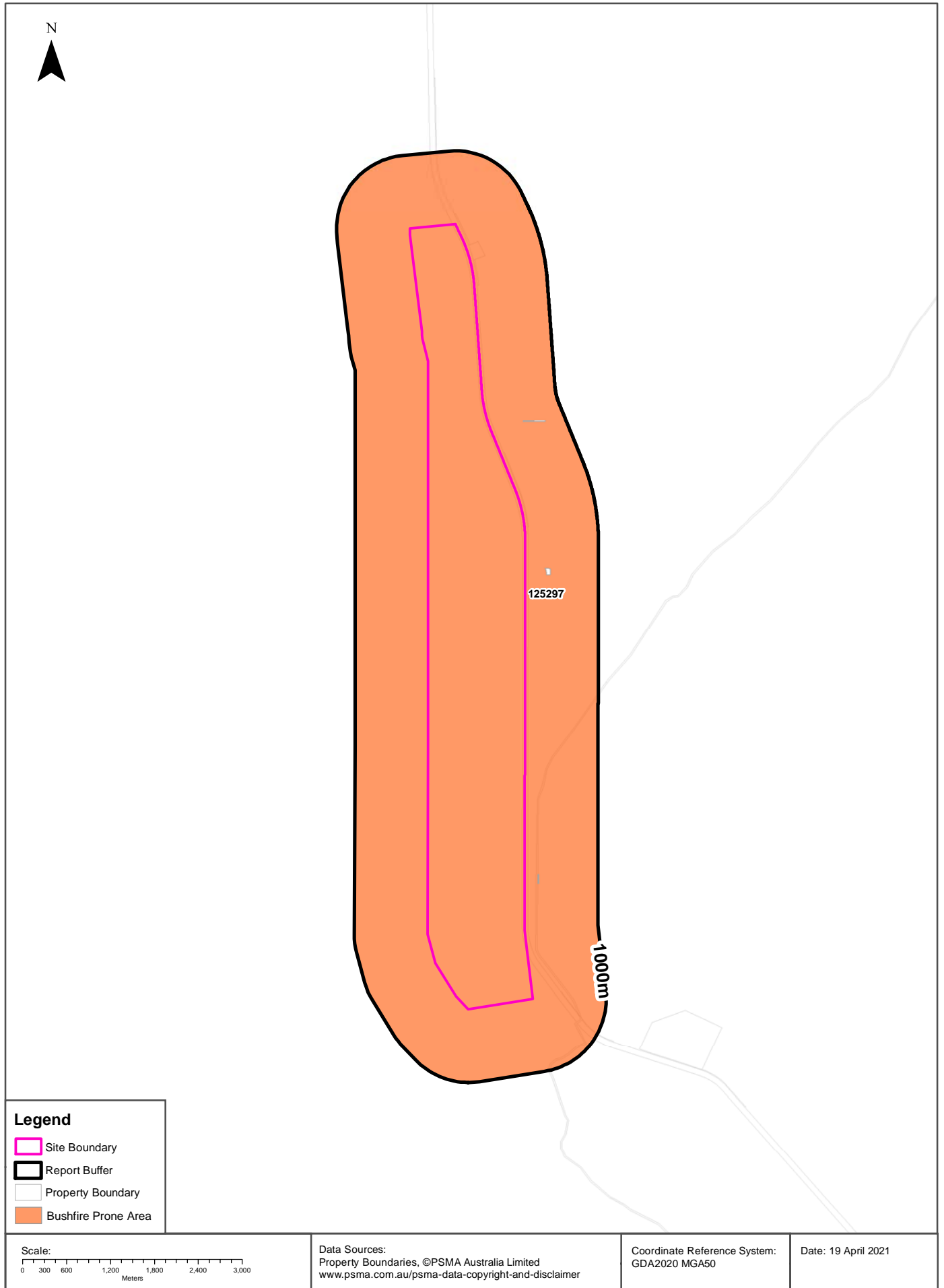
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Bushfire Prone Areas

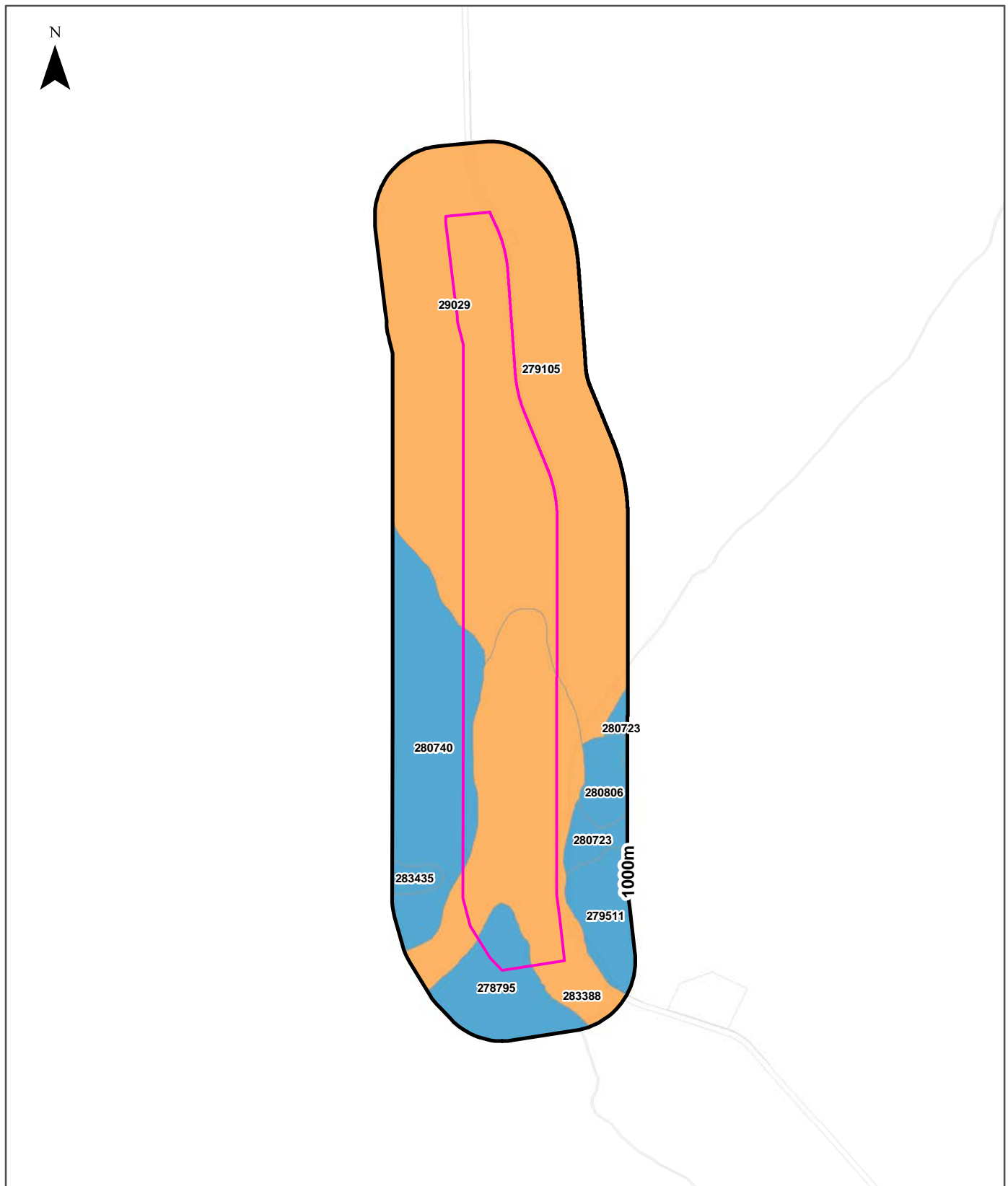
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

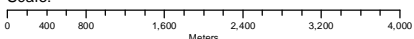
Manuwarrah Red Dog Highway Alignment, WA (Part 5)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



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Coordinate Reference System:
GDA2020 MGA50

Date: 19 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
279105	Terrestrial		Moderate potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		0m	Onsite
280740	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
278795	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
29029	Aquatic	WEELUMURRA CREEK	High potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	River		0m	Onsite
283388	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
280723	Terrestrial		Low potential GDE - from national assessment	10	Mainly alluvial lowland with hardpan wash plains and sandplain, possibly a graben.	Vegetation		89m	East
279511	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		106m	South East
283435	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		284m	West
280806	Terrestrial		Low potential GDE - from national assessment	9	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		310m	South East

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 5)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading "LC" or "LocConf". These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

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Address: Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Date: 20 Apr 2021 08:07:21

Reference: LS019698 EL

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The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

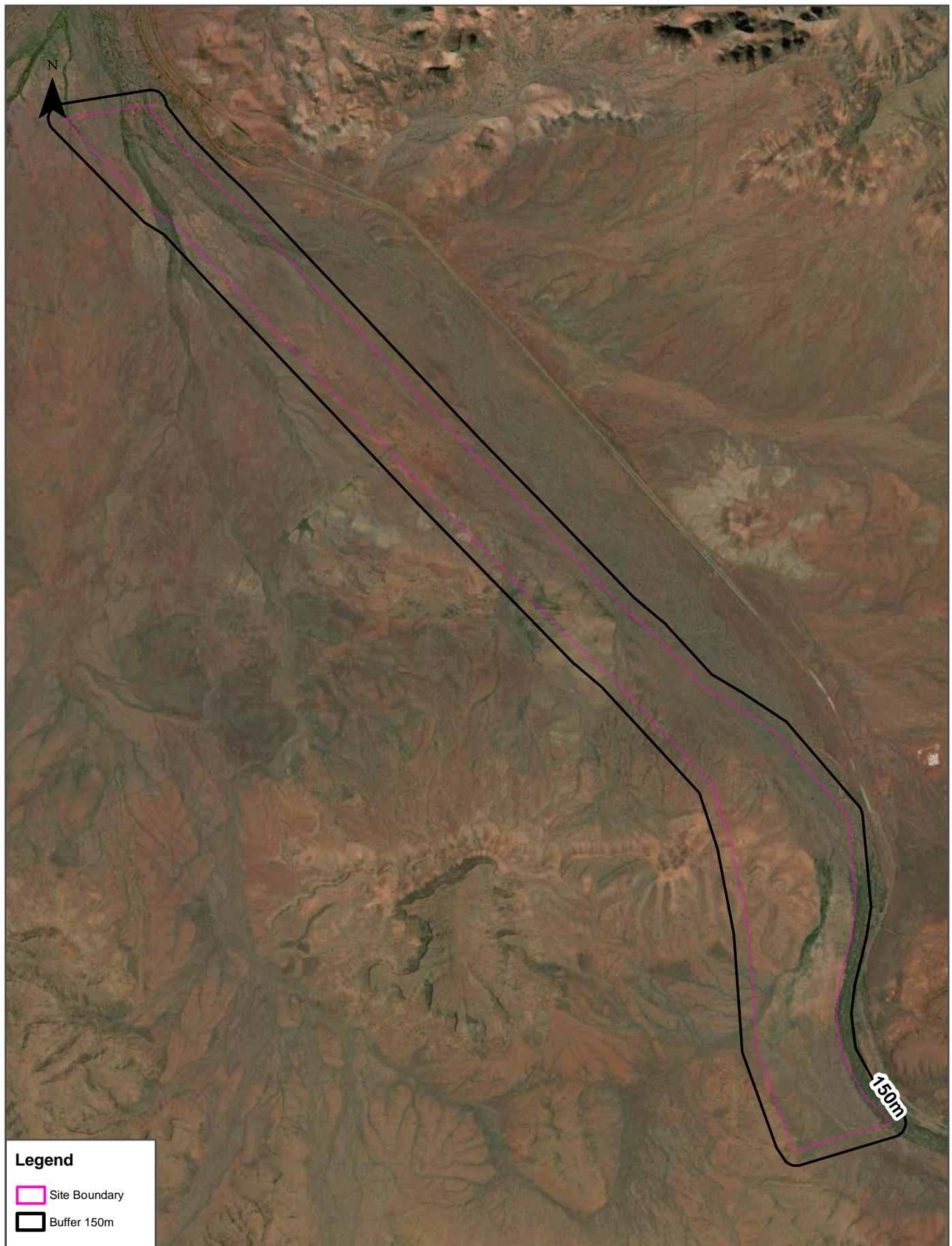
Dataset Listing

Datasets contained within this report, detailing their source and data currency:



Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	1
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	3
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	3	5	28
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	3	3	3
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	1
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	2	2	2
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	6	7	11
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

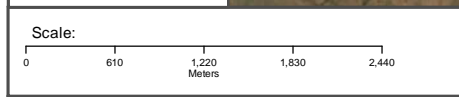
Aerial Imagery 2019 - 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Legend

-  Site Boundary
-  Buffer 150m



Data Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS UserCommunity

Coordinate Reference System: GDA2020 MGA50

Date: 20 April 2021

Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Defence 3 Year Regional Contamination Investigation Program

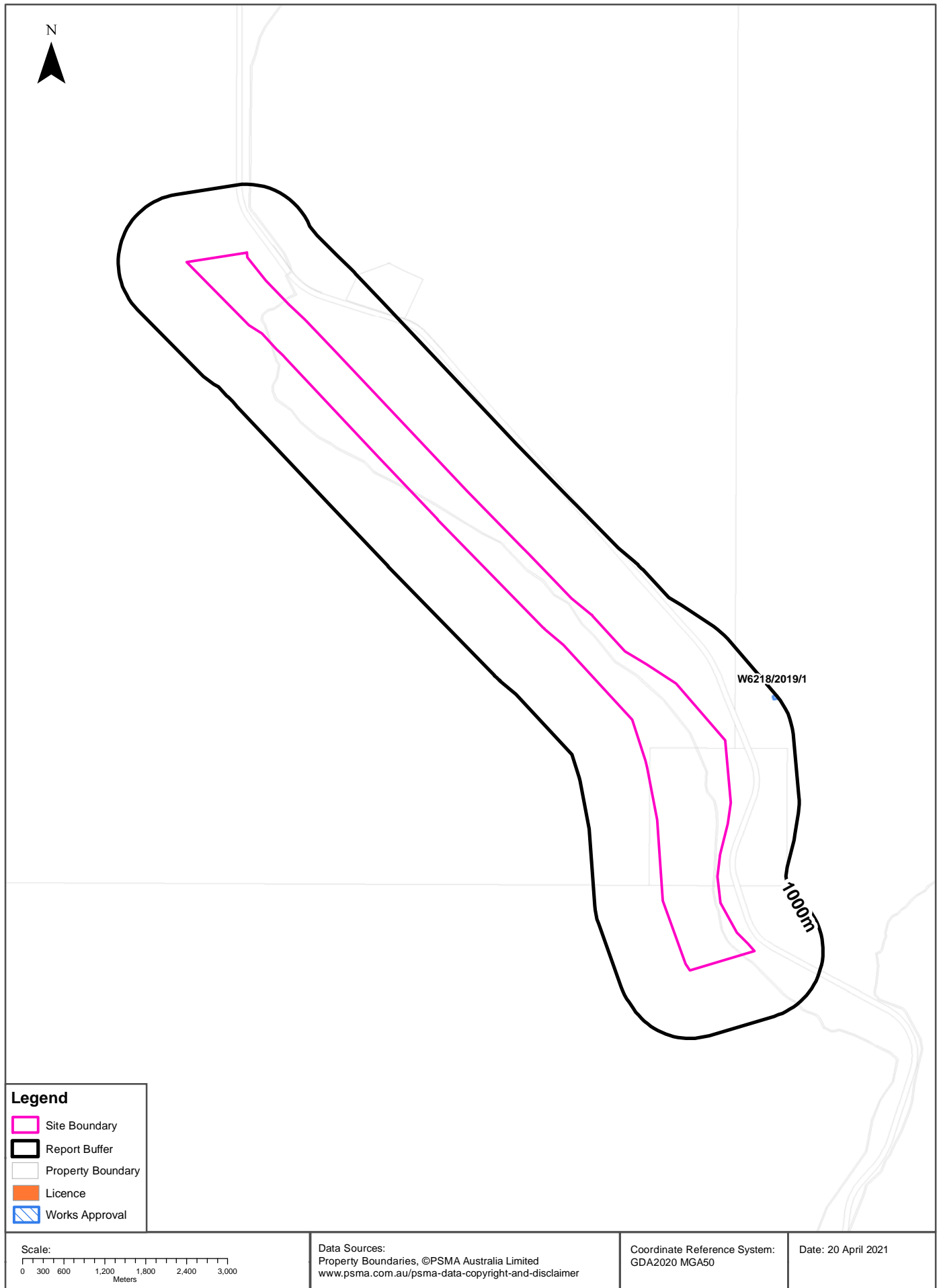
Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

DWER Licences and Works Approvals

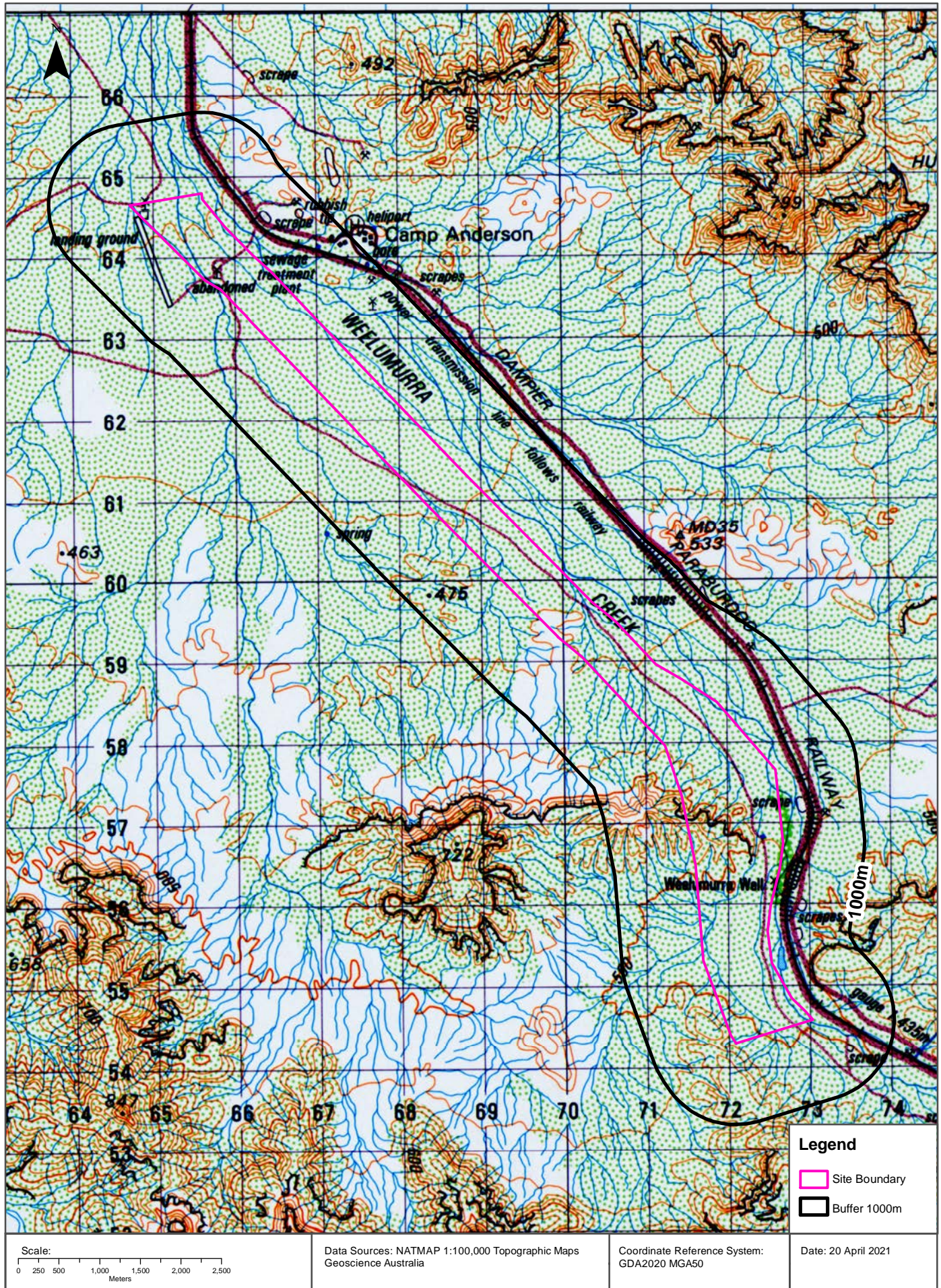
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
W6218/2019/1	Works approval	Pilbara Iron Pty Ltd	Pelican Rail Camp L47/810	Tom Price Railway Road	Ashburton Shire	2019-04-02	2019-04-02	2024-04-02	85 - Sewage facility	Premise Match	927m	East

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

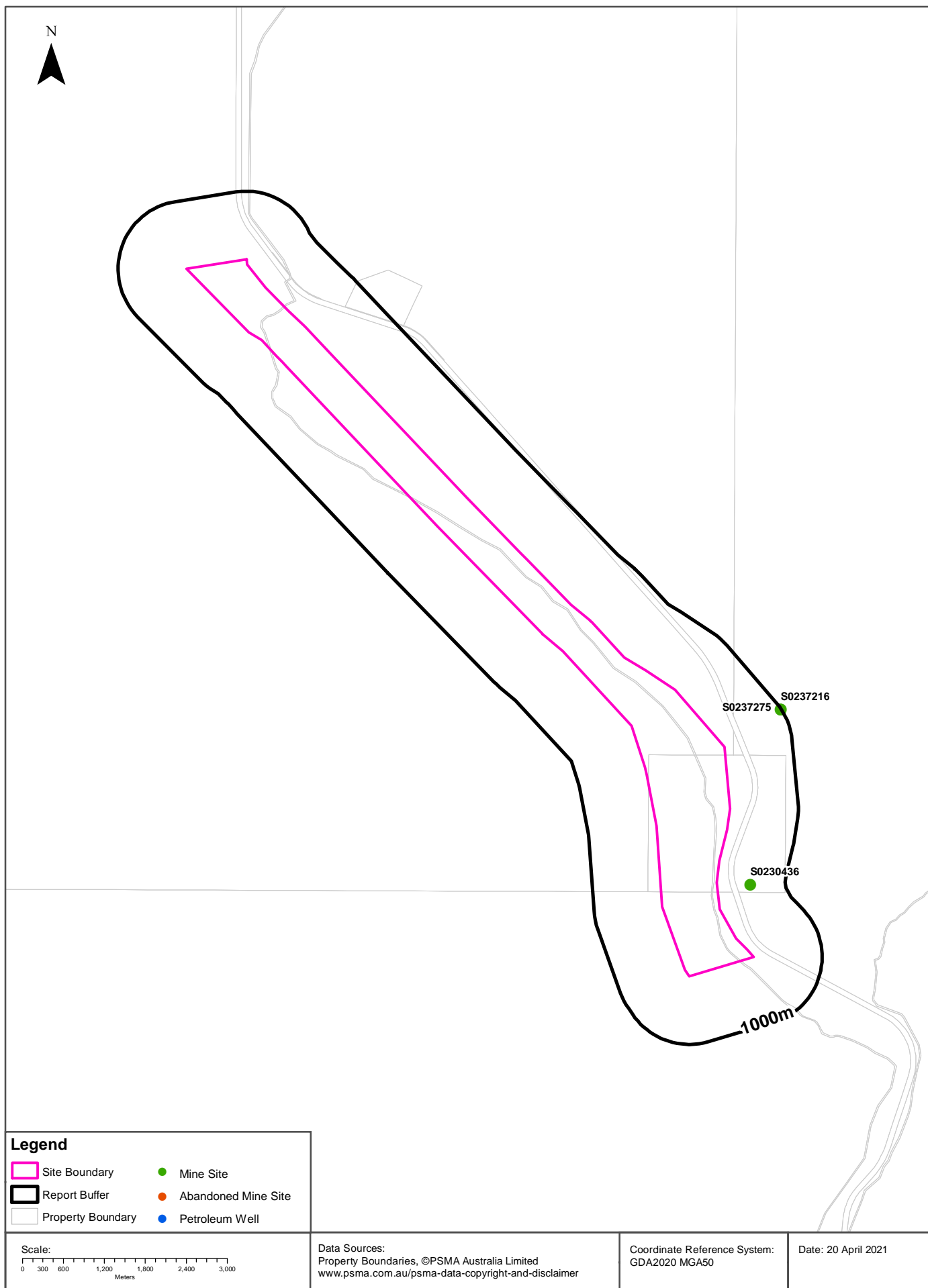
Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Mine Sites and Petroleum Wells

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0230436	Borrow Pit BP22A L47/48	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	485m	South East
S0237216	Pelican Camp	Infrastructure	Town/Village/Camp	Proposed	IRON ORE	J00557	Gudai-Darri	993m	East
S0237275	Gudai-Darri Environmental Group	Infrastructure	Town/Village/Camp	Proposed	IRON ORE	J00557	Gudai-Darri	993m	East

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50014960	70810187	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1970		421.89	NGS	0m	Onsite
50065363	70810178	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		427.48	NGS	0m	Onsite
50110014	70800371	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	0m	Onsite
50093564	70810186	Department of Water and Environmental Regulation	Unknown	Unknown	10/12/1975	28.00	425.15	TOC	23m	North West
50012362	70810179	Department of Water and Environmental Regulation	Water supply for livestock, Domestic household, Household	Unknown	1/1/1900		489.94	NGS	70m	South East
50109922	70800356	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	384m	East
50065673	70810184	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	384m	North West
50062621	70810182	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	384m	North West
50055143	70810181	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	384m	North West
50045420	70810183	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	384m	North West
50064048	70810185	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		421.69	NGS	388m	North West
50113662	70800143	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	542m	South East
50111799	70800142	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	872m	East
50111462	70800148	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1033m	South East
50092733	70812567	Department of Water and Environmental Regulation	Water supply	Unknown	8/14/2000	88.00	442.85	NGS	1072m	North

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50089670	70812542	Department of Water and Environmental Regulation	Exploration or research	Unknown	8/26/2000	6.00	442.99	NGS	1083m	North
50113654	70800357	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1141m	South East
50008504	70800359	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1283m	North
50115122	70800147	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1330m	South East
50112016	70800140	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1584m	East
50110223	70800146	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1657m	South East
50035995	70810758	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		441.57	NGS	1664m	North West
50111433	70800355	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1700m	North West
50105102	70800358	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1724m	North
50053558	70810180	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		429.14	NGS	1774m	North West
50037904	70810188	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		426.87	NGS	1776m	North West
50112068	70800141	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1930m	East
50103774	70800145	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1969m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

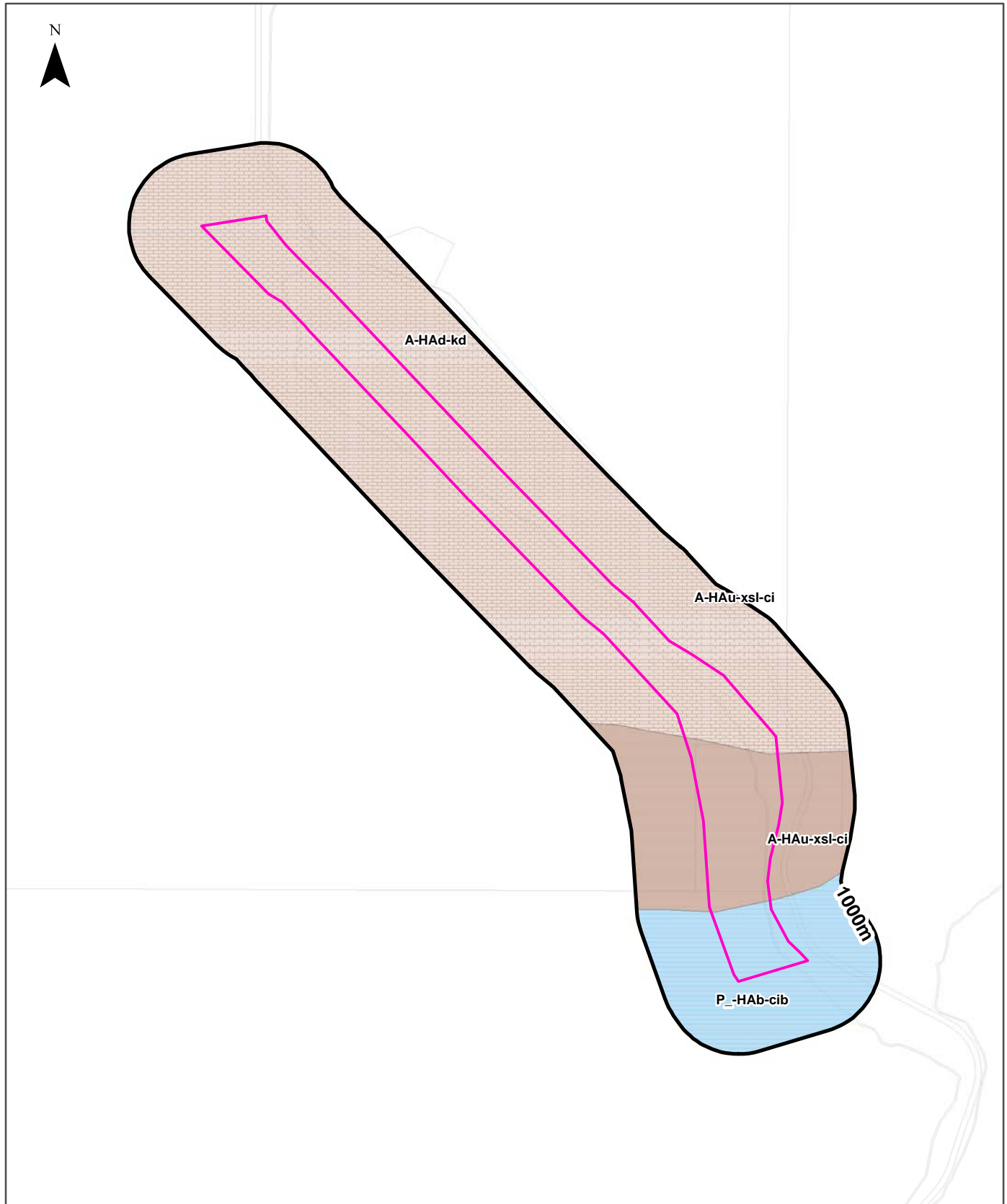
Bore ID	Driller's Log	Distance	Direction
50093564	0.00m-29.00m Tertiary 29.00m-69.00m Proterozoic	23m	North West

Groundwater Boreholes Data Source: Bureau of Meteorology

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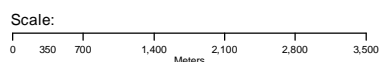
Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Legend

Site Boundary	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed	Fold axial trace, exposed
Report Buffer	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, concealed
Property Boundary				



Data Sources:
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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone	Hammersley Group	Hammersley Group, lower	Wittenoom Formation	Neoarchean	Neoarchean	2597	2504	0m
A-HAu-xsl-ci	Mount McRae Shale and Mount Sylvia Formation	Mudstone, siltstone, chert, banded iron-formation, and dolomite; metamorphosed	Hammersley Group	Hammersley Group, lower	Mount McRae Shale and Mount Sylvia Formation	Neoarchean	Neoarchean	2541	2501	0m
P_-HAb-cib	Brockman Iron Formation	Banded iron-formation, chert, mudstone, and siltstone; metamorphosed	Hammersley Group	Hammersley Group, upper	Brockman Iron Formation	Paleoproterozoic	Paleoproterozoic	2494	2451	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

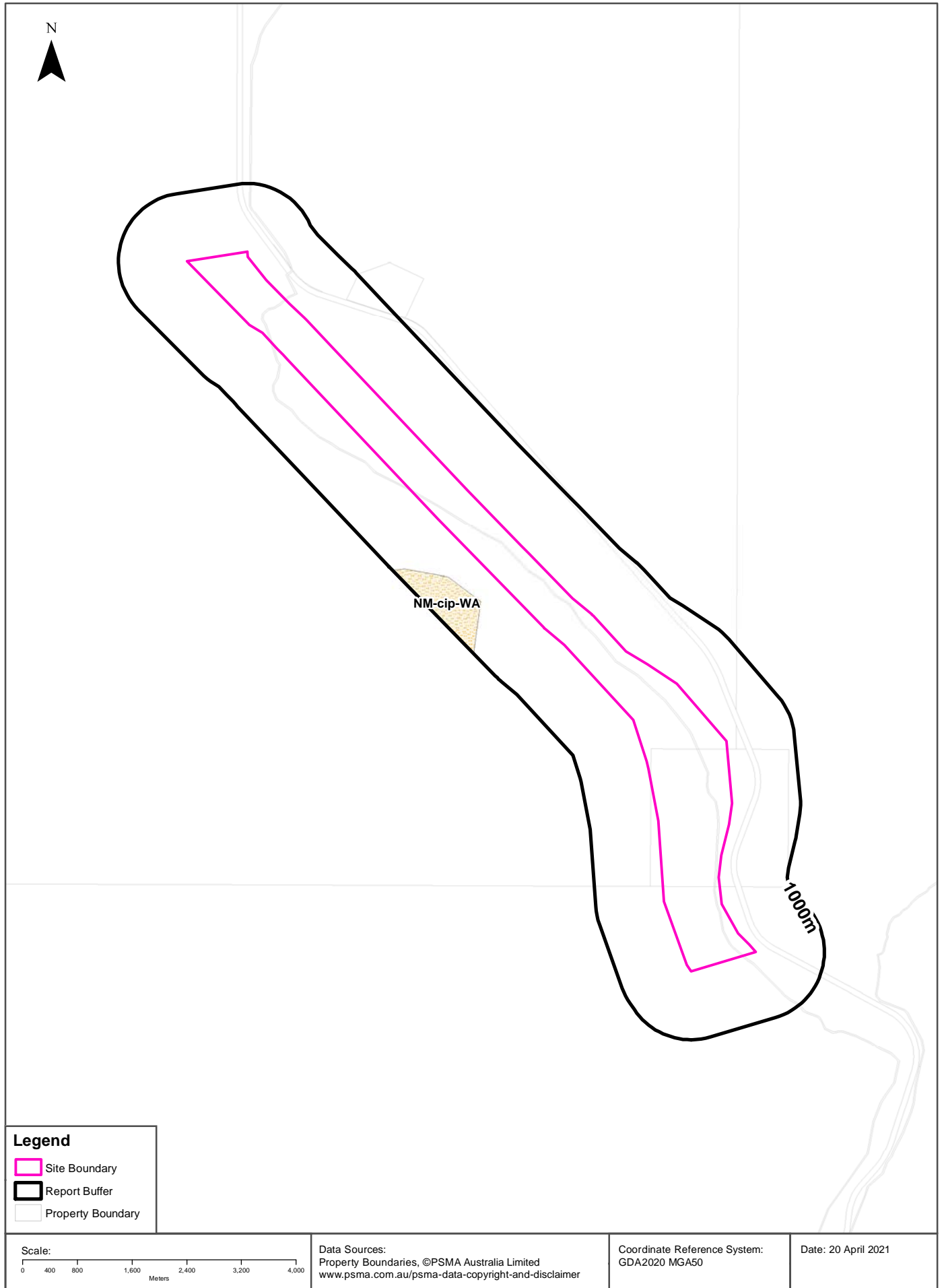
Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Cenozoic Geology 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

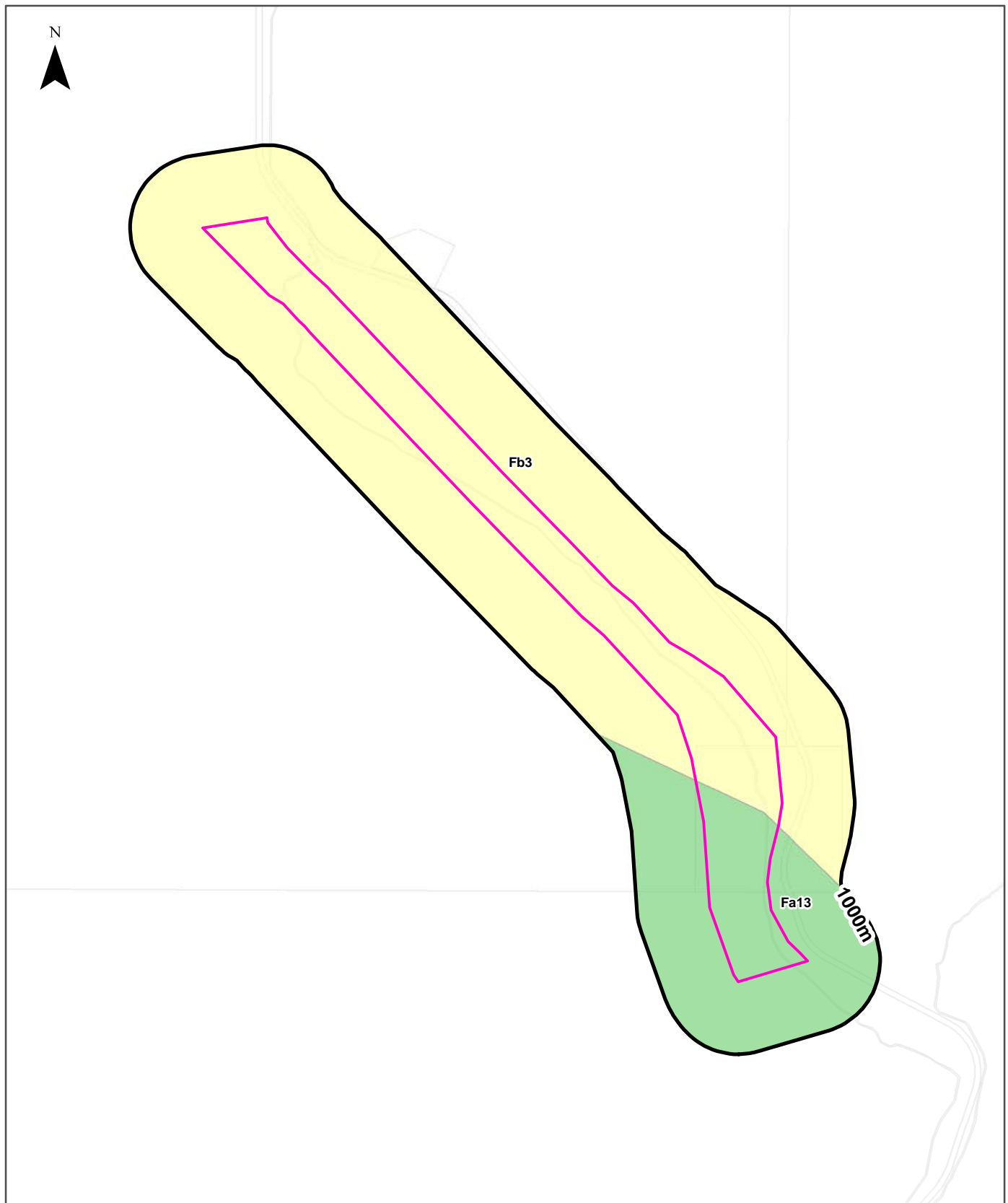
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

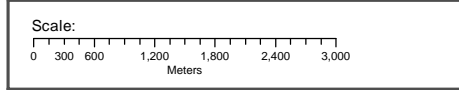
Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
NM-cip-WA	Miocene channel iron deposits	Pisolitic limonite, goethite, and hematite deposits; developed along palaeodrainage lines; dissected by present-day drainage			Miocene	Miocene	23.03	5.333	394m

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		



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Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

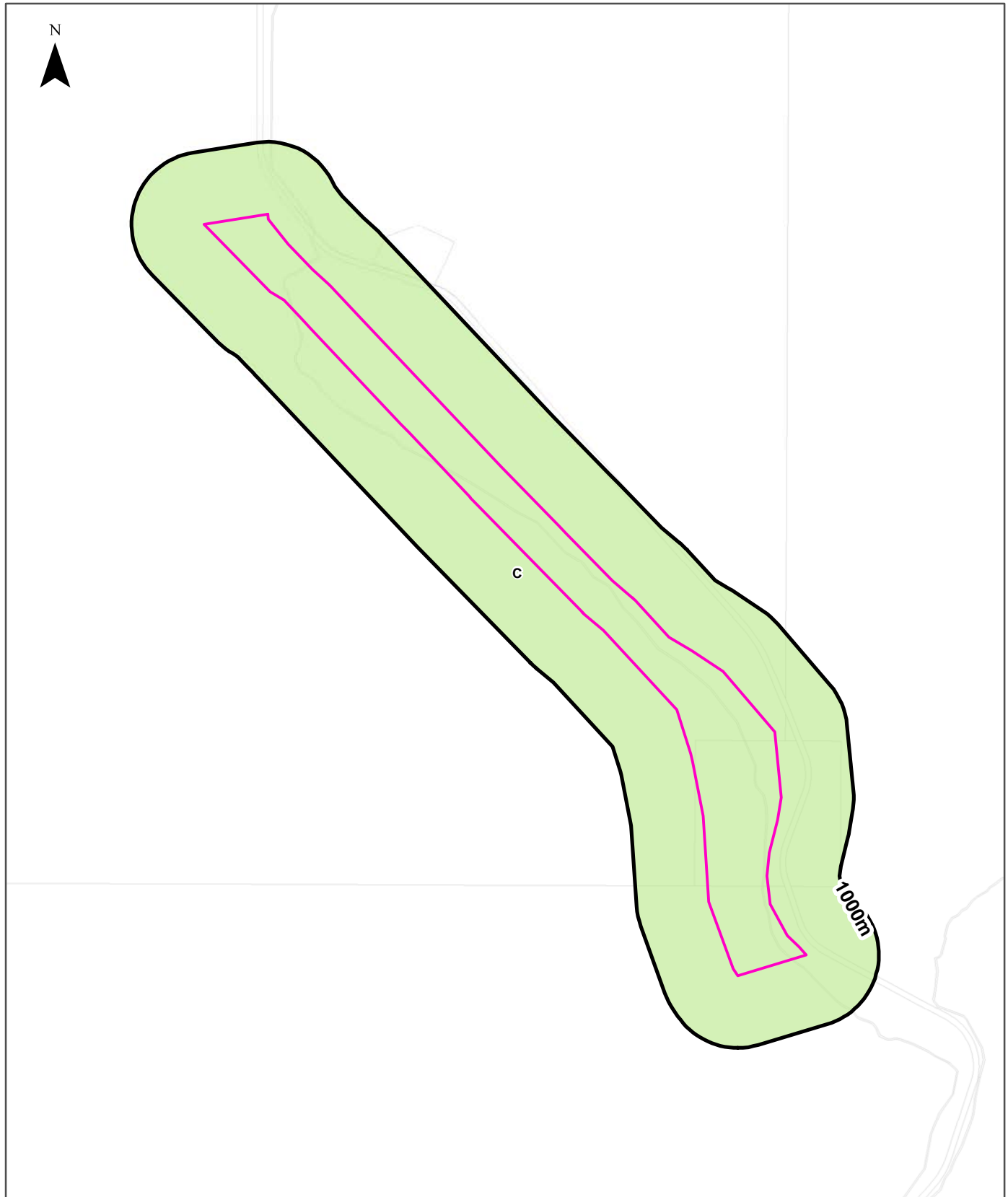
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Fa13	Tenosol	Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.	0m
Fb3	Kandosol	High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.	0m

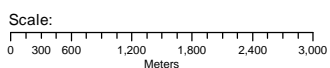
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Coordinate Reference System:
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Date: 20April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

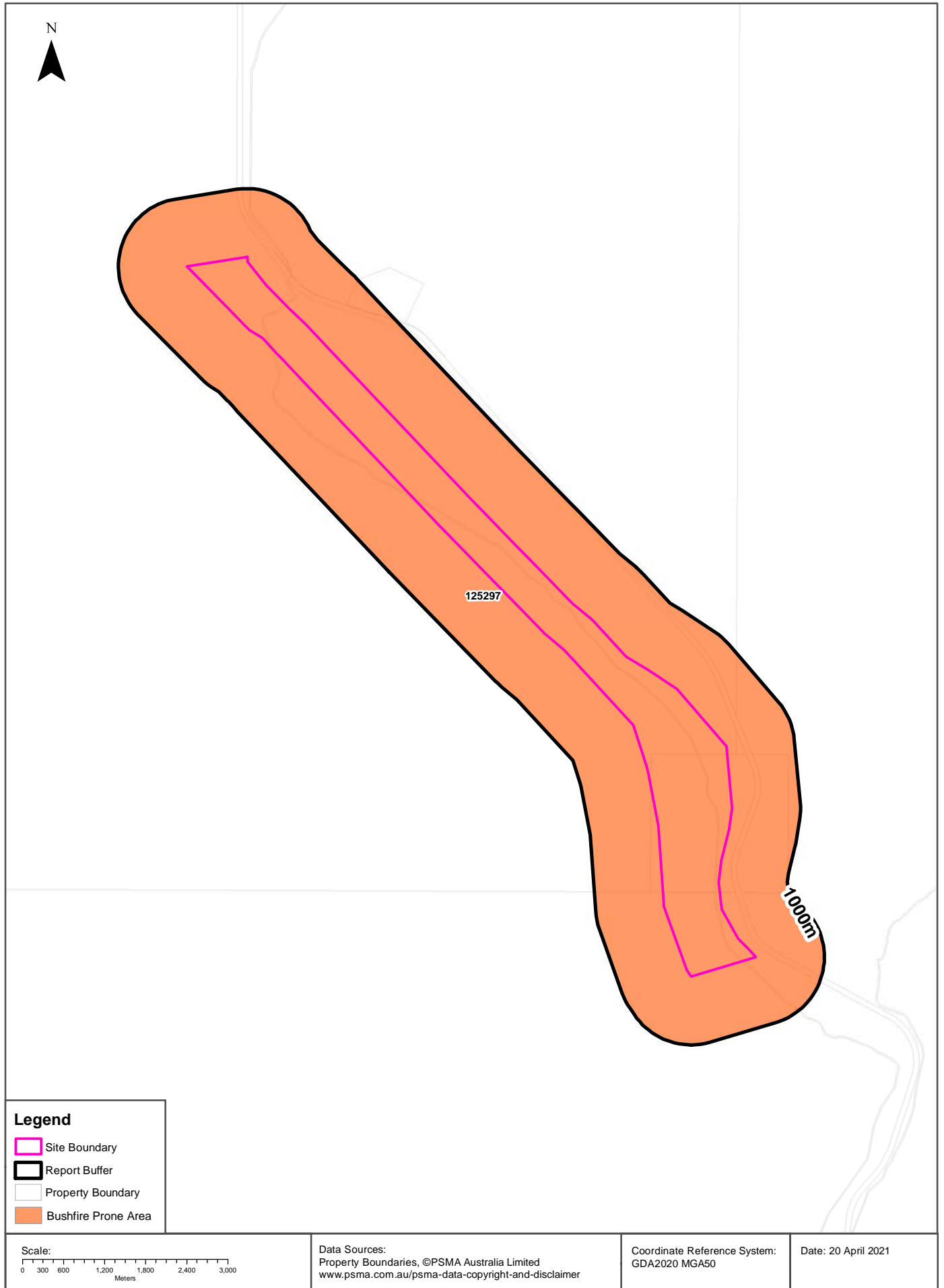
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Bushfire Prone Areas

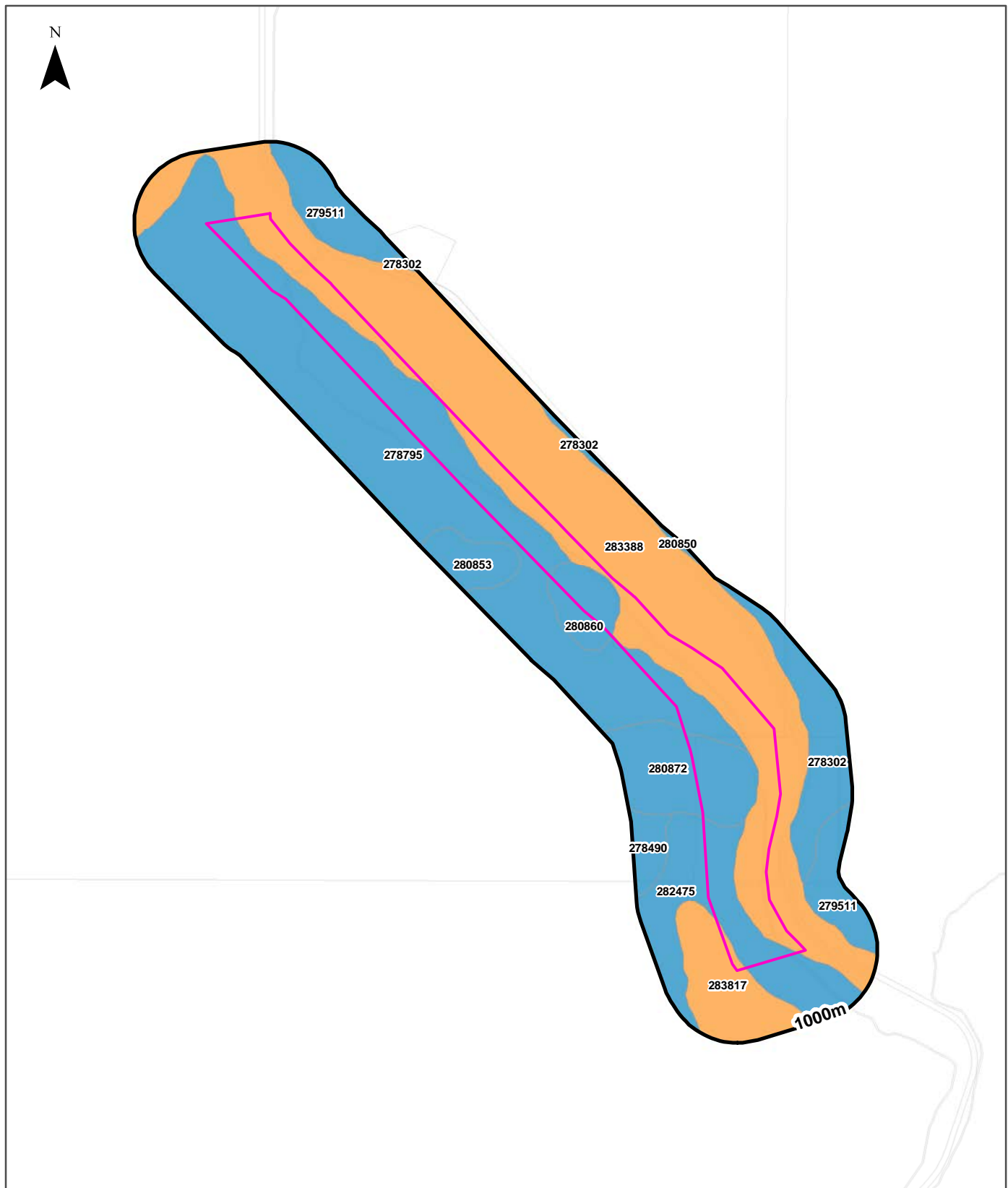
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

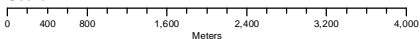
Manuwarrah Red Dog Highway Alignment, WA (Part 6)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



Data Sources:
Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
278795	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283388	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
280872	Terrestrial		Low potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
282475	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
280860	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283817	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
280853	Terrestrial		Low potential GDE - from national assessment	9	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		88m	West
278302	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		205m	North East
279511	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		302m	East
278490	Terrestrial		Low potential GDE - from national assessment	9	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		406m	South West

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
280850	Terrestrial		Low potential GDE - from national assessment	6	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		915m	East

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 6)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading "LC" or "LocConf". These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Date: 20 Apr 2021 09:07:09

Reference: LS019699 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

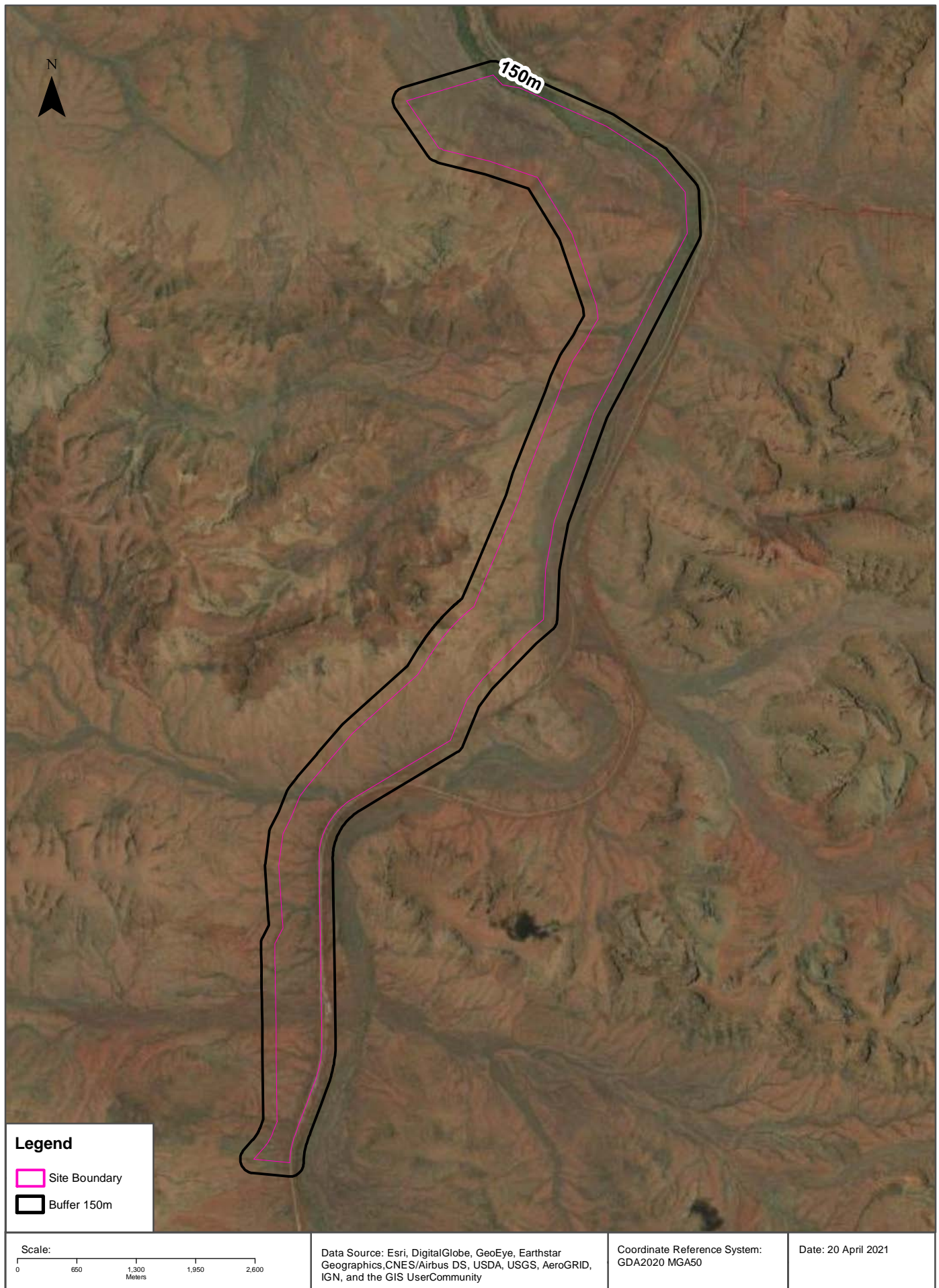
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	1	2	7
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	2	26
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	2
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	1	2
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	5	5	11
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2018 - 2019

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

DWER Licences and Works Approvals

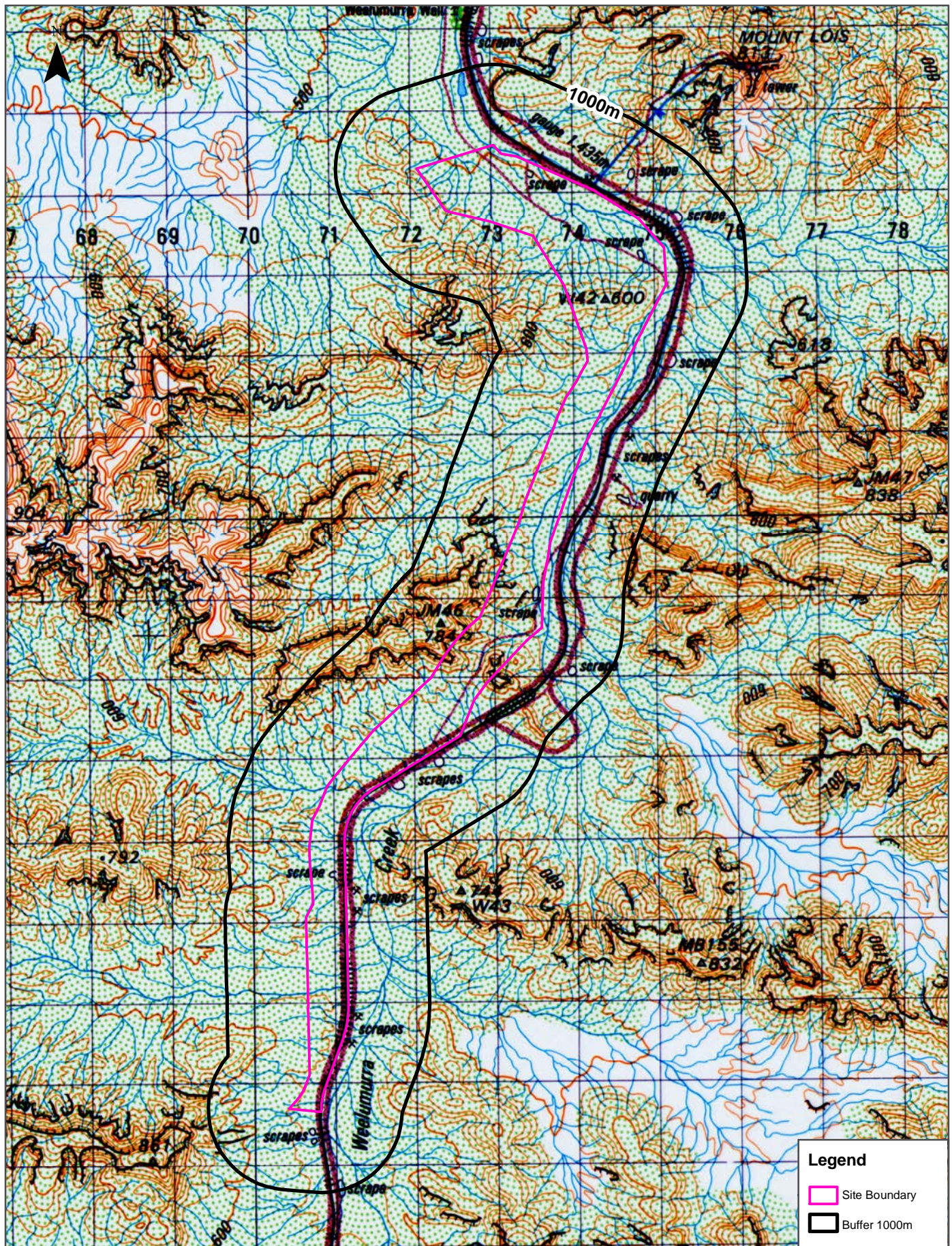
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commened	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											



Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

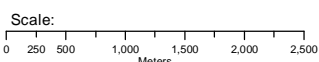
Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Legend

-  Site Boundary
-  Buffer 1000m



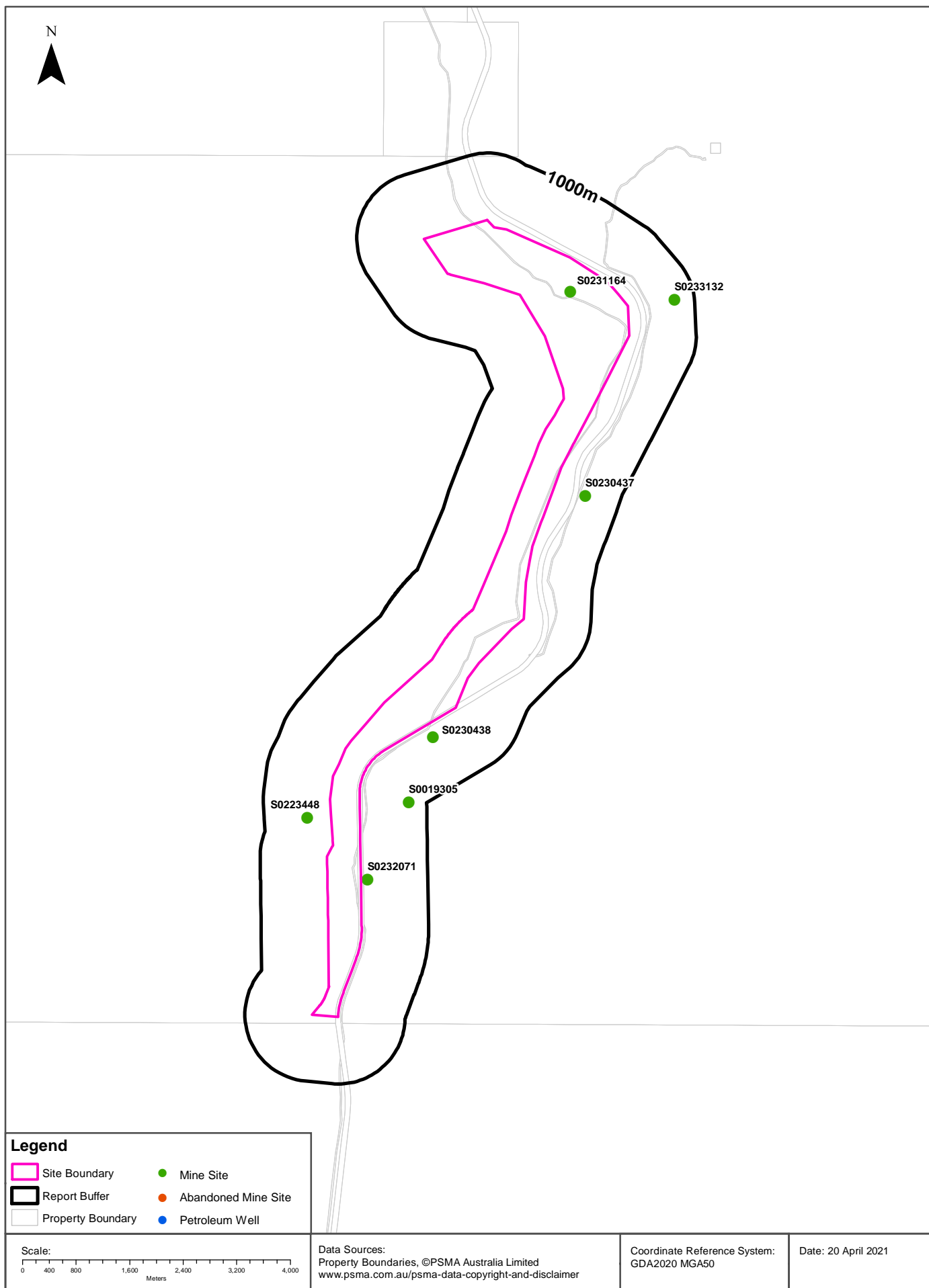
Data Sources: NATMAP 1:100,000 Topographic Maps
Geoscience Australia

Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Mine Sites and Petroleum Wells

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0231164	Queens Extension	Mine	Openpit	Proposed	IRON ORE	J01646	Solomon - Greater Solomon	0m	Onsite
S0230438	Borrow Pit BP23B L47/49	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hammersley Iron Rail / Rio Tinto - Robe River	205m	South
S0223448	Eliwana Railway	Infrastructure	Railway	Under Development	IRON ORE	J01646	Solomon - Greater Solomon	360m	South West
S0230437	Borrow Pit BP23 L47/48	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hammersley Iron Rail / Rio Tinto - Robe River	486m	East
S0233132	Queens Chemical Grout Trial	Infrastructure	Borefield	Under Development	IRON ORE	J01646	Solomon - Greater Solomon	703m	North East
S0019305	Kangeen	Deposit	Unspecified	Undeveloped	IRON ORE	J01646	Solomon - Greater Solomon	736m	South
S0232071	Borrow Pit BP225	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hammersley Iron Rail / Rio Tinto - Robe River	97m	South

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

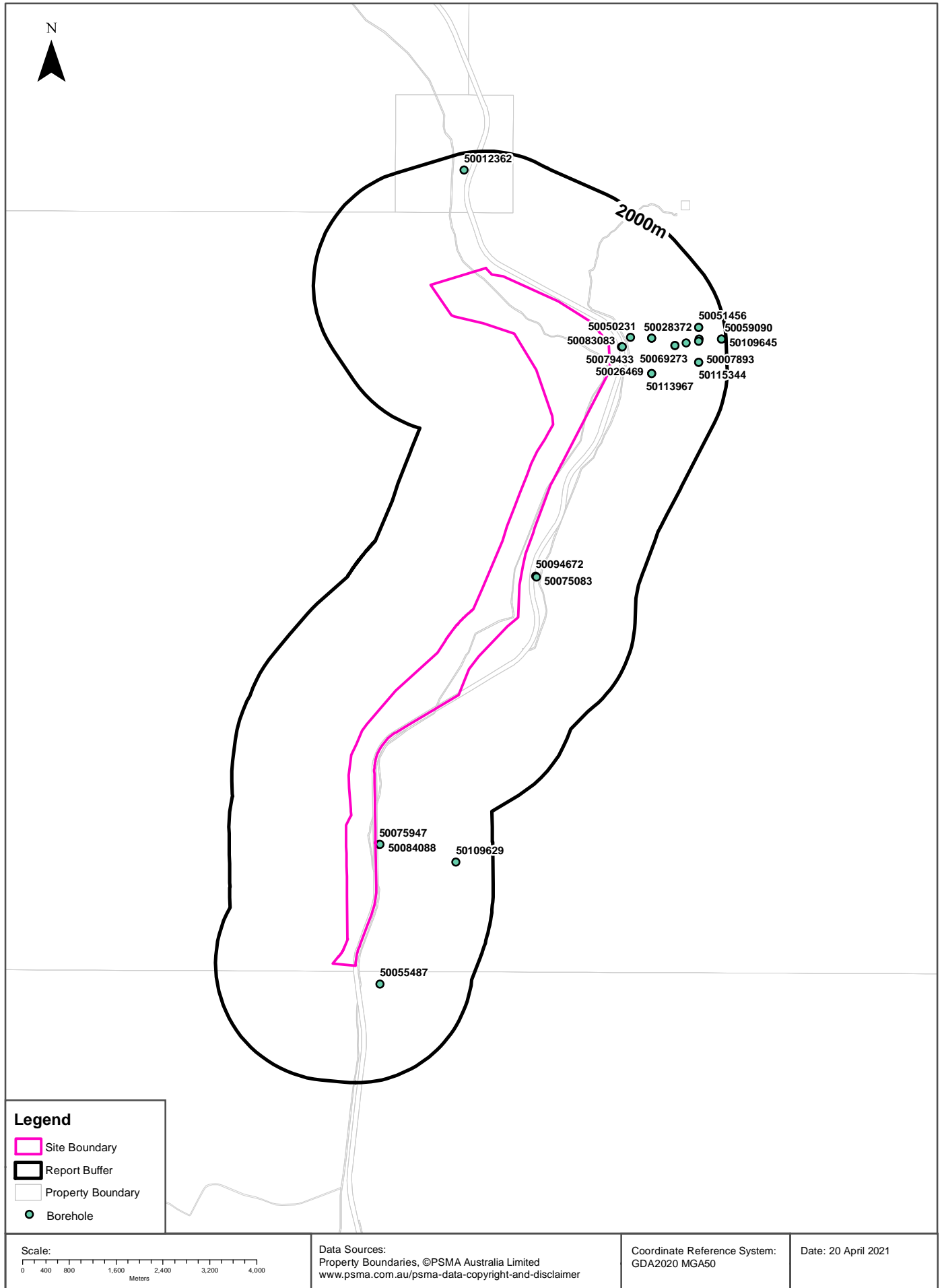
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50075947	70813058	Department of Water and Environmental Regulation	Water supply	Unknown	7/24/2004	86.00	574.29	NGS	64m	South
50084088	70813062	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/11/2004	90.00	574.22	NGS	83m	South
50079433	70812543	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/26/2000	6.00	513.33	NGS	214m	North East
50083083	70812566	Department of Water and Environmental Regulation	Water supply	Unknown	8/3/2000	58.65	513.33	NGS	229m	North East
50094672	70813061	Department of Water and Environmental Regulation	Exploration or research	Unknown	7/10/2004	66.00	537.37	NGS	248m	South East
50075083	70813059	Department of Water and Environmental Regulation	Water supply	Unknown	7/28/2004	70.00	538.07	NGS	262m	South East
50050231	70801484	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		511.68	TOC	382m	North East
50055487	70810190	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		578.51	NGS	521m	South
50113967	70800291	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	716m	North East
50026469	70801276	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900			UNK	716m	North East
50112017	70800290	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	738m	North East
50028372	70801275	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900			UNK	738m	North East
50069273	70801292	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		517.90	TOC	1132m	North East
50111823	70800238	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1132m	North East
50095332	70800673	Department of Water and Environmental Regulation	Unknown	Unknown	5/16/2010	48.00		UNK	1324m	North East

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50109629	70800233	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1369m	South
50007893	70801327	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		526.40	TOC	1518m	North East
50115344	70800262	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1518m	North East
50069997	70800671	Department of Water and Environmental Regulation	Unknown	Unknown	11/24/2008	17.00	409.70	TOC	1538m	North East
50109905	70800149	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1539m	North East
50095042	70800672	Department of Water and Environmental Regulation	Unknown	Unknown	5/11/2010	60.50	521.22	TOC	1543m	North East
50112740	70800263	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1559m	North East
50051456	70801326	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		524.40	TOC	1559m	North East
50012362	70810179	Department of Water and Environmental Regulation	Water supply for livestock, Domestic household, Household	Unknown	1/1/1900		489.94	NGS	1711m	North
50109645	70800257	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	1926m	North East
50059090	70801308	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		523.50	TOC	1926m	North East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

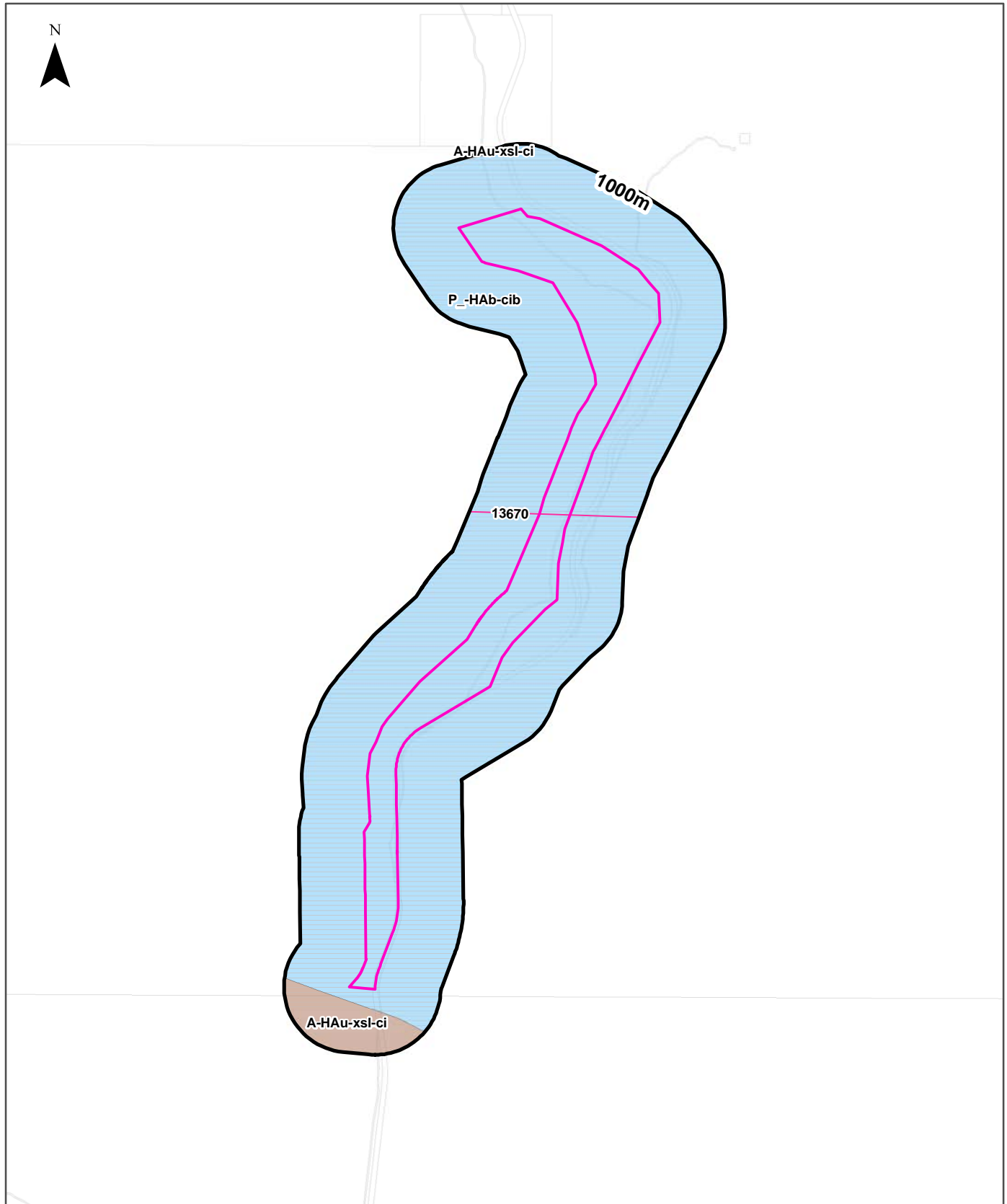
Bore ID	Driller's Log	Distance	Direction
No related drill log data			

Groundwater Boreholes Data Source: Bureau of Meteorology

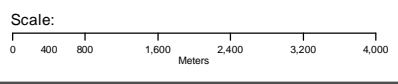
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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Legend		Linear Geological Structures		
Site Boundary	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed	Fold axial trace, exposed
Report Buffer	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, concealed
Property Boundary				



Data Sources:
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Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
P_-HAb-cib	Brockman Iron Formation	Banded iron-formation, chert, mudstone, and siltstone; metamorphosed	Hamersley Group	Hamersley Group, upper	Brockman Iron Formation	Paleoproterozoic	Paleoproterozoic	2494	2451	0m
A-HAu-xsl-ci	Mount McRae Shale and Mount Sylvia Formation	Mudstone, siltstone, chert, banded iron-formation, and dolomite; metamorphosed	Hamersley Group	Hamersley Group, lower	Mount McRae Shale and Mount Sylvia Formation	Neoproterozoic	Neoproterozoic	2541	2501	205m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

Map Code	Feature	Type	Name	Distance
13670	Fold axial trace	syncline, exposed	Yandicoogina Syncline	0m

Geology Data Source: WA Department of Mines and Petroleum

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Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

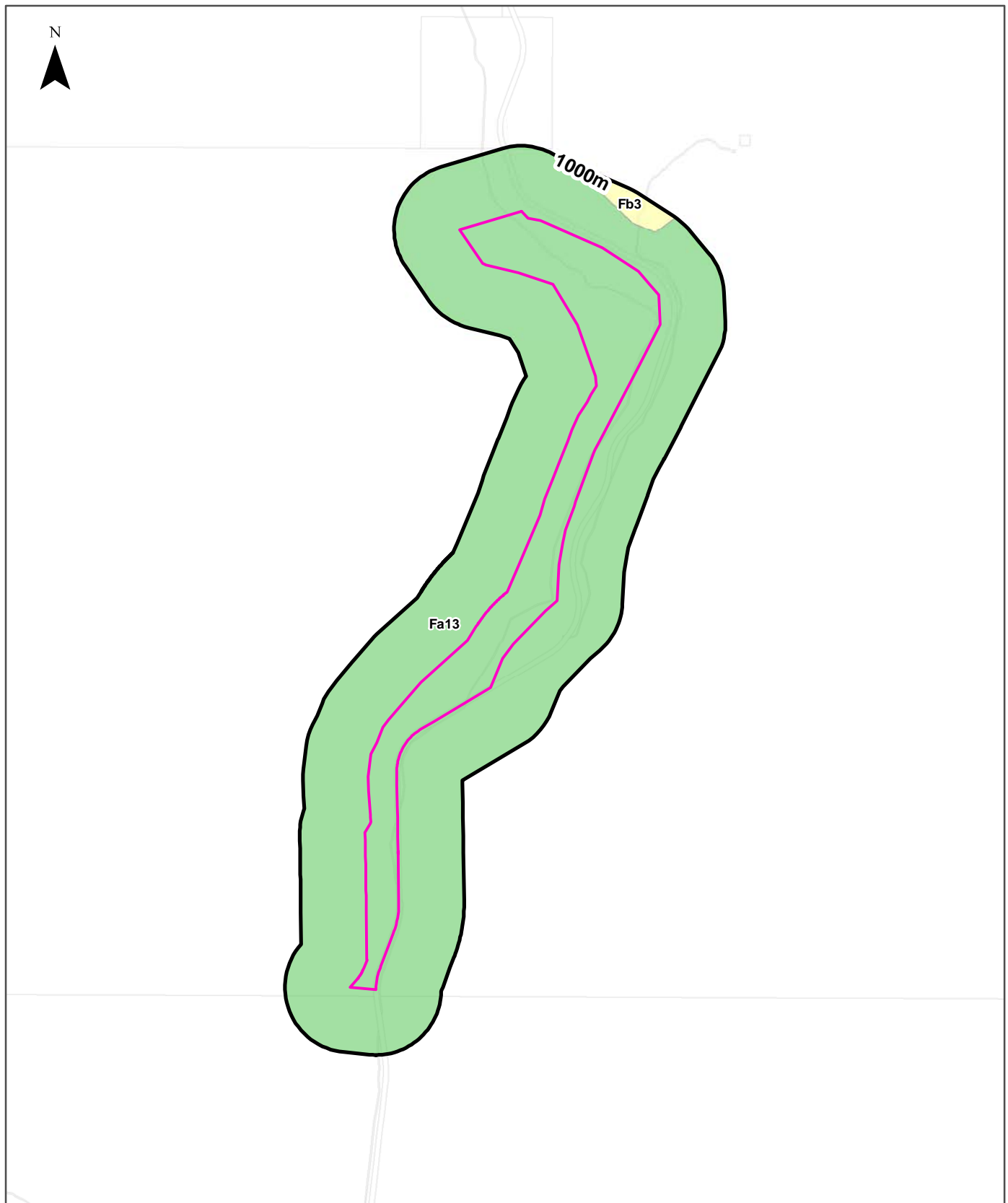
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

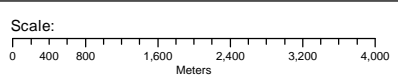
Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
N/A	No features in buffer								

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthroposol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		



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Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

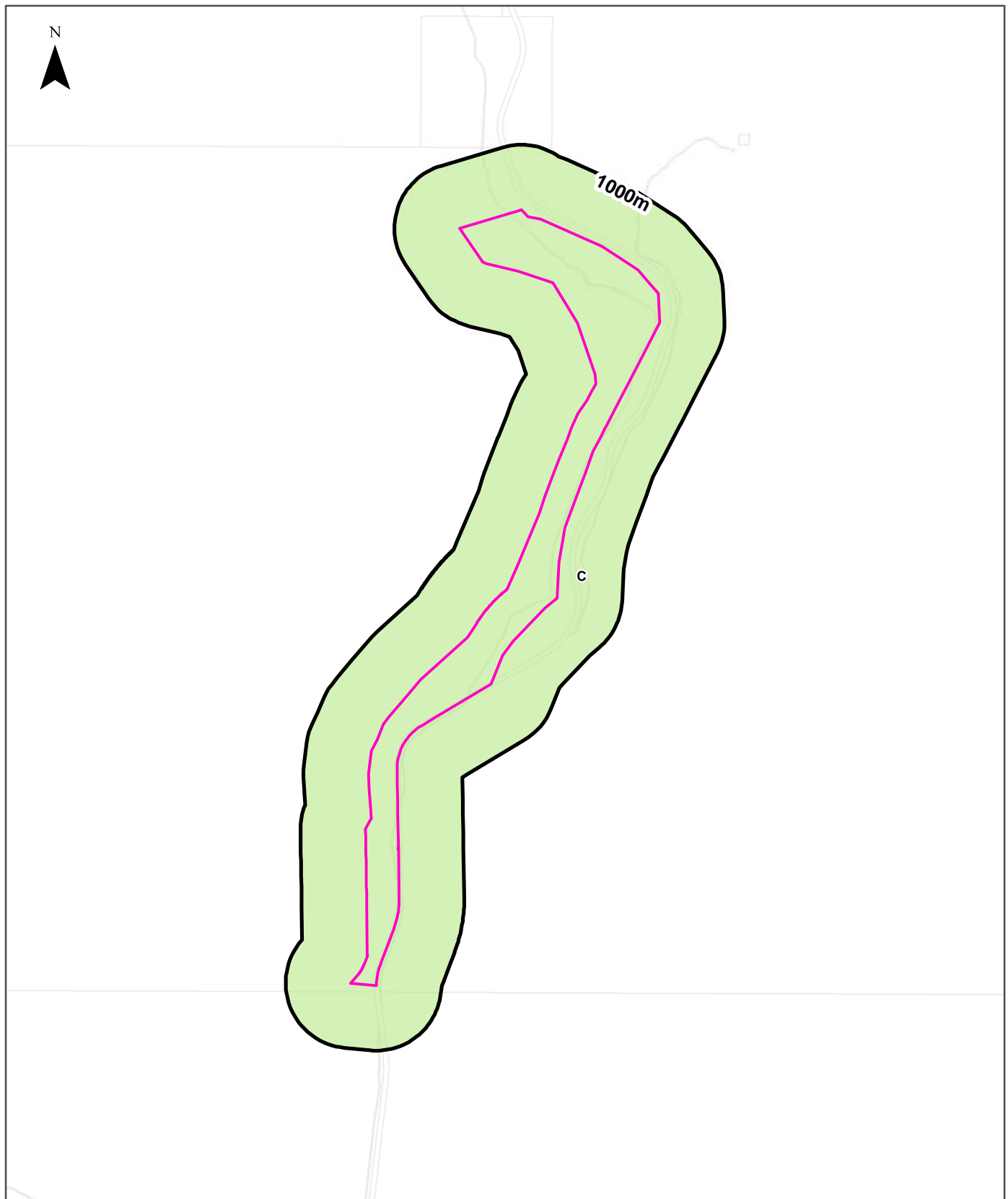
Map Unit Code	Soil Order	Map Unit Description	Distance
Fa13	Tenosol	Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.	0m
Fb3	Kandosol	High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.	571m

Atlas of Australian Soils Data Source: ABARES

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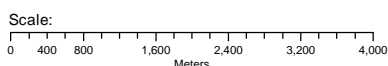
Atlas of Australian Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



Data Sources:
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Coordinate Reference System:
GDA2020 MGA50

Date: 20April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

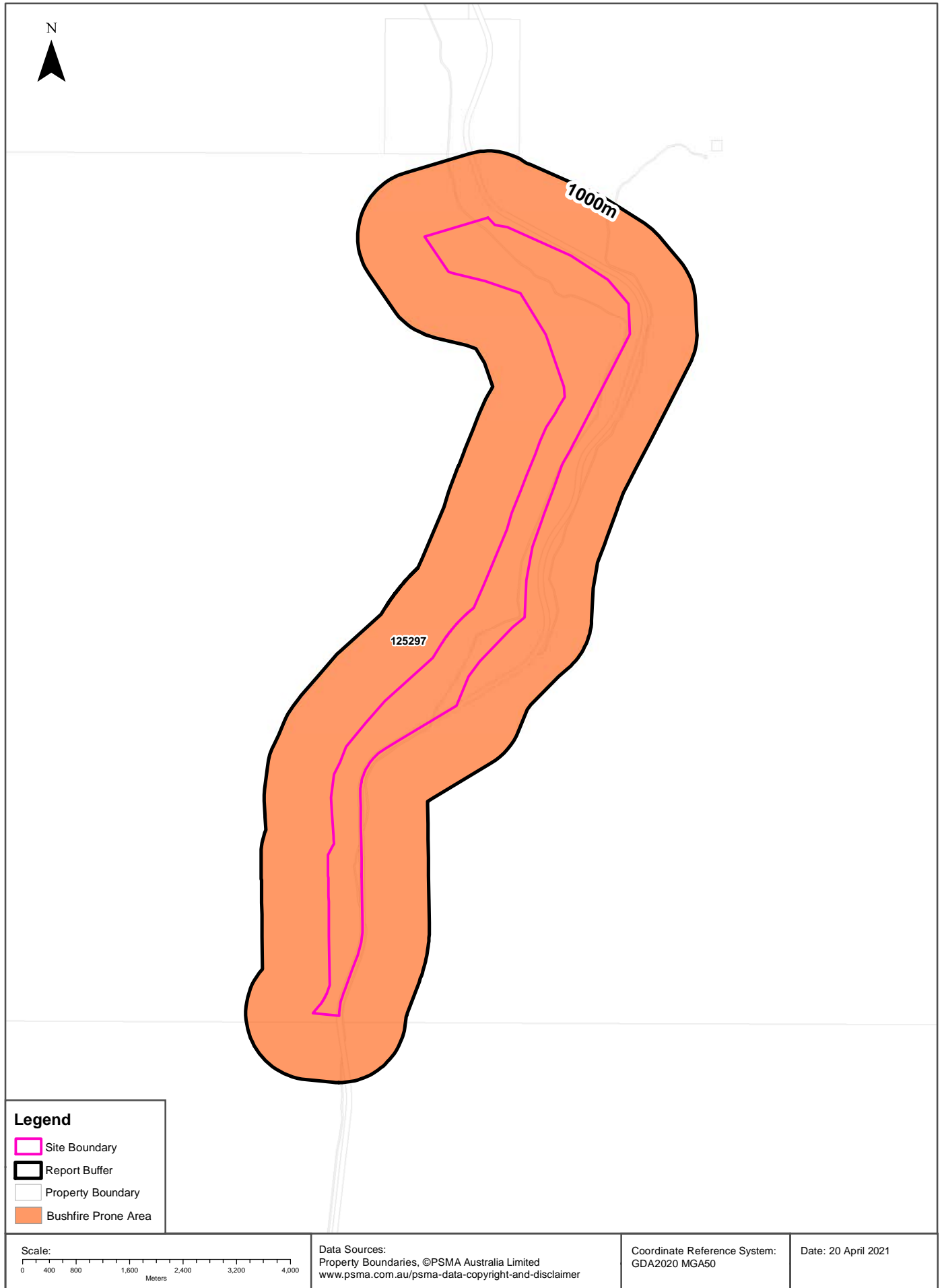
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Bushfire Prone Areas

Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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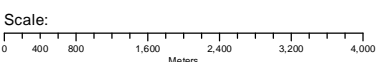
Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Manuwarrah Red Dog Highway Alignment, WA (Part 7)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies



Data Sources:
 Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
283650	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283167	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283817	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
282475	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283388	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283584	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		154m	North East
280756	Terrestrial		Moderate potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		199m	North East
279511	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		210m	North
280938	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		426m	South
284325	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		518m	South

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
278302	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		881m	North

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 7)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Date: 20 Apr 2021 09:35:43

Reference: LS019700 EL

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The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

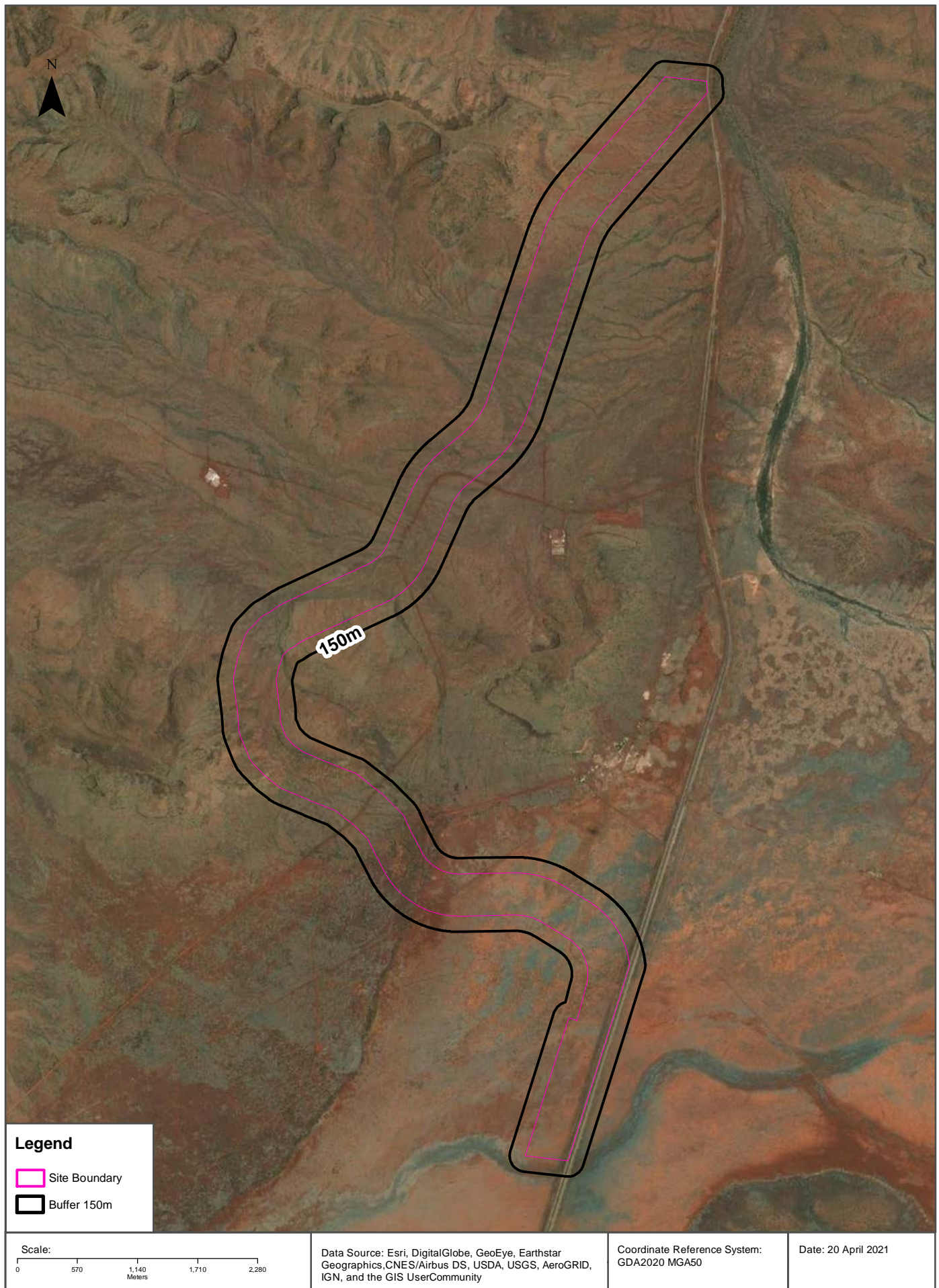
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	2
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	3
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	0	9
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	3	3	3
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	2	2	2
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	4	4	4
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	5	6	7
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2019

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Defence 3 Year Regional Contamination Investigation Program

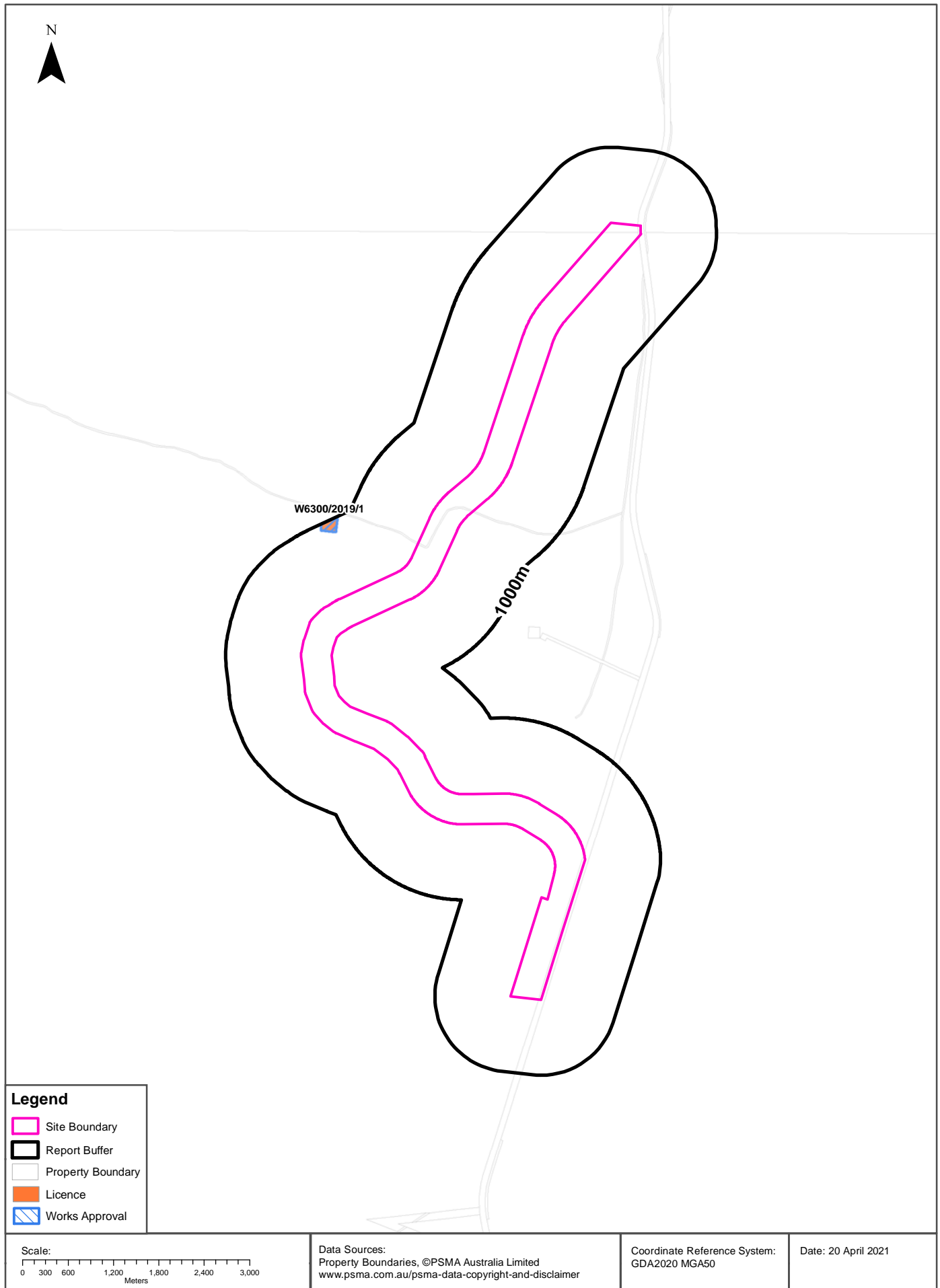
Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

DWER Licences and Works Approvals

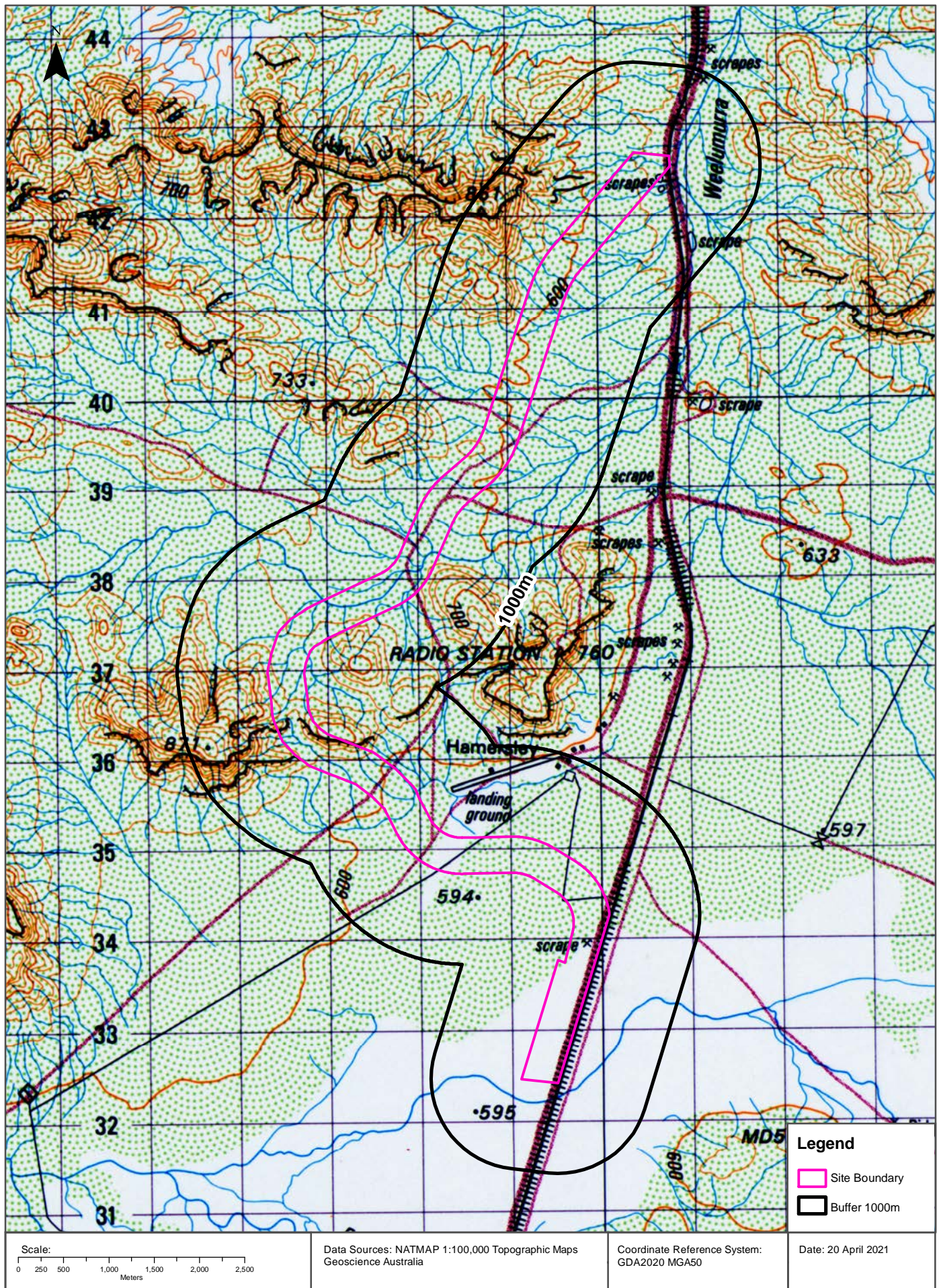
DWER Licences and Works Approvals within the dataset buffer:

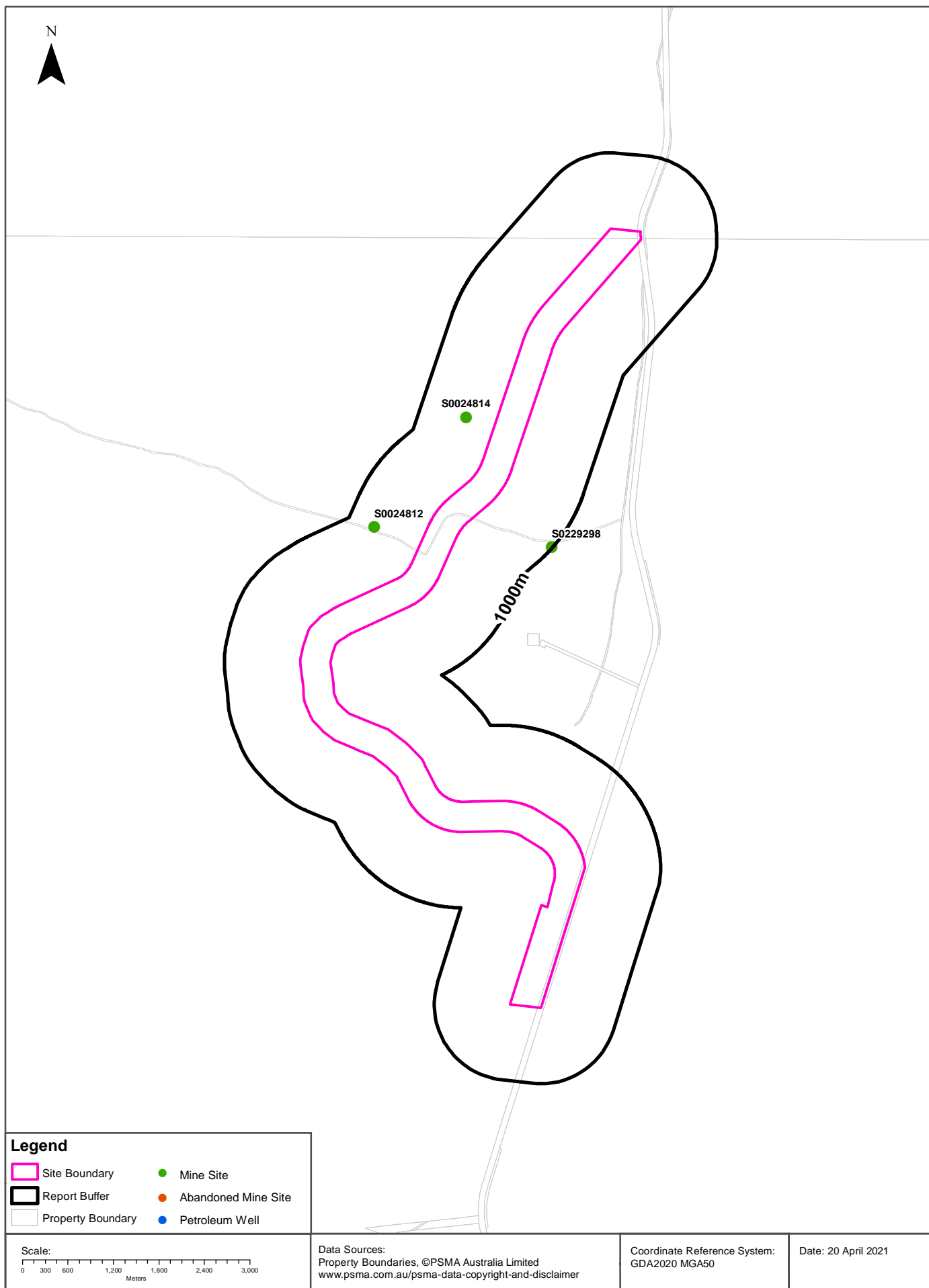
Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
L9265/2020/1	Licence	Fortescue Metals Group Ltd	Eliwana Rail Camp CH50	Part of miscellaneous lease L47/794	Ashburton Shire	2021-04-08	2021-04-08	2024-04-07	54 - Sewage facility	Premise Match	822m	North West
W6300/2019/1	Works approval	Fortescue Metals Group Ltd	Eliwana Rail Camp CH50 Wastewater Treatment Plant	Part of Miscellaneous Licence L47/794 As defined by the coordinates in Schedule 1 of the Works	Ashburton Shire	2020-02-06	2020-02-06	2023-02-05	85 - Sewage facility	Premise Match	822m	North West

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 8)





Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0024814	Mt Sheila SE 3	Occurrence	Drillhole	Undeveloped	IRON ORE	J01646	Solomon - Greater Solomon	392m	North
S0024812	Sheila Valley Southwest CID	Deposit	Unspecified	Undeveloped	IRON ORE	J01646	Solomon - Greater Solomon	643m	North West
S0229298	Weelumurra Camp Borrow Pit	Mine	Borrow Pit	Operating	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	987m	North East

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

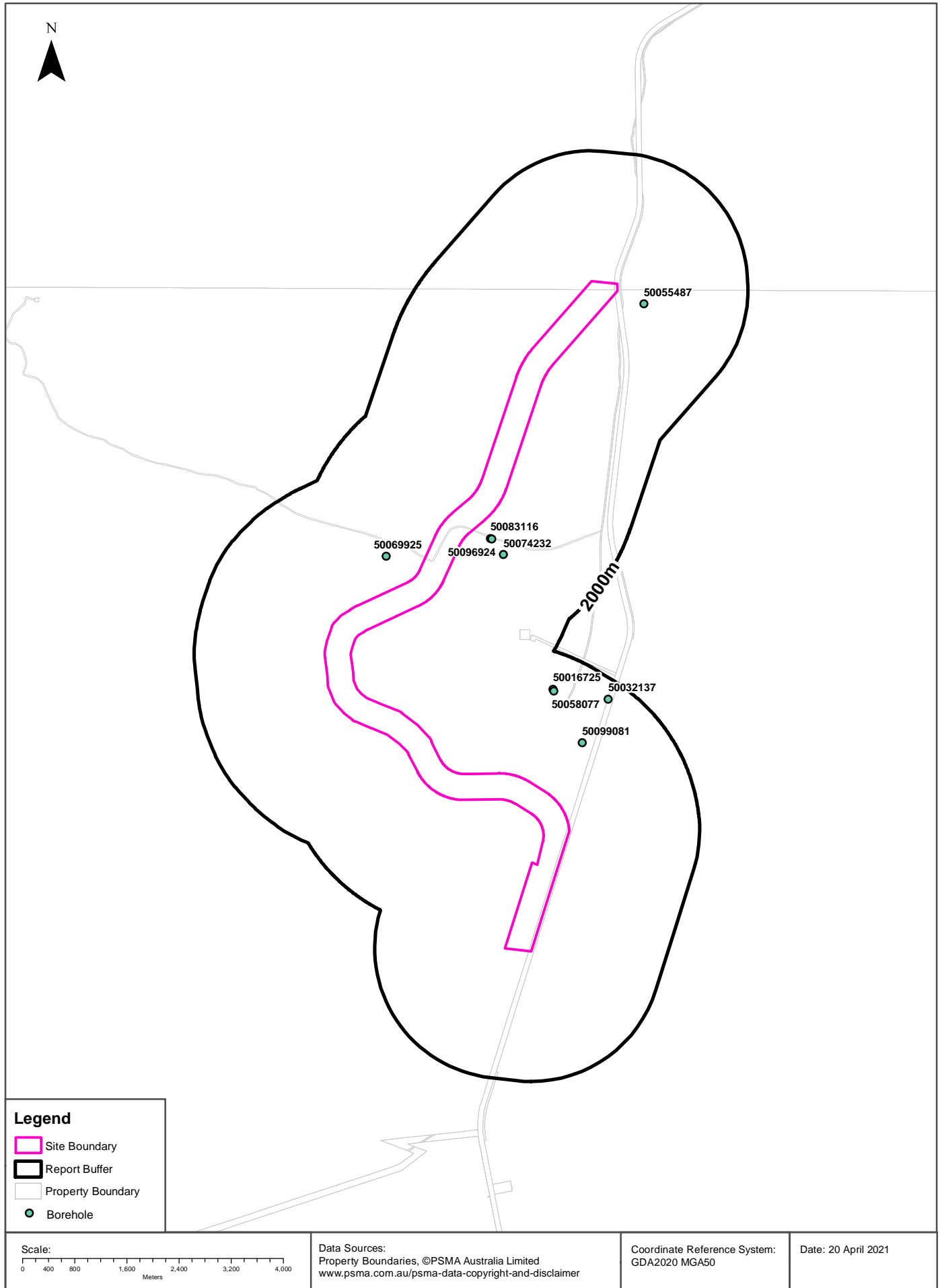
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50083116	70813057	Department of Water and Environmental Regulation	Water supply	Unknown	7/6/2004	84.00	604.58	NGS	278m	North
50096924	70813056	Department of Water and Environmental Regulation	Water supply	Unknown	7/6/2004	74.00	604.58	NGS	298m	North
50055487	70810190	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		578.51	NGS	456m	North East
50069925	70800232	Department of Water and Environmental Regulation	Unknown	Unknown				UNK	499m	North West
50074232	70813060	Department of Water and Environmental Regulation	Exploration or research	Unknown	6/29/2004	40.00	604.84	NGS	597m	North East
50099081	70810176	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		595.05	NGS	939m	South East
50058077	70810172	Department of Water and Environmental Regulation	Domestic household, Household	Unknown	1/1/1900		604.89	NGS	1419m	South East
50016725	70810757	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		605.17	NGS	1439m	South East
50032137	70810175	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		594.88	NGS	1714m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

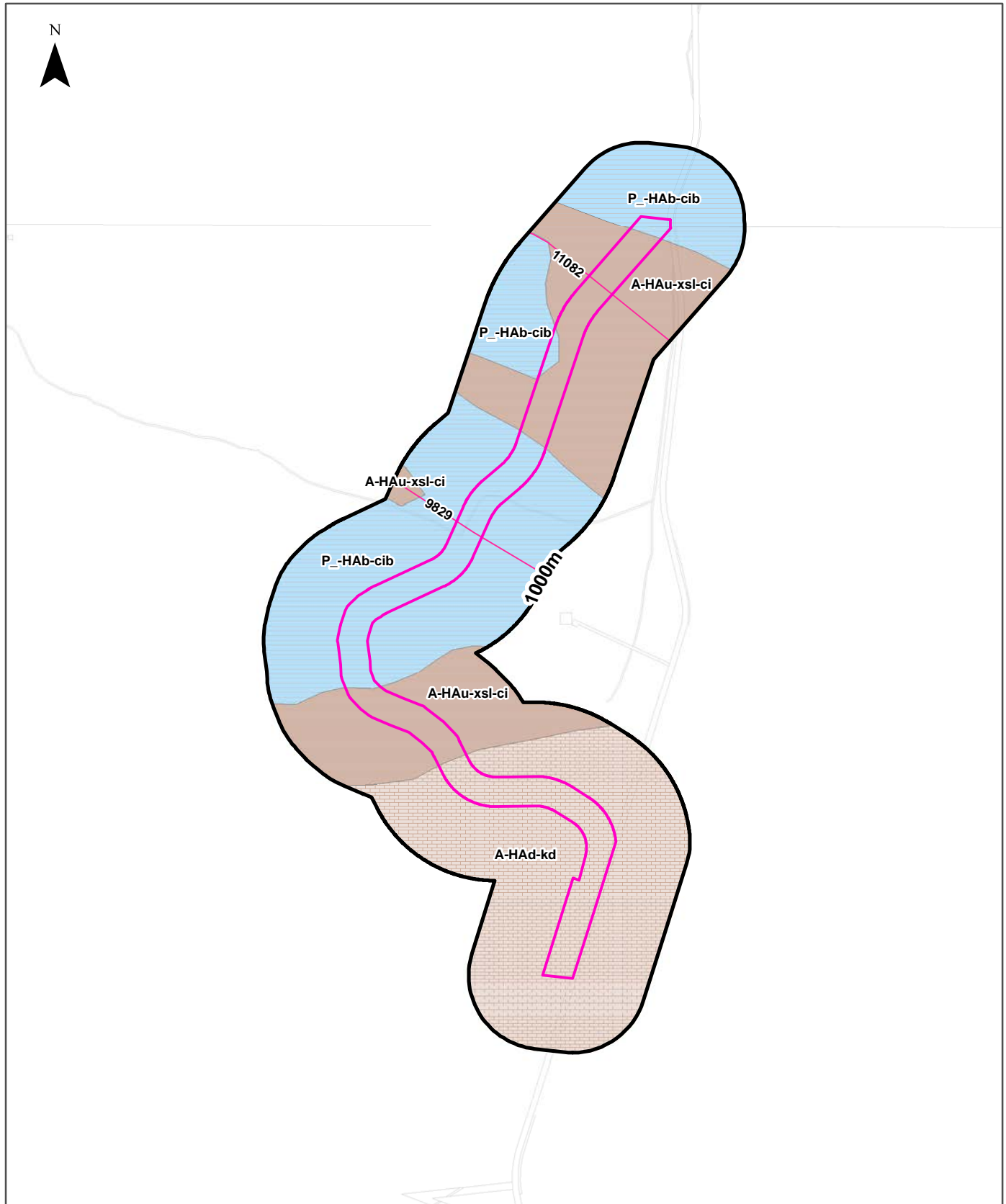
Bore ID	Driller's Log	Distance	Direction
No related drill log data			

Groundwater Boreholes Data Source: Bureau of Meteorology

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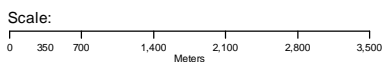
Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



Legend

- | | | | | |
|-------------------|----------------------|----------------------------------|------------------------|-----------------------------|
| Site Boundary | Major fault, exposed | Major strike-slip fault, exposed | Major fault, concealed | Fold axial trace, exposed |
| Report Buffer | Fault, exposed | Strike-slip fault, exposed | Fault, concealed | Fold axial trace, concealed |
| Property Boundary | | | | |



Data Sources:
Property Boundaries, ©PSMA Australia Limited
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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone	Hamersley Group	Hamersley Group, lower	Wittenoom Formation	Neoarchean	Neoarchean	2597	2504	0m
A-HAu-xsl-ci	Mount McRae Shale and Mount Sylvia Formation	Mudstone, siltstone, chert, banded iron-formation, and dolomite; metamorphosed	Hamersley Group	Hamersley Group, lower	Mount McRae Shale and Mount Sylvia Formation	Neoarchean	Neoarchean	2541	2501	0m
P_-HAb-cib	Brockman Iron Formation	Banded iron-formation, chert, mudstone, and siltstone; metamorphosed	Hamersley Group	Hamersley Group, upper	Brockman Iron Formation	Paleoproterozoic	Paleoproterozoic	2494	2451	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

Map Code	Feature	Type	Name	Distance
11082	Fold axial trace	anticline, exposed		0m
9829	Fold axial trace	anticline, exposed		0m

Geology Data Source: WA Department of Mines and Petroleum

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Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

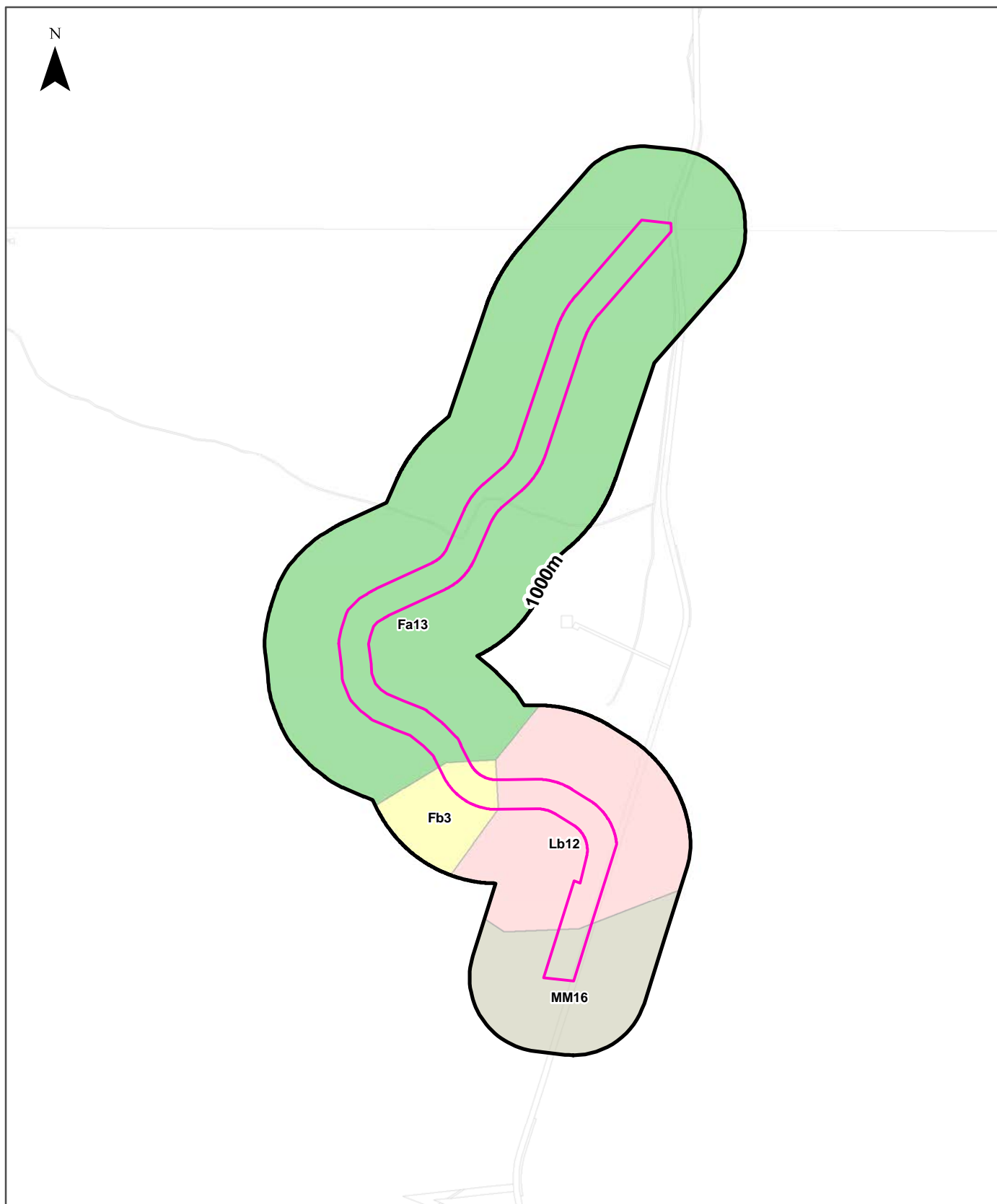
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
N/A	No features in buffer								

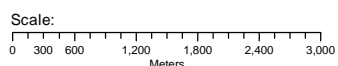
Geology Data Source: WA Department of Mines and Petroleum

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Legend

Site Boundary	Anthrosol	Dermosol	Kandosol	Podosol	Tenosol	No Data
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol	
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake	



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Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

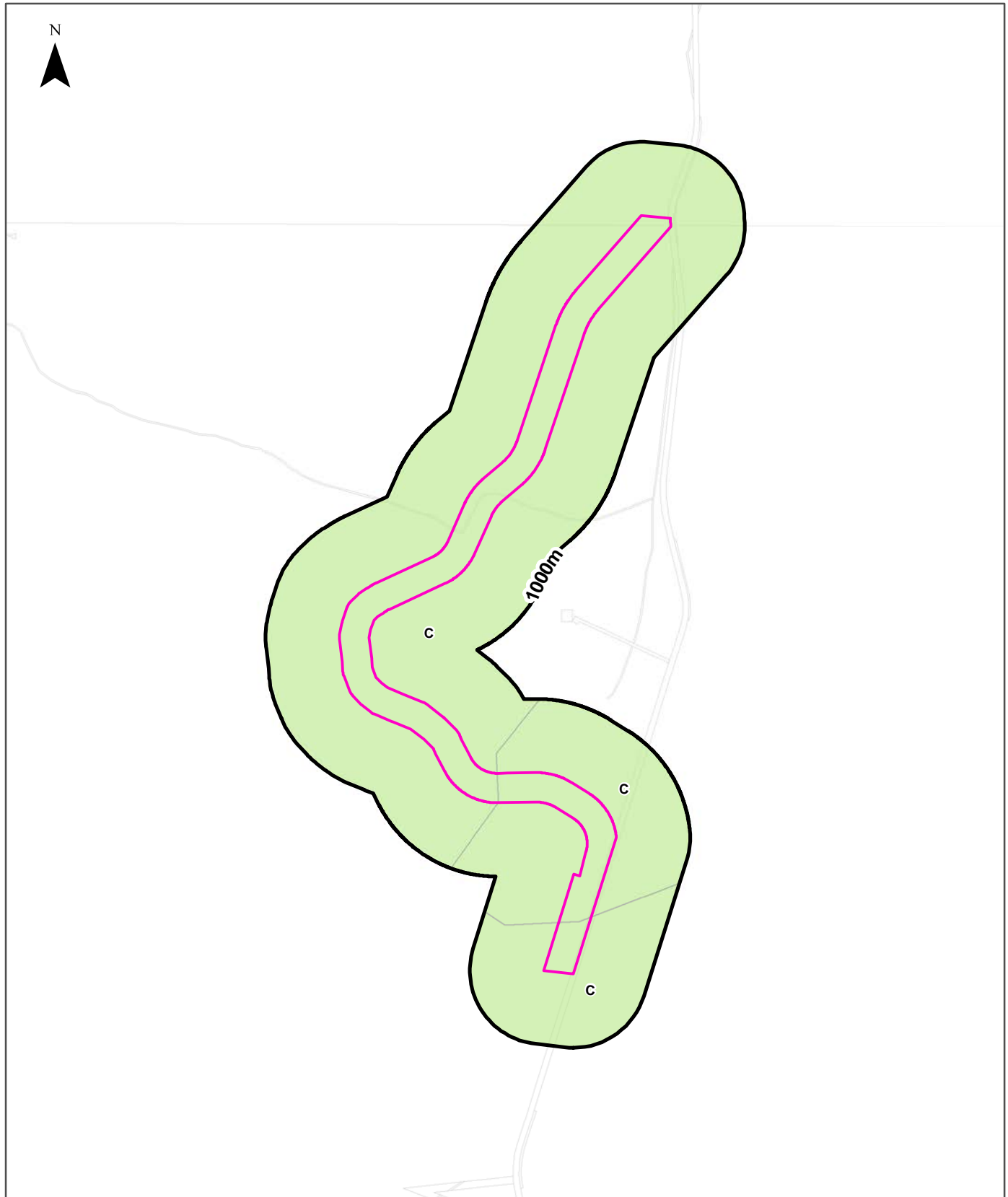
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Fa13	Tenosol	Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.	0m
Fb3	Kandosol	High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.	0m
Lb12	Calcarosol	Valley flats along major drainage lines, associated with limestone and calcareous gravels (kunkar): chief soils are highly calcareous earths (Gc1.12), with minor areas of shallow calcareous loams (Um1.1). Associated are areas of hard red soils (Dr2.33) and some cracking clays (Ug5.37).	0m
MM16	Vertosol	Alluvial plains dominated by deep cracking clays (Ug5.38) along with some areas of (Uf6.71) soils, and minor areas of (Dr2.33) soils.	0m

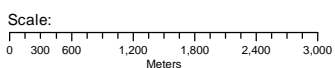
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Date: 20April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

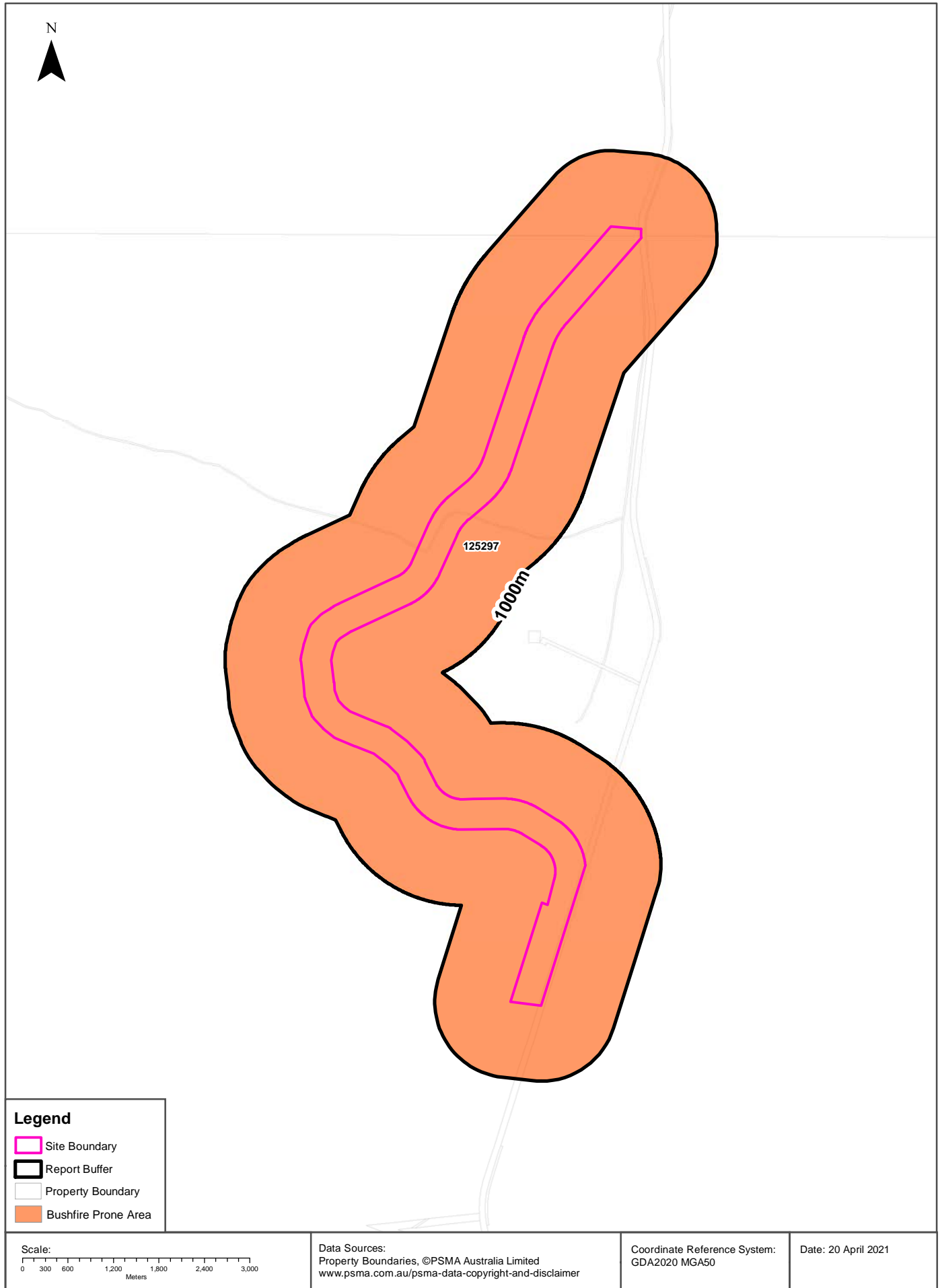
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Bushfire Prone Areas

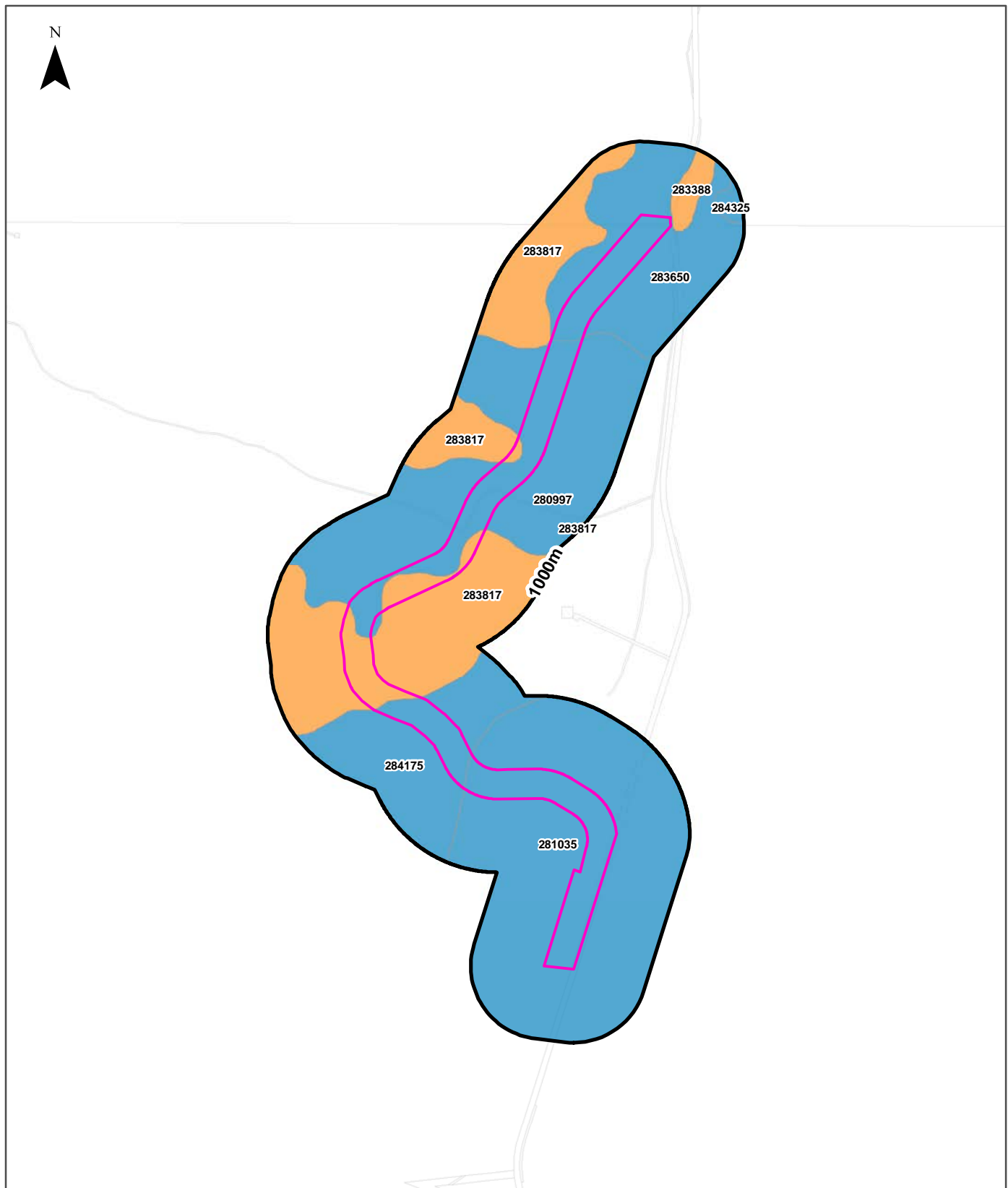
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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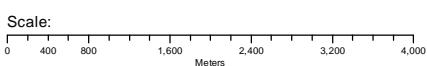
Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Manuwarrah Red Dog Highway Alignment, WA (Part 8)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Moderate potential GDE - from regional studies
	Known GDE - from regional studies	Unclassified potential GDE - from national assessment
	Unclassified potential GDE - from regional studies	



Data Sources:
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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
283650	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
280997	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283817	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
281035	Terrestrial		Low potential GDE - from national assessment	5	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
284175	Terrestrial		Low potential GDE - from national assessment	9	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283388	Terrestrial		Moderate potential GDE - from national assessment	8	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		14m	North
284325	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		627m	North East

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 8)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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LOTSEARCH

LOTSEARCH ENVIRO LITE

Address: Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Date: 20 Apr 2021 10:12:13

Reference: LS019701 EL

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	0	1
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	2	4
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	4	4	4
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	2	2	3
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	3	4	5
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2019

Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

DWER Licences and Works Approvals

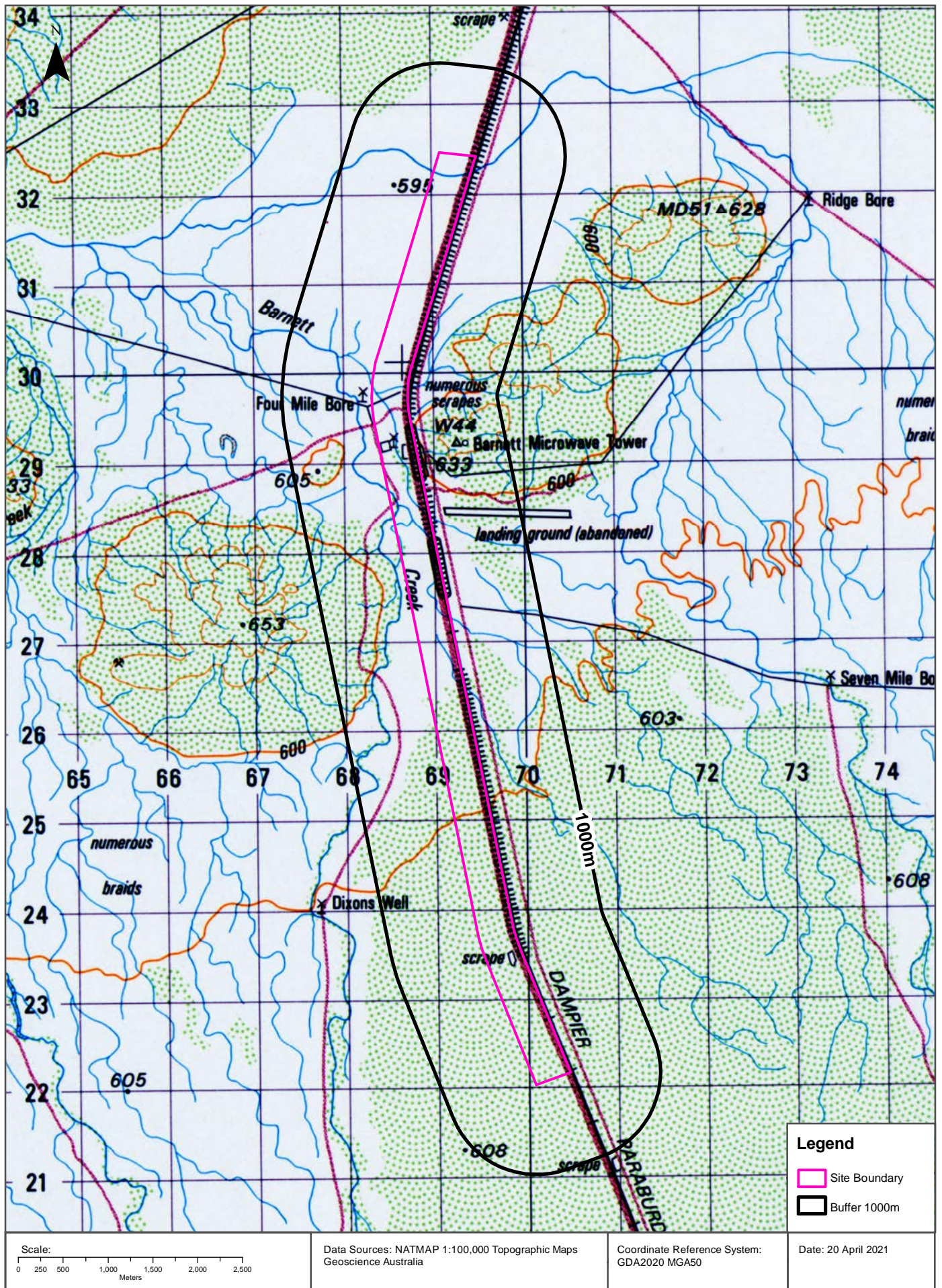
DWER Licences and Works Approvals within the dataset buffer:

Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Legend

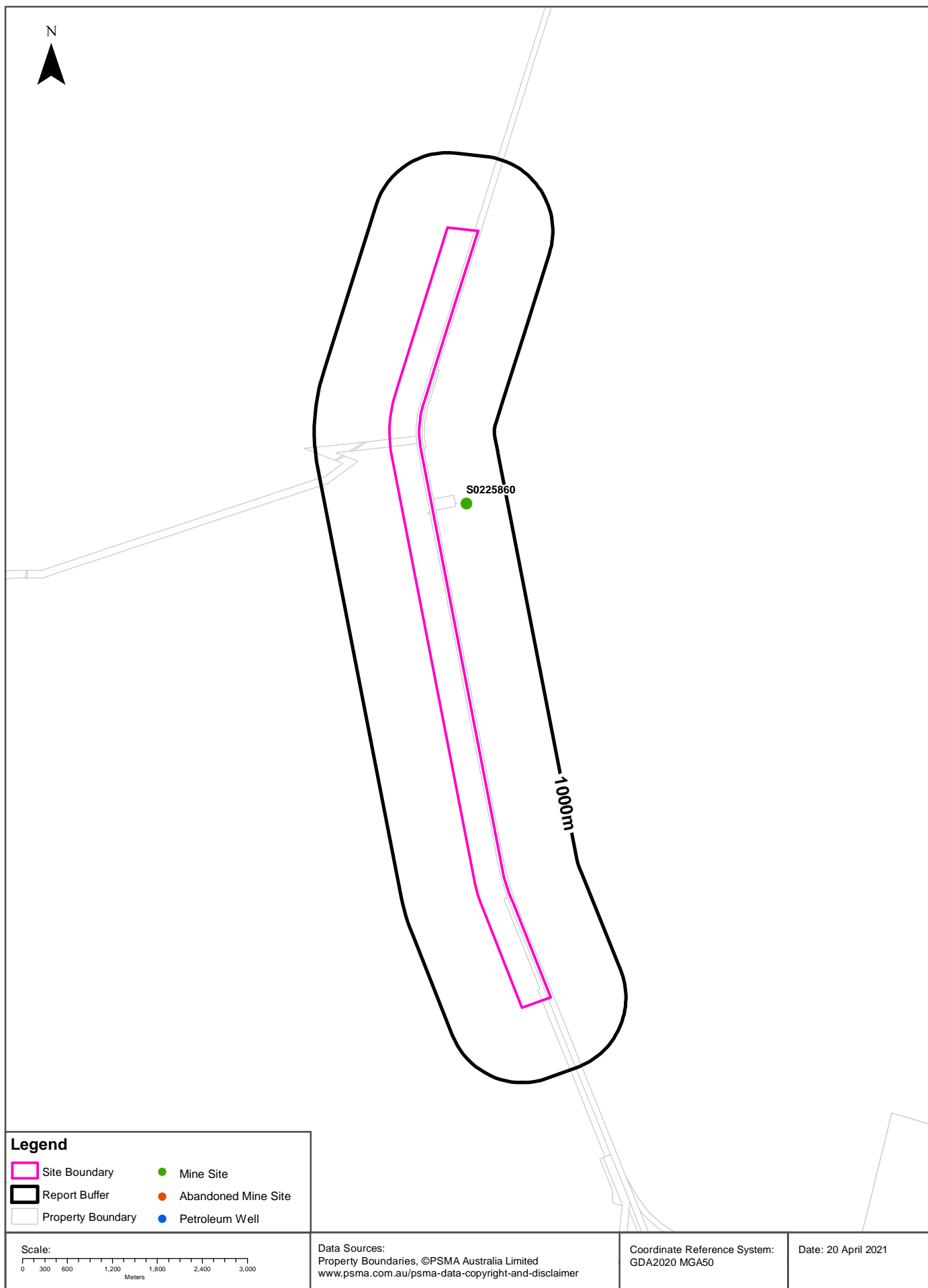
- Site Boundary
- Buffer 1000m

Scale:
 0 250 500 1,000 1,500 2,000 2,500
 Meters

Data Sources: NATMAP 1:100,000 Topographic Maps
 Geoscience Australia

Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021



Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0225860	Mt Barnett Borrow Pit	Mine	Borrow Pit	Proposed	CONSTRUCTION MATERIALS	J03943	Hamersley Iron Rail / Rio Tinto - Robe River	459m	North

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

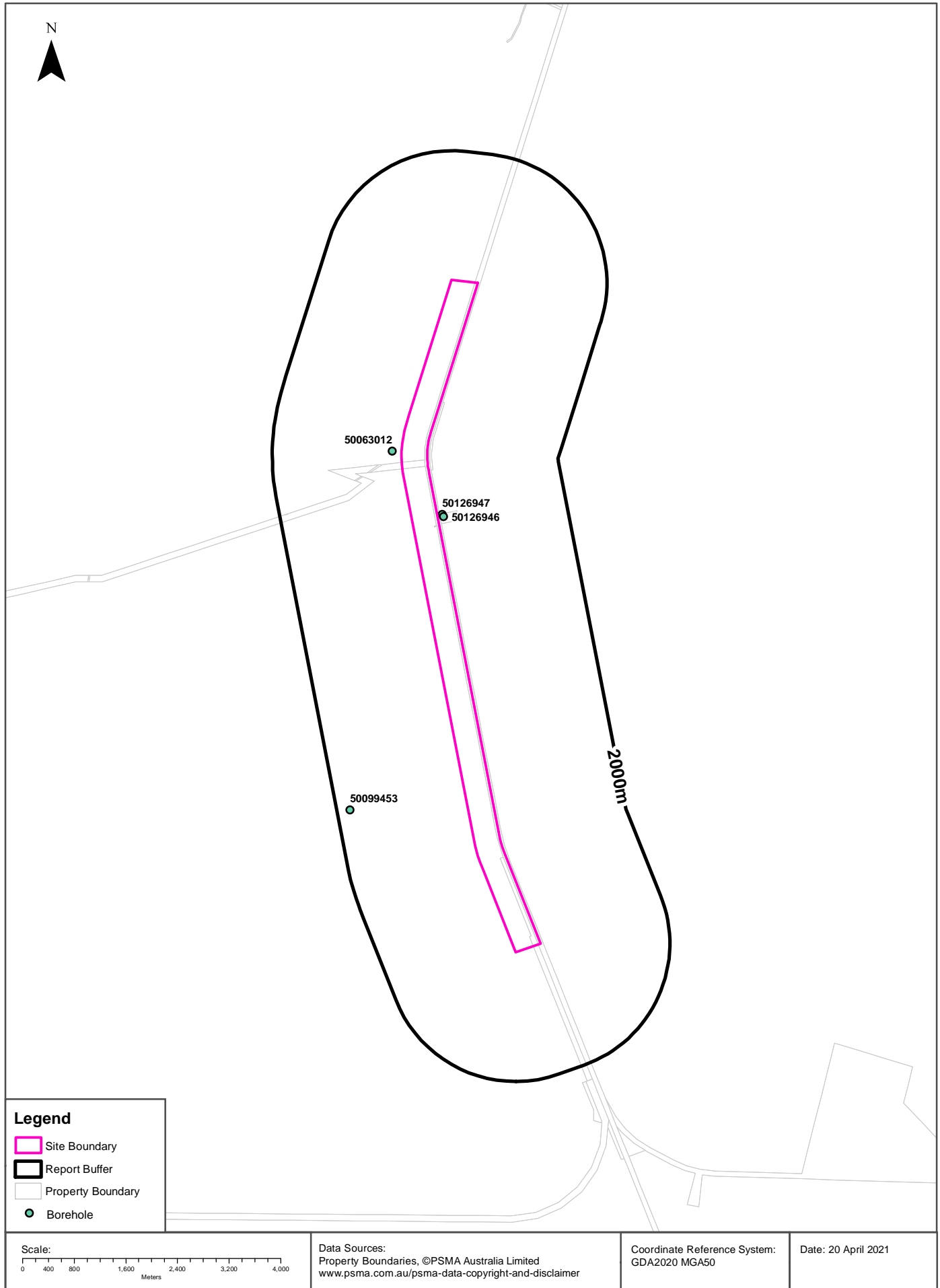
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50126947	23040673	Department of Water and Environmental Regulation	Unknown	Unknown			599.32	NGS	81m	North
50126946	23040671	Department of Water and Environmental Regulation	Unknown	Unknown			598.93	NGS	94m	North
50063012	70610586	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	1/1/1900		596.38	NGS	143m	North
50099453	70610594	Department of Water and Environmental Regulation	Water supply for livestock	Unknown	1/1/1900		604.40	NGS	1792m	South West

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

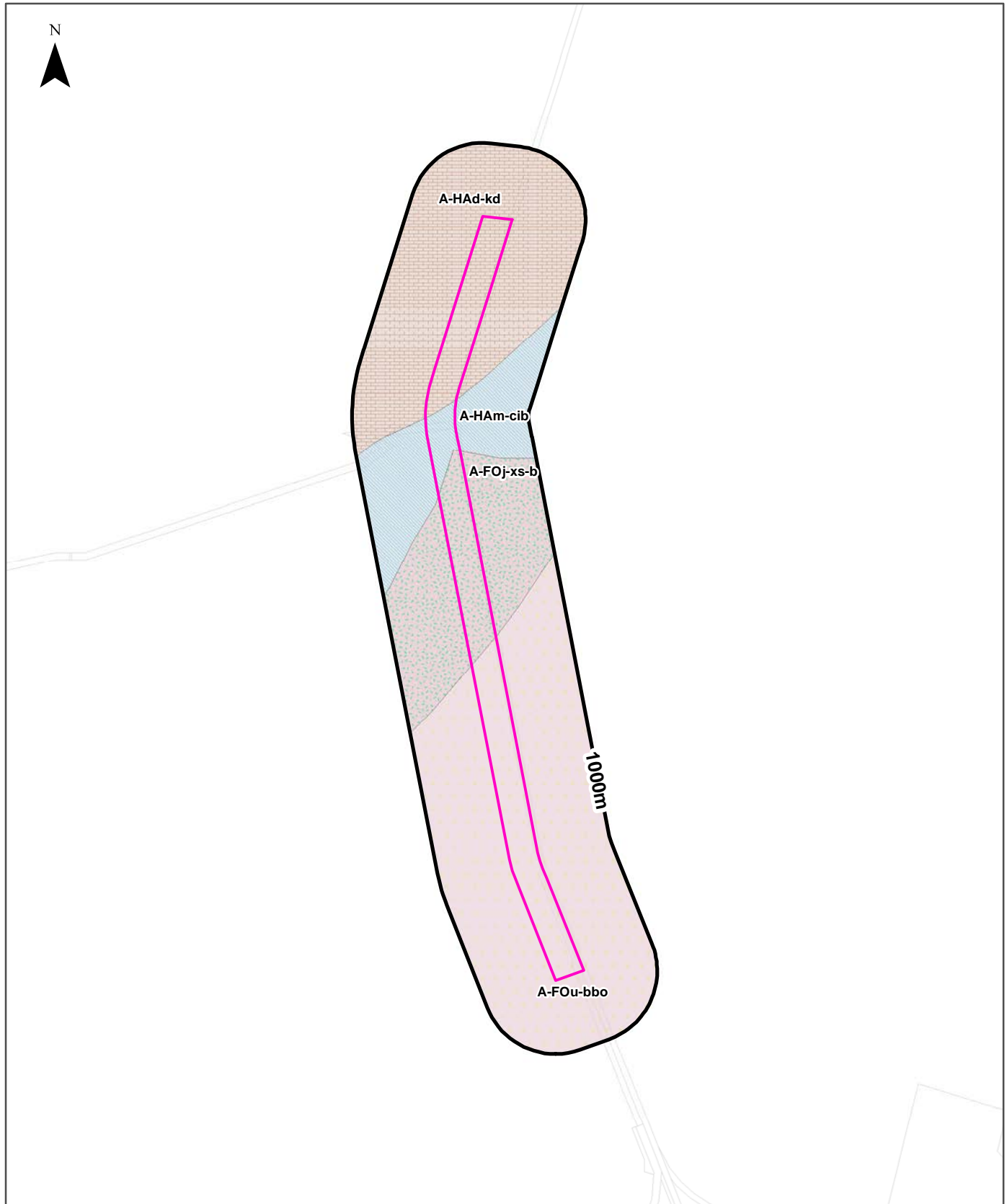
Bore ID	Driller's Log	Distance	Direction
No related drill log data			

Groundwater Boreholes Data Source: Bureau of Meteorology

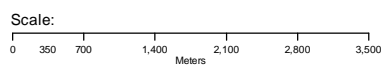
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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Legend		Linear Geological Structures		
Site Boundary	Report Buffer	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed
Property Boundary	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, exposed
				Fold axial trace, concealed



Data Sources:
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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-FOj-xs-b	Jeerinah Formation	Siliciclastic sedimentary rocks, mafic volcanic rocks and minor felsic volcanic rocks; local carbonate rocks, chert, and dolerite sills	Fortescue Group	Fortescue Group, sequence 5	Jeerinah Formation	Neoarchean	Neoarchean	2713	2629	0m
A-FOu-bbo	Bunjina Formation	Pillowed and massive basaltic flows; basaltic breccia and basaltic volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed	Fortescue Group	Fortescue Group, sequence 4	Bunjina Formation	Neoarchean	Neoarchean	2718	2715	0m
A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone	Hammersley Group	Hammersley Group, lower	Wittenoom Formation	Neoarchean	Neoarchean	2597	2504	0m
A-HAM-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	Hammersley Group	Hammersley Group, lower	Marra Mamba Iron Formation	Neoarchean	Neoarchean	2629	2597	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

Map Code	Feature	Type	Name	Distance
N/A	No features in buffer			

Geology Data Source: WA Department of Mines and Petroleum

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Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

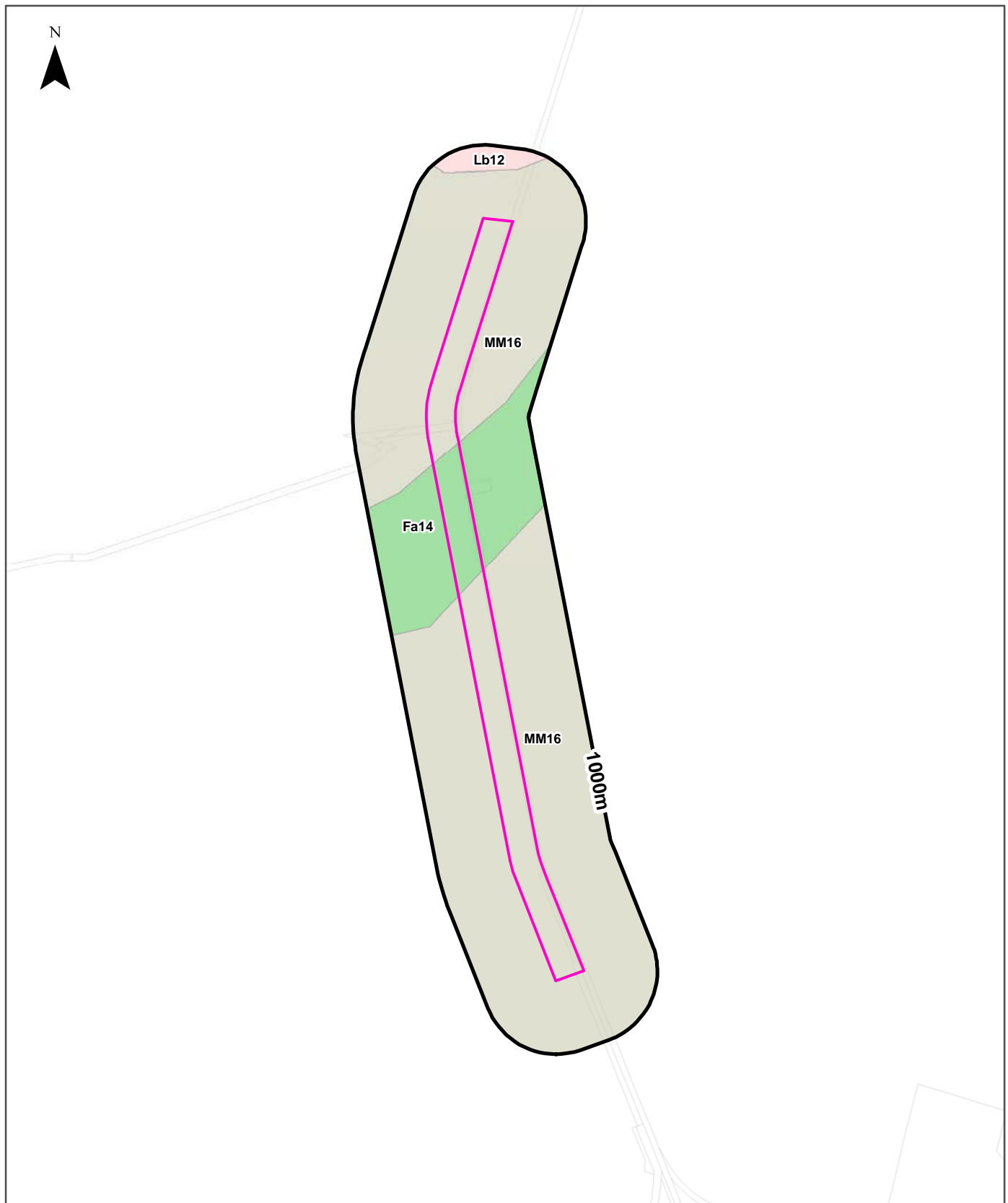
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
N/A	No features in buffer								

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthrosol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		

<p>Scale:</p> <p>0 300 600 1,200 1,800 2,400 3,000 Meters</p>	<p>Data Sources: Property Boundaries, ©PSMA Australia Limited www.pdma.com.au/psma-data-copyright-and-disclaimer</p>	<p>Coordinate Reference System: GDA2020 MGA50</p>	<p>Date: 20 April 2021</p>
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Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

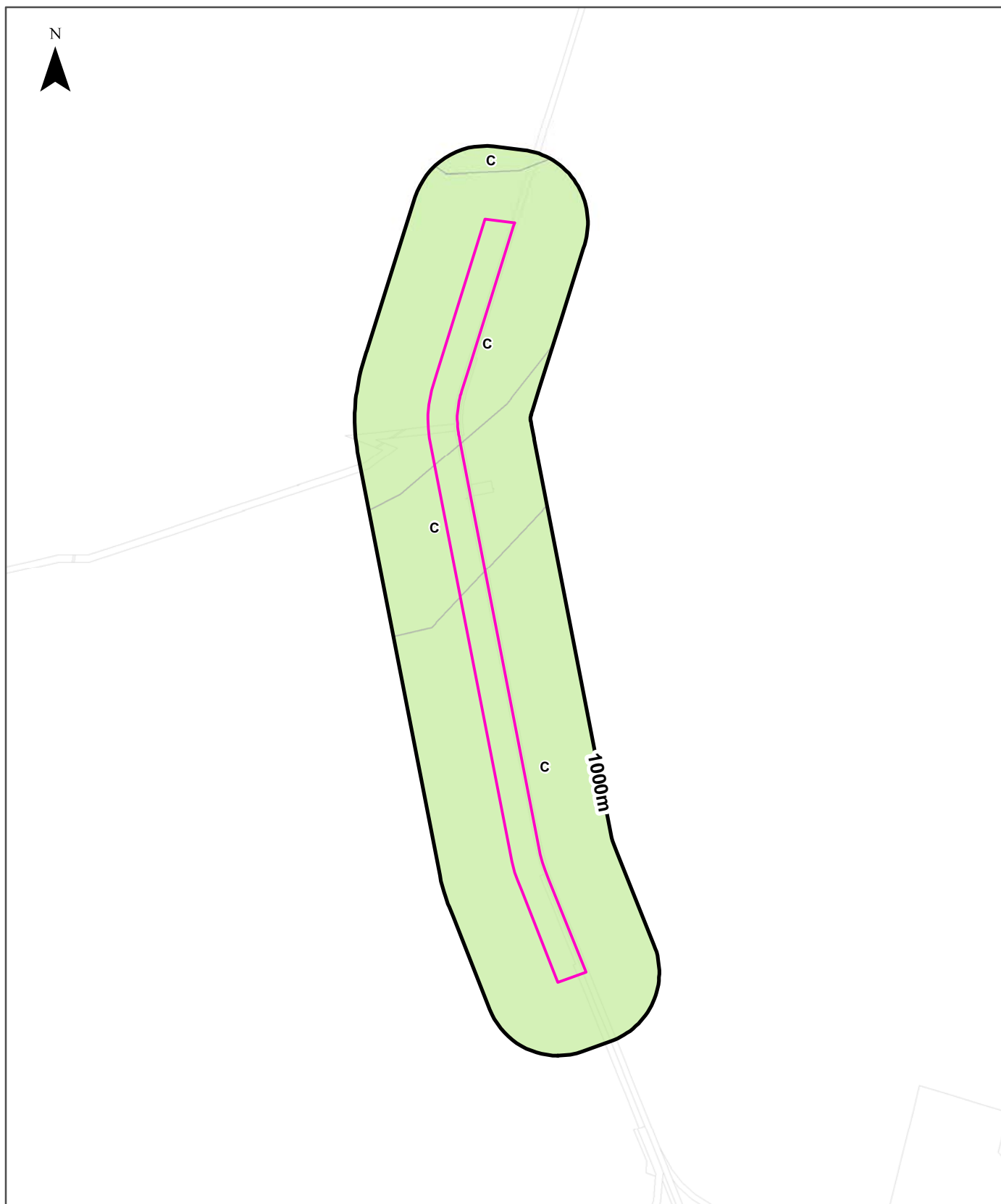
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Fa14	Tenosol	Steep hills and steeply dissected pediments on areas of banded jaspilite and chert along with shales, dolomite, and iron ore formations; some narrow winding valley plains: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. (Dr2.33, Dr2.32) soils which occur on the pediments are more extensive in this unit than in unit Fa13. (Um5.52) and (Uf6.71) soils occur on the valley plains.	0m
MM16	Vertosol	Alluvial plains dominated by deep cracking clays (Ug5.38) along with some areas of (Uf6.71) soils, and minor areas of (Dr2.33) soils.	0m
Lb12	Calcarosol	Valley flats along major drainage lines, associated with limestone and calcareous gravels (kunkar): chief soils are highly calcareous earths (Gc1.12), with minor areas of shallow calcareous loams (Um1.1). Associated are areas of hard red soils (Dr2.33) and some cracking clays (Ug5.37).	639m

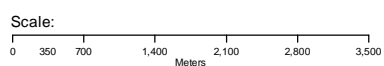
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Date: 20April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

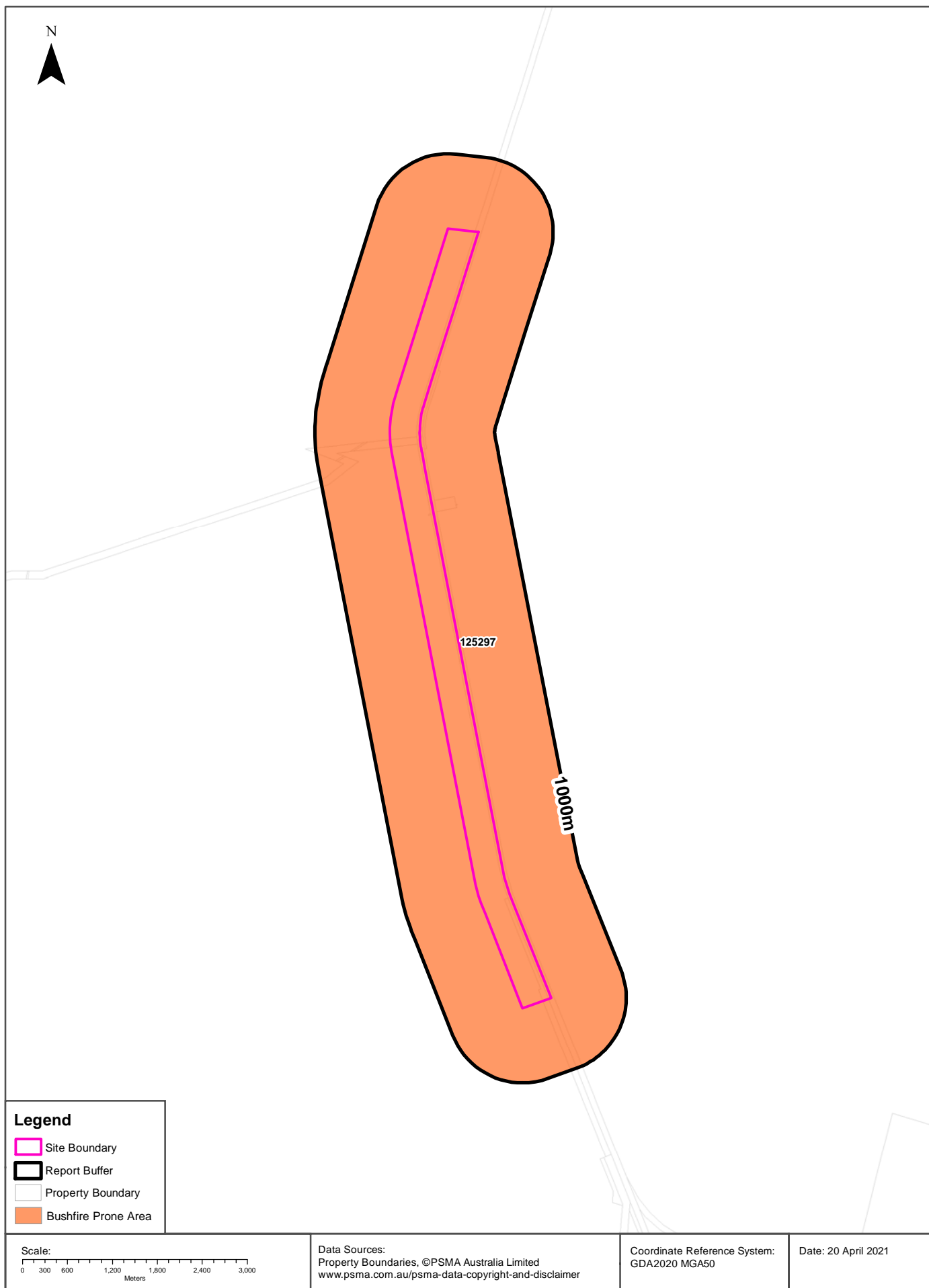
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Bushfire Prone Areas

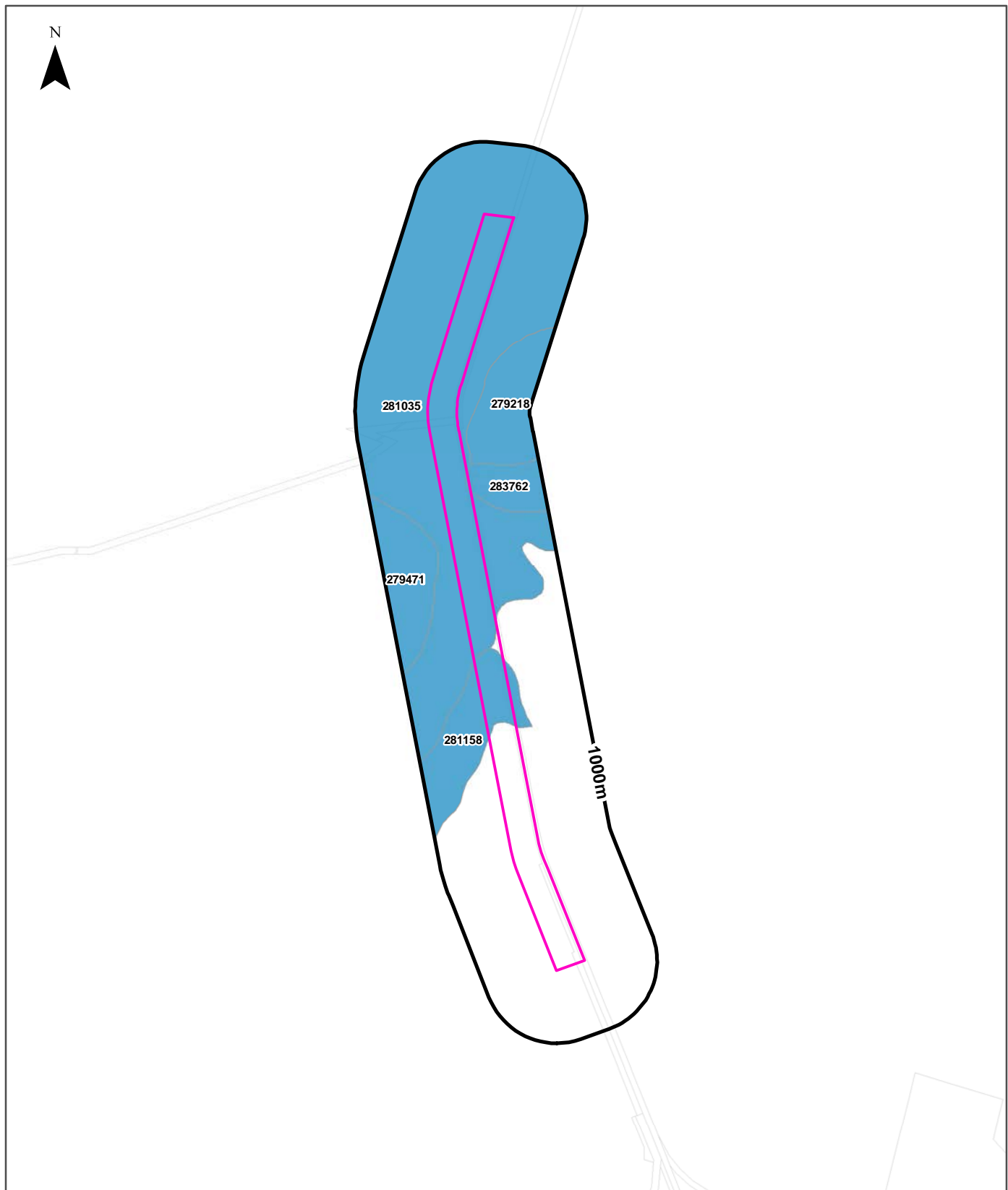
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

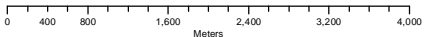
Manuwarrah Red Dog Highway Alignment, WA (Part 9)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
283762	Terrestrial		Low potential GDE - from national assessment	9	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
281158	Terrestrial		Low potential GDE - from national assessment	4	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
281035	Terrestrial		Low potential GDE - from national assessment	5	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
279218	Terrestrial		Low potential GDE - from national assessment	7	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		71m	North East
279471	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		199m	West

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 9)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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Reference: LS019702 EL

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The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

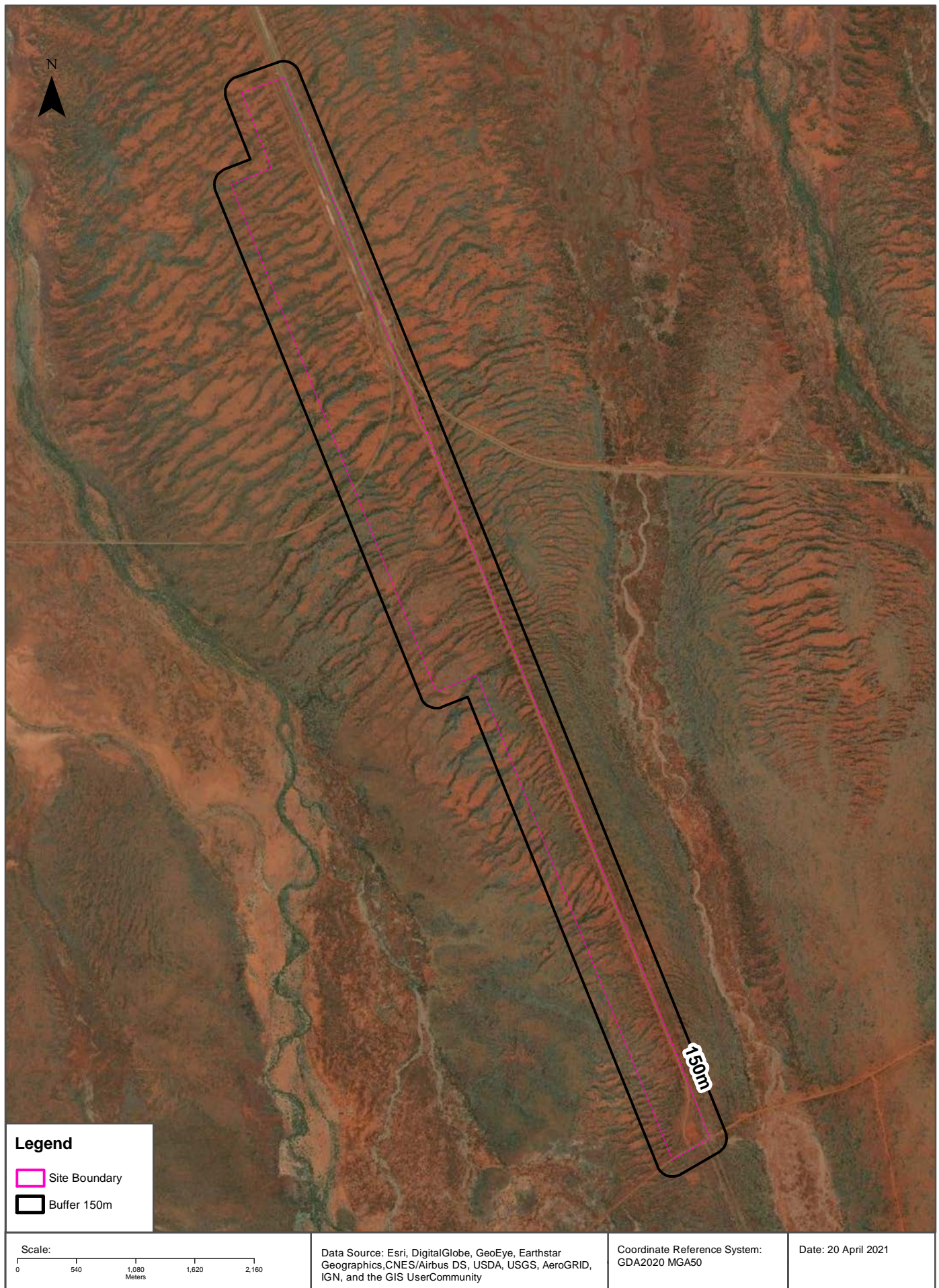
Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Contaminated Sites Database	WA Department of Water and Environmental Regulation	15/04/2021	15/04/2021	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	11/02/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	15/03/2012	Annually	1000	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	30/03/2021	30/03/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	29/03/2021	29/03/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	13/04/2021	13/04/2021	Monthly	2000	0	0	0
Licences and Works Approvals	WA Department of Water and Environmental Regulation	14/04/2021	14/04/2021	Monthly	1000	0	0	0
Mines and Mineral Deposits (MINEDEX)	WA Department of Mines and Petroleum	14/04/2021	14/04/2021	Monthly	1000	0	1	1
Inventory of Abandoned Mine Sites Database	WA Department of Mines and Petroleum	03/12/2020	04/11/2019	Annually	1000	0	0	0
Petroleum Wells	WA Department of Mines and Petroleum	25/03/2021	25/03/2021	Quarterly	1000	0	0	0
National Groundwater Information System (NGIS) Boreholes	Bureau of Meteorology	02/02/2021	02/02/2021	Annually	2000	0	0	4
1:500 000 State Interpreted Bedrock Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	2	2	2
1:500 000 State Linear Structures	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	1	1	1
1:500 000 State Cenozoic Geology	WA Department of Mines and Petroleum	07/11/2017	30/06/2016	As required	1000	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	2	2	2
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	1
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
WA State Heritage Register	WA State Heritage Office	19/04/2021	19/04/2021	Monthly	1000	0	0	0
Bush Fire Prone Areas	WA Department of Fire and Emergency Services	25/11/2019	28/09/2019	Annually	1000	1	1	1
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	1	1	2
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000	0	0	0

Aerial Imagery 2018 - 2020

Manuwarrah Red Dog Highway Alignment, WA (Part 10)



Contaminated Land

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

DWER Contaminated Sites Database

Sites in the DWER Contaminated Sites Database within the dataset buffer:

Site ID	Classification	Lot on Plan / Diagram	Certificate of Title	Database Status	Location Confidence	Distance	Direction
N/A	No records in buffer						

Contaminated Sites Database Data Source: WA Department of Water and Environmental Regulation

Waste Management and Liquid Fuel Facilities

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site ID	Name	Address	Suburb	Owner	Class	Landfill Status	Reproc Status	Transfer Status	Revised Date	Comments	Loc Conf	Dist	Dir'n
N/A	No records in buffer												

Waste Management Facilities Data Source: Geoscience Australia

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National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia

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PFAS Investigation Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

DWER Licences and Works Approvals

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

DWER Licences and Works Approvals

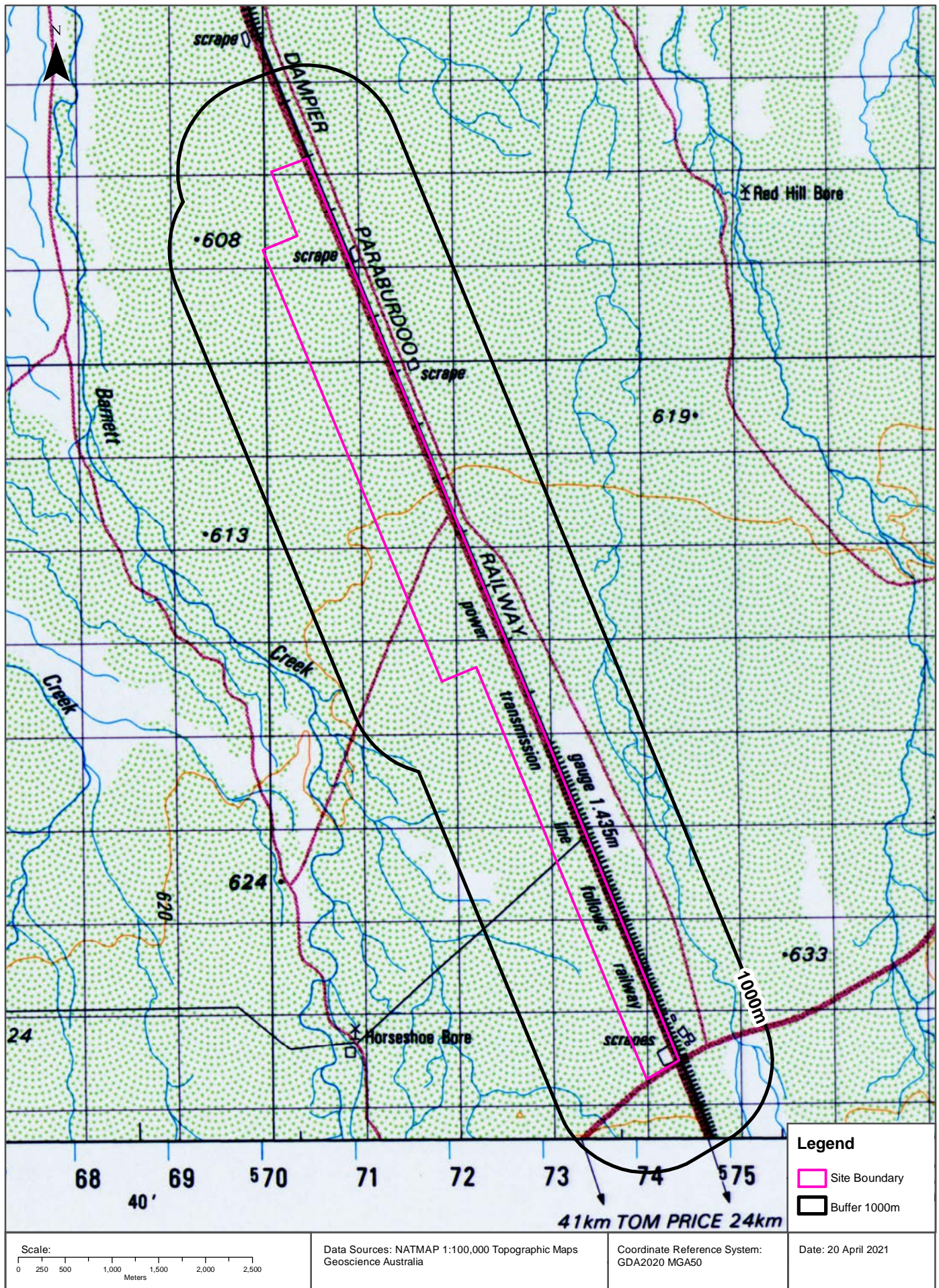
DWER Licences and Works Approvals within the dataset buffer:

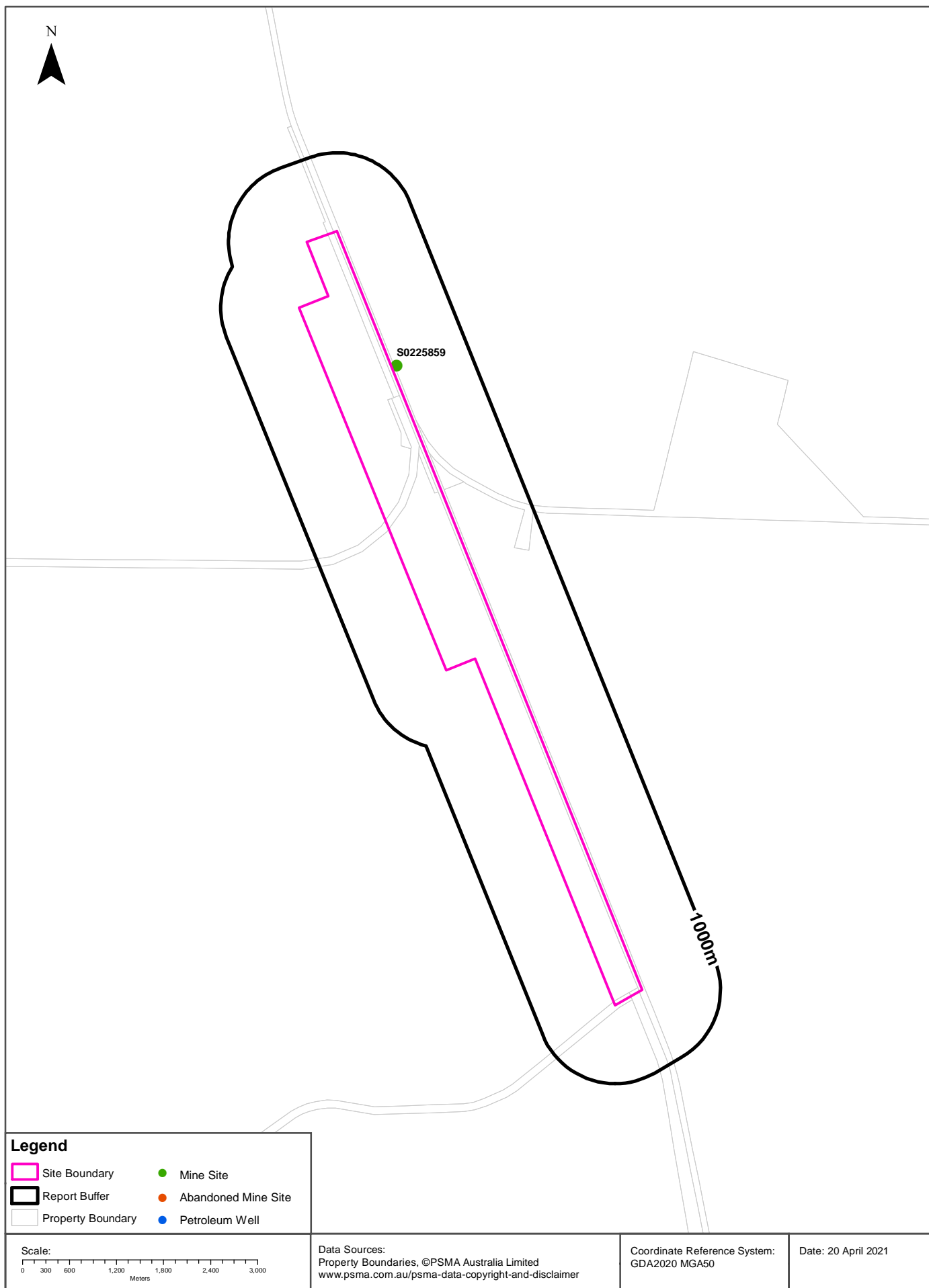
Licence / Works No.	Type	Licence Holder	Premise	Location	LGA	Date Issued	Date Commenced	Date of Expiry	Category	Loc Conf	Dist	Dir'n
N/A	No records in buffer											

Licences and Works Approvals Data Source: WA Department of Water and Environmental Regulation

Historical Map 1987

Manuwarrah Red Dog Highway Alignment, WA (Part 10)





Mining

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Mines

Mine sites within the dataset buffer:

Site Code	Site Title	Site Type	Site Subtype	Site Stage	Target Commodity	Project Code	Project Title	Dist	Dir'n
S0225859	Rosella Passing Station - Hope Downs 4 Railway	Infrastructure	Railway	Proposed	IRON ORE	J00685	Hope Downs Joint Venture	66m	North

Mines Data Source: MINEDEX Database, WA Department of Mines and Petroleum
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Abandoned Mines

Abandoned mine sites within the dataset buffer:

Site Code	Feature Group	Feature Type	Site Type	Site Subtype	Target Commodity	Visibility	Depth	Dump Material	Dump Other	Re-vegetation	Dist	Dir'n
N/A	No records in buffer											

Abandoned Mines Data Source: Inventory of Abandoned Mine Sites Database, WA Department of Mines and Petroleum
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Petroleum Wells

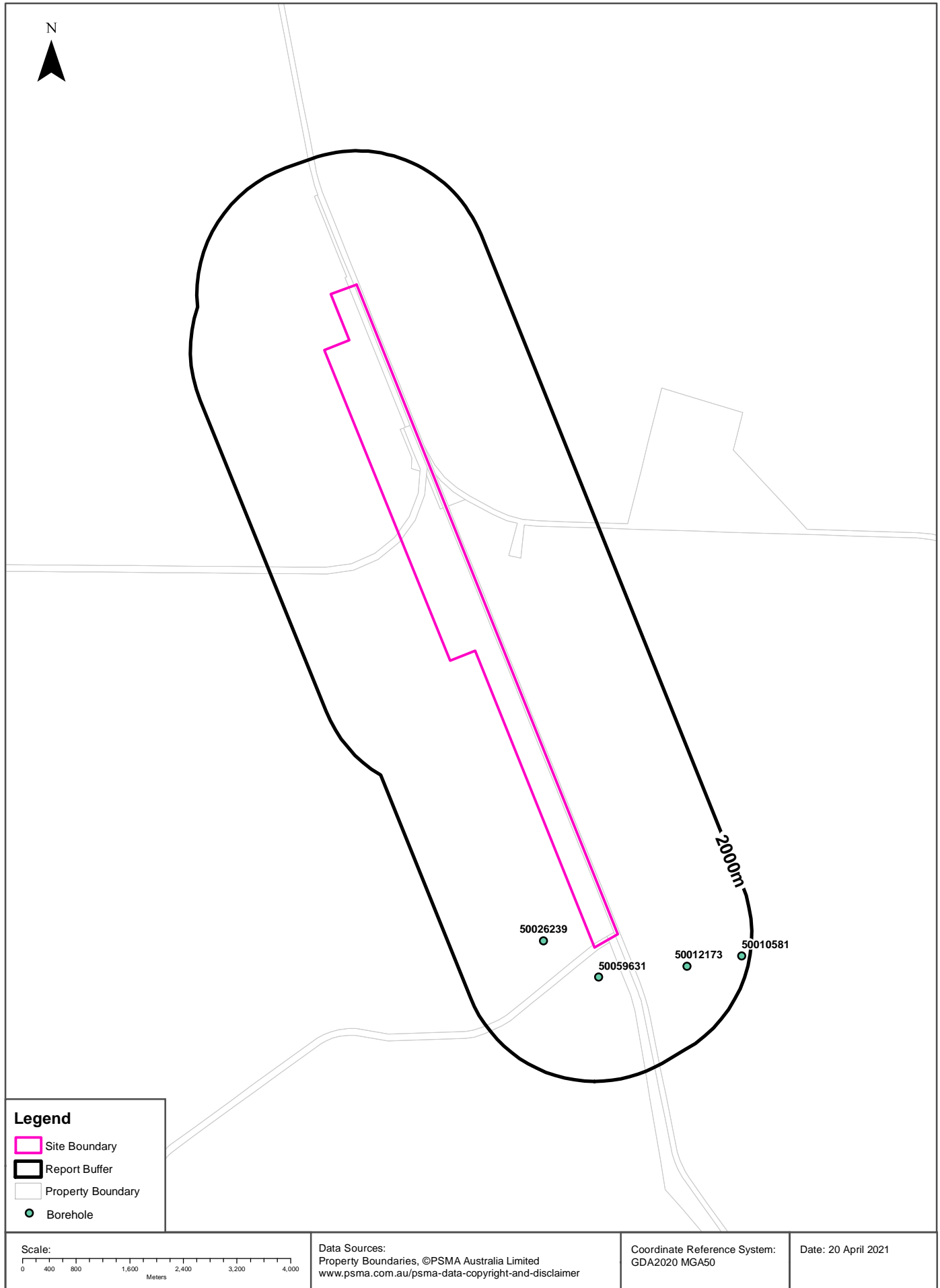
Petroleum wells within the dataset buffer:

Well ID	Well Name	Basin	LeaseNo	Operator	Class	Status	Field	Dist	Dir'n
N/A	No records in buffer								

Petroleum Wells Data Source: WAPPIPE Database, WA Department of Mines and Petroleum
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Groundwater Boreholes

Manuwarrah Red Dog Highway Alignment, WA (Part 10)



Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Groundwater Boreholes

Groundwater Boreholes within the dataset buffer:

NGIS Bore ID	WA Bore ID	Agency Responsible	Bore Type	Status	Drill Date	Bore Depth (m)	Reference Elevation	Reference Elevation Description	Distance	Direction
50059631	70610601	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		645.48	NGS	451m	South
50026239	70610600	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		640.97	NGS	670m	South
50012173	70610599	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		640.92	NGS	1145m	South East
50010581	70610602	Department of Water and Environmental Regulation	Unknown	Unknown	1/1/1900		644.05	NGS	1881m	South East

Groundwater Boreholes Data Source: Bureau of Meteorology

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Groundwater

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

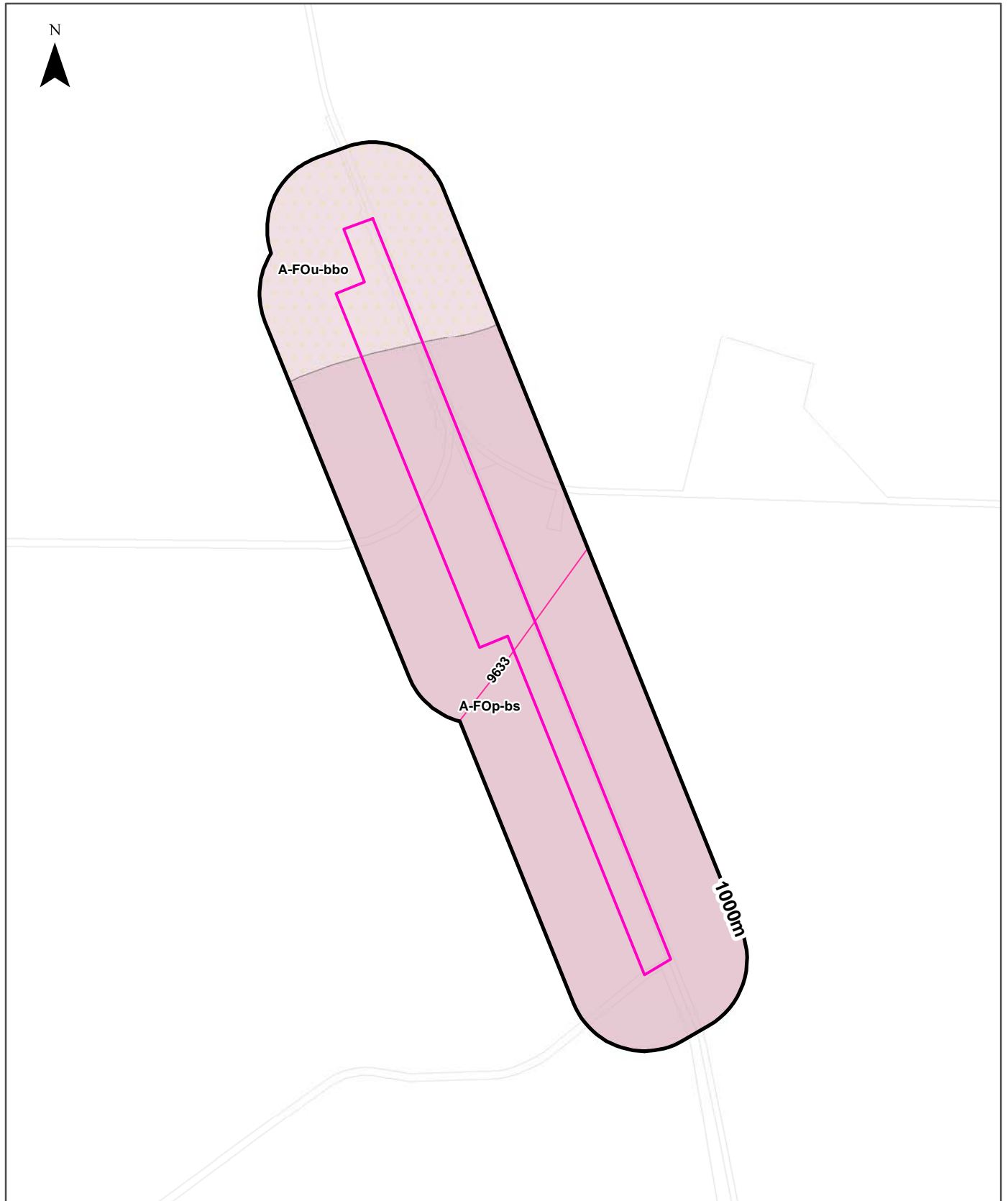
Bore ID	Driller's Log	Distance	Direction
No related drill log data			

Groundwater Boreholes Data Source: Bureau of Meteorology

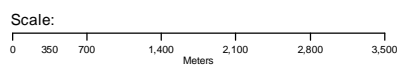
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Pre-Cenozoic Geology and Structures 1:500,000

Manuwarrah Red Dog Highway Alignment, WA (Part 10)



Legend		Linear Geological Structures		
Site Boundary	Major fault, exposed	Major strike-slip fault, exposed	Major fault, concealed	Fold axial trace, exposed
Report Buffer	Fault, exposed	Strike-slip fault, exposed	Fault, concealed	Fold axial trace, concealed
Property Boundary				



Data Sources:
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Coordinate Reference System:
 GDA2020 MGA50

Date: 20 April 2021

Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Pre-Cenozoic (Bedrock) Geology 1:500,000

Pre-Cenozoic (Bedrock) Geology Units within the dataset buffer:

Map Unit Code	Name	Description	Group	Subgroup	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
A-FOp-bs	Pyradie Formation	Pyroxene spinifex-textured basaltic flows and pillow lava with mafic volcanoclastic rock; minor chert and local komatiite; metamorphosed	Fortescue Group	Fortescue Group, sequence 4	Pyradie Formation	Neoarchean	Neoarchean	2730	2718	0m
A-FOu-bbo	Bunjina Formation	Pillowed and massive basaltic flows; basaltic breccia and basaltic volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed	Fortescue Group	Fortescue Group, sequence 4	Bunjina Formation	Neoarchean	Neoarchean	2718	2715	0m

Geology Data Source: WA Department of Mines and Petroleum

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Linear Structures 1:500,000

Linear geological structures within the dataset buffer:

Map Code	Feature	Type	Name	Distance
9633	Fold axial trace	anticline, exposed		0m

Geology Data Source: WA Department of Mines and Petroleum

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Geology

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

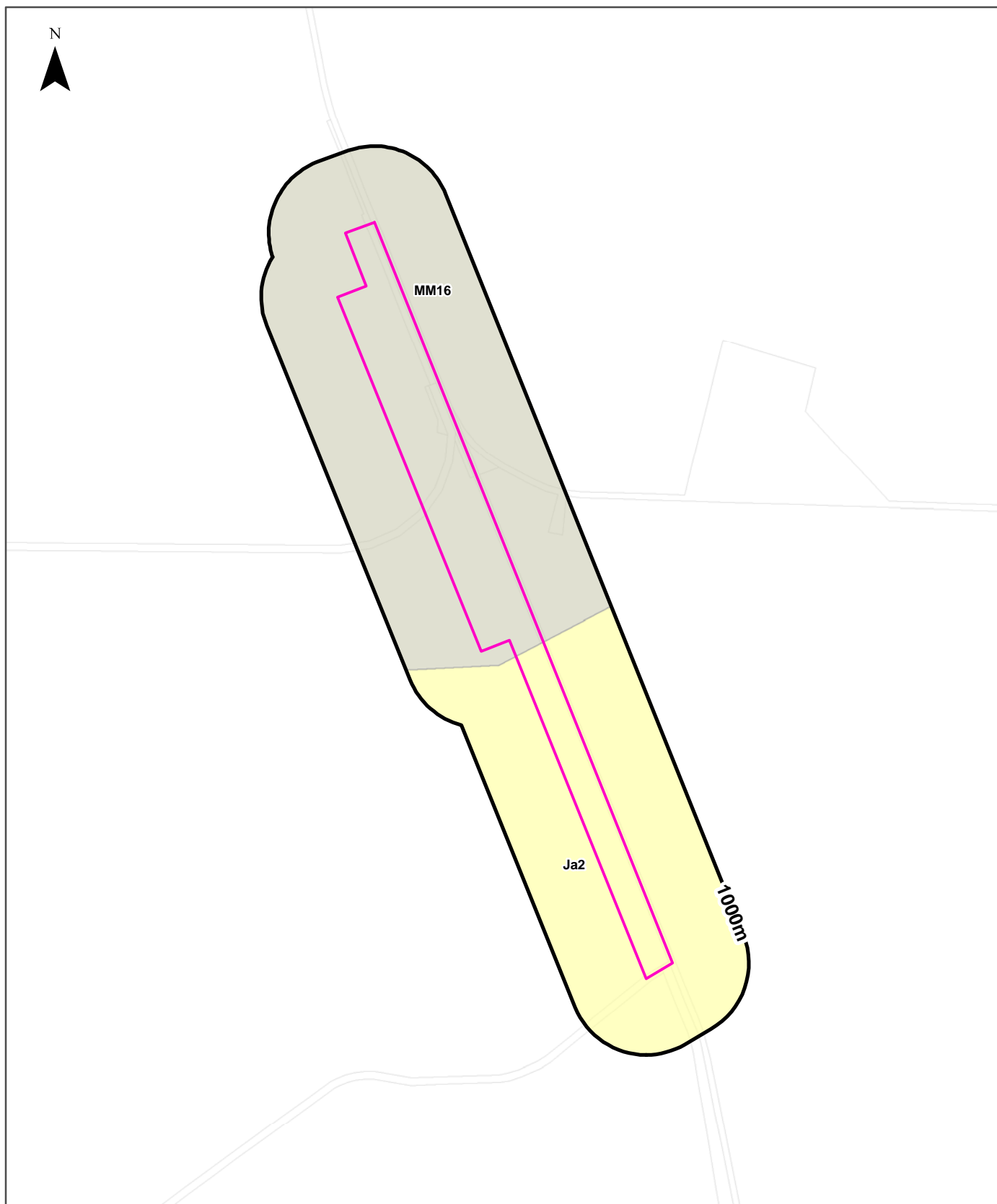
Cenozoic Geology 1:500,000

Cenozoic Geology Units within the dataset buffer:

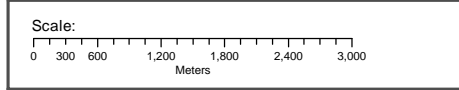
Map Unit Code	Name	Description	Group	Formation	Age From	Age To	Max Age (MA)	Min Age (MA)	Distance
N/A	No features in buffer								

Geology Data Source: WA Department of Mines and Petroleum

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Legend		Australian Soil Classification Orders					
Site Boundary	Anthrosol	Dermosol	Kandosol	Podosol	Tenosol	No Data	
Report Buffer	Calcarosol	Ferrosol	Kurosol	Rudosol	Vertosol		
Property Boundary	Chromosol	Hydrosol	Organosol	Sodosol	Lake		



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Date: 20 April 2021

Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

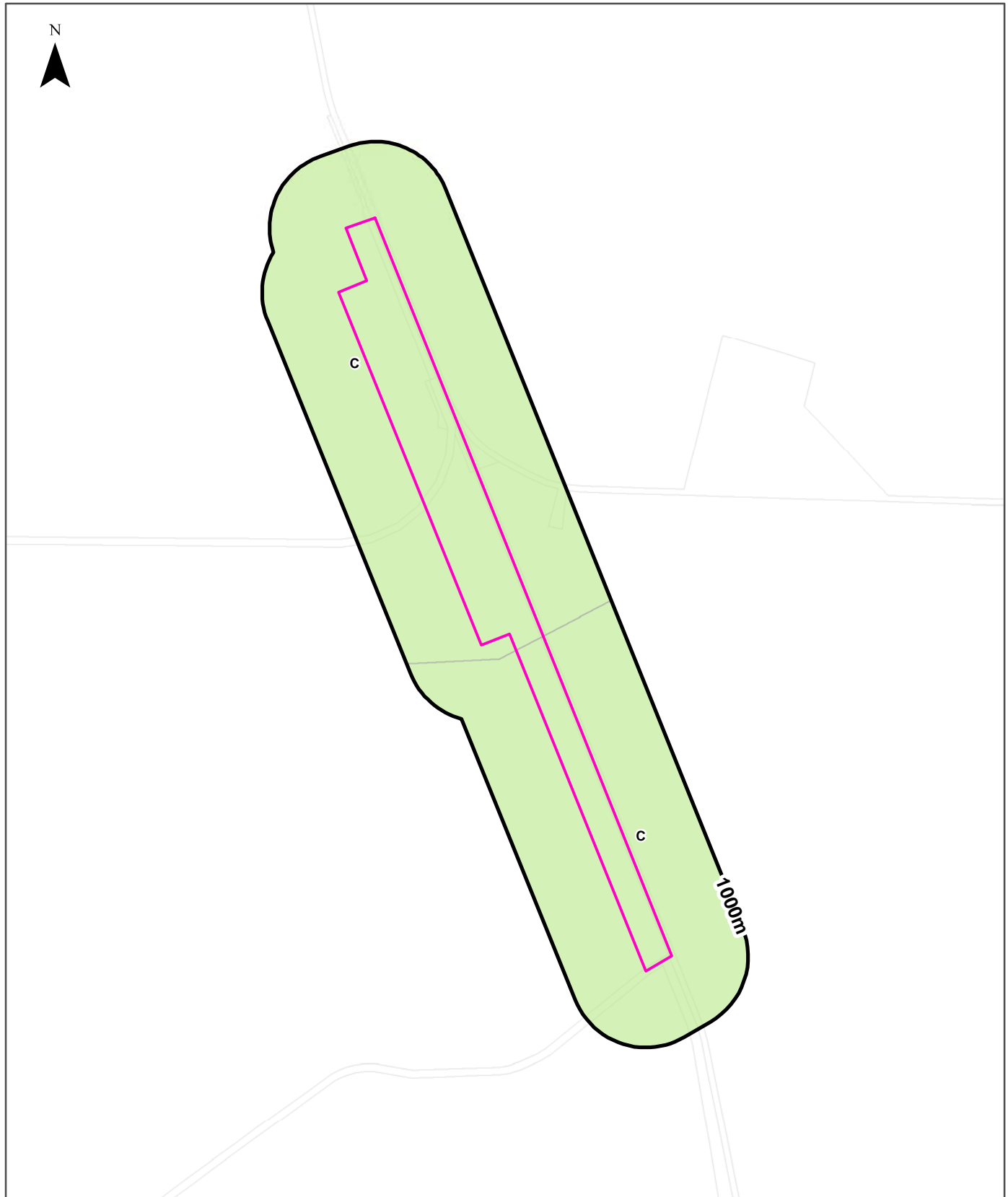
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Ja2	Kandosol	This unit occupies the central position within the high-level valley plains represented by unit Fb3: chief soils are earthy clays (Uf6.71) along with extensive areas of (Ug5.38) soils.	0m
MM16	Vertosol	Alluvial plains dominated by deep cracking clays (Ug5.38) along with some areas of (Uf6.71) soils, and minor areas of (Dr2.33) soils.	0m

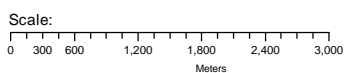
Atlas of Australian Soils Data Source: ABARES

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Legend

- | | | | |
|-------------------|--------------------------------------------------------|-------------------------|---------|
| Site Boundary | Probability of occurrence of Acid Sulfate Soils | | No Data |
| Report Buffer | A. High (>70%) | C. Extremely Low (1-5%) | |
| Property Boundary | B. Low (6-70%) | D. No Chance (0%) | |



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Coordinate Reference System:
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Date: 20April 2021

Acid Sulfate Soils

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register

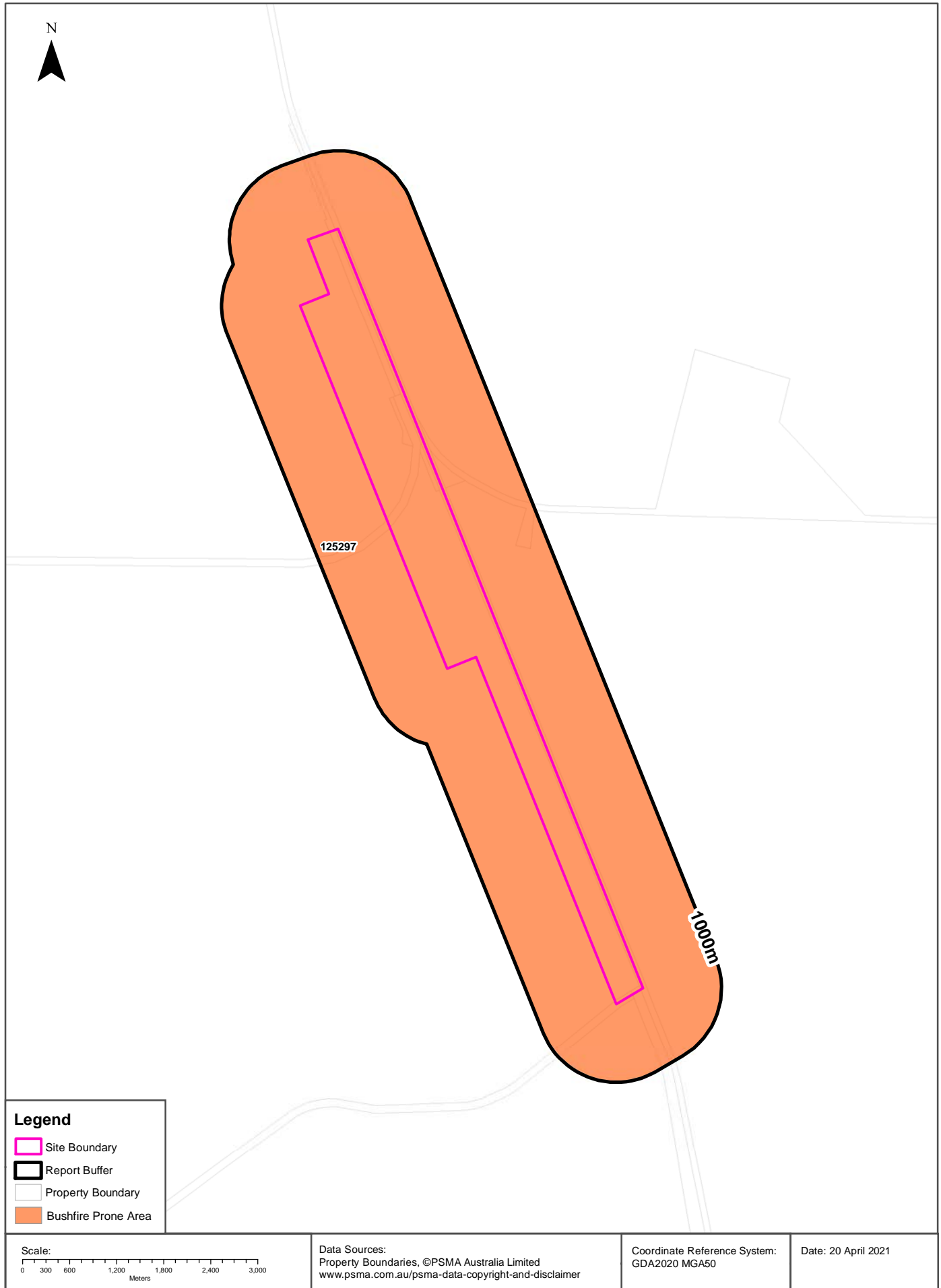
Sites listed on the State Heritage Register within the dataset buffer:

Place No.	Place Name	Location	LGA	Distance	Direction
N/A	No records in buffer				

Heritage Sites Data Source: WA State Heritage Office
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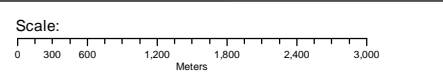
Natural Hazards - Bushfire Prone Areas

Manuwarrah Red Dog Highway Alignment, WA (Part 10)



Legend

- Site Boundary
- Report Buffer
- Property Boundary
- Bushfire Prone Area



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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Natural Hazards

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Bushfire Prone Areas

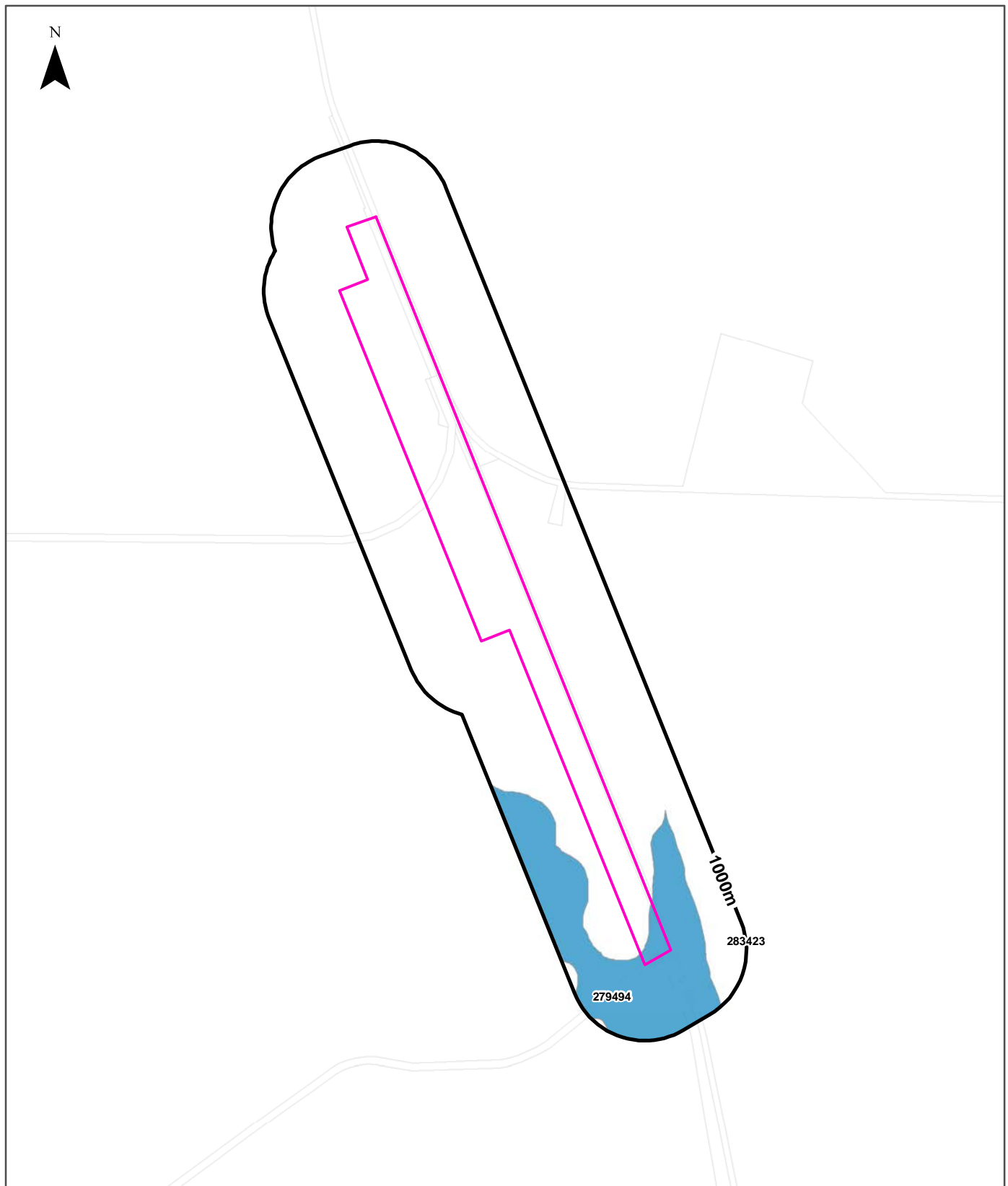
Bushfire Prone Areas within the dataset buffer:

Map Id	Local Government Area	Distance	Direction
125297	ASHBURTON	0m	Onsite

Bushfire Prone Areas Data Source: WA Department of Fire and Emergency Services
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Ecological Constraints - Groundwater Dependent Ecosystems Atlas

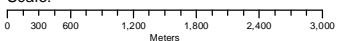
Manuwarrah Red Dog Highway Alignment, WA (Part 10)



Legend

Site Boundary	High potential GDE - from national assessment	Low potential GDE - from national assessment
Report Buffer	High potential GDE - from regional studies	Low potential GDE - from regional studies
Property Boundaries	Moderate potential GDE - from national assessment	Known GDE - from regional studies
	Moderate potential GDE - from regional studies	Unclassified potential GDE - from national assessment
		Unclassified potential GDE - from regional studies

Scale:



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Coordinate Reference System:
GDA2020 MGA50

Date: 20 April 2021

Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Groundwater Dependent Ecosystems

GDEs within the dataset buffer:

MapID	Type	Name	GDE Potential	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Dist	Dir'n
279494	Terrestrial		Low potential GDE - from national assessment	7	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		0m	Onsite
283423	Terrestrial		Low potential GDE - from national assessment	10	Dissected bold plateaus and ranges of flat lying or moderately folded sandstone, quartzite and volcanic rocks.	Vegetation		998m	South East

Groundwater Dependent Ecosystems Atlas Data Source: Bureau of Meteorology
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Ecological Constraints

Manuwarrah Red Dog Highway Alignment, WA (Part 10)

Ramsar Wetlands

Ramsar Wetlands within the dataset buffer:

RAMSAR Reference Code	Wetland	Distance	Direction
N/A	No records in buffer		

Ramsar Wetlands Data Source: Australian Government Department of the Environment and Energy
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LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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Appendix B. Registered Boreholes within Study Area

HydroID	StateBoreID	StateTerritory	BoreDepth	DrilledDepth	Status	DrilledDate	BoreType	HeightDatum	RefElev	RefElevDesc	Distance	Direction	Easting	Northing
50086592	70812541	WA	58	62	Unknown	27/07/2000	Water supply, Exploration or research	AHD	347.02	NGS	0m	Onsite	561457.02	7586264.49
50014960	70810187	WA		15.24	Unknown	1/01/1970	Unknown	AHD	421.89	NGS	0m	Onsite	564999.77	7564786.49
50011998	70800370	WA			Unknown		Unknown	AHD		UNK	0m	Onsite	564754.84	7569822.53
50065363	70810178	WA		9.14	Unknown	1/01/1900	Unknown	AHD	427.48	NGS	0m	Onsite	565921.75	7563899.49
50025054	70810067	WA		36.58	Unknown	1/01/1900	Unknown	AHD	345.87	NGS	0m	Onsite	546519.7	7603024.78
50097558	70812563	WA	84.5	96	Unknown	15/08/2000	Water supply, Exploration or research	AHD	343.61	NGS	0m	Onsite	547763.02	7602423.49
50071549	70812569	WA	83.4	84	Unknown	15/08/2000	Water supply	AHD	343.54	NGS	0m	Onsite	547819.02	7602406.49
50110014	70800371	WA			Unknown		Unknown	AHD		UNK	0m	Onsite	572696.9	7556999.02
50083068	70812546	WA	66	78	Unknown	12/08/2000	Exploration or research, Water supply	AHD	347.54	NGS	0m	Onsite	561472.02	7586245.49
50111796	70810739	WA			Unknown		Unknown	AHD	345.17	NGS	0m	Onsite	547040.71	7601781.78
50104089	70810072	WA			Unknown		Unknown	AHD	342.84	NGS	0m	Onsite	547278.72	7601799.77
50037333	70810231	WA		7.62	Unknown	1/01/1900	Unknown	AHD	348.14	NGS	16m	North	563474.86	7583045.64
50093564	70810186	WA	28	69	Unknown	12/10/1975	Unknown	AHD	425.15	TOC	23m	South East	565059.76	7564559.49
50085475	70812547	WA	71	78	Unknown	11/08/2000	Water supply, Exploration or research	AHD	354.02	NGS	41m	North	558743.02	7591730.49
50075947	70813058	WA	86	87	Unknown	24/07/2004	Water supply	AHD	574.29	NGS	64m	South	571341.02	7544858.49
50012362	70810179	WA		6.2	Unknown	1/01/1900	Water supply for livestock, Domestic household, Household	AHD	489.94	NGS	70m	South East	572792.63	7556384.36
50126947	23040673	WA			Unknown		Unknown	AHD	599.32	NGS	81m	South	569076.22	7528946.14
50080476	70812544	WA	6	72	Unknown	28/07/2000	Exploration or research	AHD	354.09	NGS	81m	North	558881.02	7591670.49
50084088	70813062	WA	90	90	Unknown	11/07/2004	Exploration or research	AHD	574.22	NGS	83m	South	571360.02	7544863.49
50075200	70812562	WA	70	72	Unknown	10/08/2000	Water supply, Exploration or research	AHD	354.33	NGS	86m	North	558886.02	7591673.49
50126946	23040671	WA			Unknown		Unknown	AHD	598.93	NGS	94m	South	569095.22	7528916.14
50063012	70610586	WA		12.19	Unknown	1/01/1900	Water supply for livestock	AHD	596.38	NGS	143m	South	568297.23	7529925.15
50076153	70813047	WA	90	90	Unknown	23/03/2002	Water supply	AHD	344.35	NGS	204m	North	548071.71	7602555.77
50067992	70810259	WA		25.91	Unknown	1/01/1900	Unknown	AHD	352.56	NGS	213m	North	553911.81	7595536.74
50079433	70812543	WA	6	48	Unknown	26/07/2000	Exploration or research	AHD	513.33	NGS	214m	South East	575483.02	7553366.49
50007976	70810238	WA		28.65	Unknown	1/01/1900	Unknown	AHD	402.99	NGS	217m	North East	565835.82	7569010.55
50074956	70830012	WA	42.74	42.74	Unknown	14/07/1976	Monitoring	AHD	351.81	NGS	219m	North	559373.82	7590072.69
50083083	70812566	WA	58.65	60	Unknown	3/08/2000	Water supply	AHD	513.33	NGS	229m	South East	575499.02	7553363.49
50094672	70813061	WA	66	66	Unknown	10/07/2004	Exploration or research	AHD	537.37	NGS	248m	South East	574019.02	7549448.49
50075083	70813059	WA	70	73	Unknown	28/07/2004	Water supply	AHD	538.07	NGS	262m	South East	574030.02	7549432.49
50045420	70810183	WA		21.34	Unknown	1/01/1900	Unknown	AHD	421.69	NGS	269m	East	565963.78	7565253.51
50065673	70810184	WA		15.24	Unknown	1/01/1900	Unknown	AHD	421.69	NGS	269m	East	565963.78	7565253.51
50062621	70810182	WA		22.86	Unknown	1/01/1900	Unknown	AHD	421.69	NGS	269m	East	565963.78	7565253.51
50055143	70810181	WA		30.48	Unknown	1/01/1900	Unknown	AHD	421.69	NGS	275m	East	565970.78	7565247.51
50064048	70810185	WA		15.24	Unknown	1/01/1900	Unknown	AHD	421.69	NGS	276m	East	565970.78	7565253.51
50083116	70813057	WA	84	86	Unknown	6/07/2004	Water supply	AHD	604.58	NGS	278m	South	568995.02	7538872.49
50096924	70813056	WA	74	86	Unknown	6/07/2004	Water supply	AHD	604.58	NGS	298m	South	569017.02	7538864.49
50086326	70810247	WA	58.21	67.41	Unknown	15/05/1975	Monitoring	AHD	395.91	TOC	350m	North East	565970.84	7570573.57
50099877	70810237	WA		23.16	Unknown	30/06/1935	Water supply for livestock	AHD	398.87	NGS	360m	North East	565980.83	7570027.56
50068537	70810258	WA		30.48	Unknown	1/01/1900	Unknown	AHD	356.59	NGS	380m	North	553412.81	7596047.74
50050231	70801484	WA		58.6	Unknown	1/01/1900	Unknown	AHD	511.68	TOC	382m	South East	575636.02	7553525.49
50109922	70800356	WA			Unknown		Unknown	AHD		UNK	384m	South East	572600.42	7558539.15
50059631	70610601	WA		30.48	Unknown	1/01/1900	Unknown	AHD	645.48	NGS	451m	South	574210.03	7511961.08
50055487	70810190	WA		30.48	Unknown	1/01/1900	Unknown	AHD	578.51	NGS	456m	South	571353.36	7542476.23
50069925	70800232	WA			Unknown		Unknown	AHD		UNK	499m	South	567398.02	7538601.49
50113662	70800143	WA			Unknown		Unknown	AHD		UNK	542m	South East	573231.02	7558006.49
50082857	70819011	WA	71	71	Functioning	15/05/1975	Monitoring	AHD	274.45	NGS	553m	North	565396.85	7575206.61
50085689	70830006	WA	38.56	43.5	Unknown	11/05/1976	Monitoring	AHD	344.99	NGS	564m	North	551788.83	7595774.76
50017560	70810071	WA		10.61	Unknown	15/10/1976	Monitoring	AHD	344.55	NGS	564m	North	551788.83	7595774.76
50020288	70813055	WA		78	Unknown	7/04/2002	Monitoring	AHD	332.75	NGS	596m	North West	540211.62	7604702.79
50074232	70813060	WA	40	40	Unknown	29/06/2004	Exploration or research	AHD	604.84	NGS	597m	South	569196.02	7538624.49
50086940	70813052	WA	90	90	Unknown	6/04/2002	Water supply	AHD	332.81	NGS	615m	North West	540180.61	7604695.79
50114121	70810242	WA			Unknown	1/01/1900	Unknown	AHD	383.69	NGS	658m	North	565638.85	7573976.6

HydroID	StateBoreID	StateTerritory	BoreDepth	DrilledDepth	Status	DrilledDate	BoreType	HeightDatum	RefElev	RefElevDesc	Distance	Direction	Easting	Northing
50098557	70810245	WA		56	Unknown	15/04/1975	Unknown	AHD	376.74	NGS	664m	North	565455.85	7575388.61
50016609	70810246	WA		85	Unknown	15/04/1975	Unknown	AHD	376.74	NGS	664m	North	565455.85	7575388.61
50026239	70610600	WA		15.24	Unknown	1/01/1900	Unknown	AHD	640.97	NGS	670m	South	573385.03	7512506.08
50018017	70810239	WA		15.24	Unknown	1/01/1900	Unknown	AHD	399.75	NGS	689m	North East	566308.83	7569497.56
50113967	70800291	WA			Unknown		Unknown	AHD		UNK	716m	South East	575999.02	7552908.49
50026469	70801276	WA		62	Unknown	1/01/1900	Unknown	AHD		UNK	716m	South East	575999.02	7552908.49
50028372	70801275	WA		59.5	Unknown	1/01/1900	Unknown	AHD		UNK	738m	South East	576000.02	7553510.49
50112017	70800290	WA			Unknown		Unknown	AHD		UNK	738m	South East	576000.02	7553510.49
50108473	70800361	WA			Unknown		Unknown	AHD		UNK	773m	North East	566393.34	7569846.3
50043112	70810069	WA		30.48	Unknown	1/01/1900	Unknown	AHD	345.67	NGS	776m	North	549698.76	7599656.76
50075855	70812545	WA	6	66	Unknown	28/07/2000	Exploration or research	AHD	374.34	NGS	807m	North	565275.02	7576140.49
50073167	70812568	WA	65.4	66	Unknown	9/08/2000	Water supply	AHD	374.34	NGS	814m	North	565281.02	7576143.49
50055362	70810229	WA		30.48	Unknown	1/01/1954	Unknown	AHD	344.82	NGS	829m	North	560078.84	7586350.68
50116696	70818062	WA			Functioning		Monitoring	AHD	359.18	TOC	845m	North	565139.86	7579456.62
50111799	70800142	WA			Unknown		Unknown	AHD		UNK	872m	South East	573361.02	7558401.49
50097978	70830016	WA	38	74	Functioning	15/08/1982	Monitoring	AHD	358.88	NGS	911m	North	565207.02	7579417.49
50099081	70810176	WA		25.91	Unknown	1/01/1900	Unknown	AHD	595.05	NGS	939m	South	570404.27	7535735.19
50111462	70800148	WA			Unknown		Unknown	AHD		UNK	1033m	South East	573831.02	7556681.49
50097620	70830017	WA	52	86	Functional	15/08/1982	Monitoring	AHD	371.62	TOC	1043m	North	565439.86	7576356.61
50107519	70818063	WA			Unknown		Unknown	AHD	371.62	TOC	1043m	North	565439.86	7576356.61
50014421	70810249	WA		7.75	Unknown	1/01/1900	Unknown	AHD	414.15	NGS	1052m	North	563243.8	7567956.5
50092733	70812567	WA	88	96	Unknown	14/08/2000	Water supply	AHD	442.85	NGS	1072m	South East	569231.02	7562723.49
50089670	70812542	WA	6	90	Unknown	26/08/2000	Exploration or research	AHD	442.99	NGS	1083m	South East	569249.02	7562719.49
50111823	70800238	WA			Unknown		Unknown	AHD		UNK	1132m	South East	576401.02	7553391.49
50069273	70801292	WA		60.6	Unknown	1/01/1900	Unknown	AHD	517.9	TOC	1132m	South East	576401.02	7553391.49
50113654	70800357	WA			Unknown		Unknown	AHD		UNK	1141m	South East	573957.46	7556847.03
50012173	70610599	WA		21.34	Unknown	1/01/1900	Unknown	AHD	640.92	NGS	1145m	South	575528.03	7512123.08
50079830	70810250	WA	51.5	61	Unknown	15/06/1975	Exploration or research	AHD	369.5	TOC	1264m	North	562729.82	7576572.61
50008504	70800359	WA			Unknown		Unknown	AHD		UNK	1283m	East	569195.54	7563068.3
50100068	70810235	WA		45.72	Unknown	30/06/1935	Water supply for livestock	AHD	379.96	NGS	1308m	North	566221.86	7574888.61
50051433	70810737	WA		30.48	Unknown	1/01/1900	Unknown	AHD	344.72	NGS	1313m	North West	548853.76	7599559.77
50095332	70800673	WA	48	63	Unknown	16/05/2010	Unknown	AHD		UNK	1324m	South East	576592.02	7553432.49
50115122	70800147	WA			Unknown		Unknown	AHD		UNK	1330m	South East	574146.02	7556951.49
50109629	70800233	WA			Unknown		Unknown	AHD		UNK	1369m	South East	572651.02	7544559.49
50098099	70810243	WA	66.9	76	Unknown	15/05/1975	Monitoring	AHD	362.76	NGS	1378m	North	565698.87	7578254.62
50058077	70810172	WA		9.14	Unknown	1/01/1900	Domestic household, Household	AHD	604.89	NGS	1419m	South	569969.27	7536529.19
50038700	70810240	WA		43.28	Unknown	1/01/1900	Water supply for livestock	AHD	362.56	NGS	1420m	North	565722.87	7579086.62
50016725	70810757	WA		19.8	Unknown	1/01/1900	Unknown	AHD	605.17	NGS	1439m	South	569956.27	7536555.19
50053558	70810180	WA		21.34	Unknown	1/01/1900	Unknown	AHD	429.14	NGS	1477m	East	567092.8	7566084.53
50115344	70800262	WA			Unknown		Unknown	AHD		UNK	1518m	South East	576801.02	7553101.49
50007893	70801327	WA		60	Unknown	1/01/1900	Unknown	AHD	526.4	TOC	1518m	South East	576801.02	7553101.49
50037904	70810188	WA		8.69	Unknown	1/01/1900	Unknown	AHD	426.87	NGS	1537m	South	563077.76	7564648.47
50069997	70800671	WA	17	17	Unknown	24/11/2008	Unknown	AHD	409.7	TOC	1538m	South East	576805.02	7553458.49
50109905	70800149	WA			Unknown		Unknown	AHD		UNK	1539m	South East	576805.18	7553458.49
50095042	70800672	WA	60.5	63	Unknown	11/05/2010	Unknown	AHD	521.22	TOC	1543m	South East	576808.02	7553498.49
50112740	70800263	WA			Unknown		Unknown	AHD		UNK	1559m	South East	576801.02	7553701.49
50051456	70801326	WA		29.4	Unknown	1/01/1900	Unknown	AHD	524.4	TOC	1559m	South East	576801.02	7553701.49
50048444	70810228	WA		30.48	Unknown	1/01/1900	Unknown	AHD	346.83	NGS	1579m	North	557423.83	7590197.72
50112016	70800140	WA			Unknown		Unknown	AHD		UNK	1584m	South East	573596.02	7559221.49
50110223	70800146	WA			Unknown		Unknown	AHD		UNK	1657m	South East	574451.02	7557216.49
50035995	70810758	WA		7.62	Unknown	1/01/1900	Unknown	AHD	441.57	NGS	1664m	East	567396.79	7565496.52
50111433	70800355	WA			Unknown		Unknown	AHD		UNK	1700m	South East	565713.13	7561536.44
50032137	70810175	WA		30.48	Unknown	1/01/1900	Unknown	AHD	594.88	NGS	1714m	South	570800.28	7536404.19
50105102	70800358	WA			Unknown		Unknown	AHD		UNK	1724m	South East	570722.68	7562110.44

HydroID	StateBoreID	StateTerritory	BoreDepth	DrilledDepth	Status	DrilledDate	BoreType	HeightDatum	RefElev	RefElevDesc	Distance	Direction	Easting	Northing
50099453	70610594	WA		21.34	Unknown	1/01/1900	Water supply for livestock	AHD	604.4	NGS	1792m	South	567649.13	7524369.14
50020871	70830011	WA		61.87	Unknown	15/07/1976	Unknown	AHD	339.14	NGS	1868m	North	558766.84	7586891.7
50010581	70610602	WA		15.24	Unknown	1/01/1900	Unknown	AHD	644.05	NGS	1881m	South	576343.04	7512278.07
50109645	70800257	WA			Unknown		Unknown	AHD		UNK	1926m	South East	577191.02	7553501.49
50059090	70801308	WA		49.6	Unknown	1/01/1900	Unknown	AHD	523.5	TOC	1926m	South East	577191.02	7553501.49
50112068	70800141	WA			Unknown		Unknown	AHD		UNK	1930m	South East	573511.02	7559851.49
50019494	70810738	WA		30.48	Unknown	1/01/1900	Unknown	AHD	339.12	NGS	1953m	North West	549830.81	7596827.76
50103774	70800145	WA			Unknown		Unknown	AHD		UNK	1969m	South East	574741.02	7557461.49

Appendix C. Risk Criteria Based on Potential Presence of NOA

This risk categorisation presented in the table below has been adopted based on guidance provided in NSW, Mapping of naturally occurring asbestos in NSW - Known and potential for occurrence, July 2015 and modified to be suitable for the bespoke project in WA.

Risk Category	Definition	Criteria
High	High potential areas have been assessed to have the highest potential for asbestos and asbestiform minerals (NOA). The distribution of asbestos in a 'high' risk area is most likely to be widespread. Where present, large accumulations of asbestos are possible. However, asbestos/asbestiform minerals will mostly be confined to narrow horizons / veins and will likely only constitute a small proportion of the rock overall (<0.1%).	<p>Geological units that host asbestos occurrences include indicator minerals such as serpentine minerals, tremolite, antigorite, or multiple instances of descriptive terms such as fibrous, matted and sheared.</p> <p>Favourable lithology and chemistry – for example, serpentinites and ultramafic rocks which typically contain minerals such as olivine and pyroxene, which can react to form asbestiform minerals and favourable chemistry (e.g. high Mg and Fe and high Mg/Fe ratios).</p> <p>Favourable geological age and geological setting.</p> <p>Favourable metamorphic grade.</p> <p>Most areas attributed as 'high' potential satisfy at least three of the above criteria.</p>
Medium	Medium potential areas have the potential for unidentified NOA, but the potential is low overall. Any size of occurrences of NOA are possible – although NOA is unlikely to be extensive throughout.	<p>Medium potential areas have the same criteria as for high potential areas but generally satisfy only two of the criteria outlined above. The most common of these criteria are:</p> <p>Favourable lithology and chemistry (such as ultramafic, ultramafites, dunites, lherzolites and harzburgites) and favourable known metamorphic grade but with few known asbestos occurrences and/or the areas are away from major faults or metamorphic complexes that are associated with NOA.</p> <p>Favourable rock types but less favourable age and geological history for NOA.</p> <p>Medium potential areas include some sediments that thinly overlay 'high potential' rocks such as serpentinites.</p>
Low	<p>The majority of areas with low potential will not have any NOA. Where present, occurrences are likely to be localised in these areas, but larger occurrences are possible.</p> <p>Low potential areas cover a wide range of rock types, although most are of mafic composition, or are sedimentary rocks that include or may include minor amounts of ultramafic material.</p>	<p>The selection of low potential areas is generalised, but most of these areas satisfy only one or possibly two of the above criteria. They also include:</p> <p>Rocks that host a small number of mineral occurrences indicator minerals and/or textures typically associated with NOA but have not undergone geological history that would be favourable to asbestos formation.</p> <p>Have less favourable lithology and chemistry but are physically adjacent to known NOA occurrences and/or areas assessed with high potential.</p> <p>Where natural superficial deposits derived from low risk rock units overlies potentially medium to high risk rocks and where anticipated disturbance below of those rocks is considered low.</p> <p>NOA is known in the geological region and there is such uncertainty of the geology that the possibility of NOA cannot be discounted.</p>