Australian Government
Defence

List of submissions to the 2024 Review of the Woomera Prohibited Area Coexistence Framework

1. Association of Mining and Exploration Companies
2. Australian Conservation Foundation
3. Driver Bus Lines
4. Extract of Classified Defence Position
5. Friends of the Earth Adelaide
6. Government of South Australia
7. Sarah Isaacs
8. Michele Madigan
9. Julie Marlow
10. Marmota Ltd
11. Annie McGovern OAM
12. David Noonan
13. Nova Systems
14. Paupiyala Tjarutja Aboriginal Corporation
15. South Australian Chamber of Mines and Energy

[Note: the Review received permission to publish 13 of 15 submissions received]

Wurundjeri Country,
Level 1, 60 Leicester Street
Carlton VIC 3053
ABN 22 007 498 482

Telephone. +61 3 9345 1111
www.acf.org.au

Email. acf@acf.org.au
@AusConservation

AUSTRALIAN CONSERVATION FOUNDATION | Nature needs us, now

Comments from the Australian Conservation Foundation on the Woomera Prohibited Area Coexistence Framework Review

September 2024

The Australian Conservation Foundation Inc (ACF) was founded in the mid-1960s with the support of prominent Australians, the Government and the wider community and is Australia's lead national environment organization and advocate for the environment.

ACF is strictly non-partisan, and we are proud of our political independence.

ACF welcomes this opportunity to provide input to this review (the Review) and future management approaches and options for the Woomera Prohibited Area (WPA). This is especially critical in the context of a rapidly evolving set of Defence and security arrangements which may have profound and lasting implications for our nations, especially the AUKUS arrangement.

At the time of the AUKUS proposals surprise announcement in September 2021, the acquisition of nuclear-powered submarines was described by the Chief of Navy Vice Admiral Michael Noonan as "the single most consequential capability decision" and one that would "no doubt change the shape of our nation".

Given the profound – indeed nation changing - strategic, safety, environmental and economic implications of this decision there has been little public or Parliamentary scrutiny of the AUKUS project.

ACF maintains that it is unacceptable and inconsistent with democratic principles that such a fundamental policy decision be advanced with such limited transparency or review.

This approach actively reduces scrutiny, precludes the credible and comprehensive consideration of the many complex issues and undermines both community confidence and procedural credibility.

In this context the Reviews consideration of a wide range of WPA issues is timely and very important. Particularly the key task of exploring *the WPA's contribution to current and future Defence capability, including the financial and other benefits deriving from Australia's ability to share knowledge and technology with allies, particularly in light of new and emerging technologies, and the subsequent value of the WPA to the US Alliance and other key international relationships.*

ACF holds serious concerns around the AUKUS Agreement, including around environmental and waste management impacts, costs and consequences and the way this initiative has been and is being advanced.

There has been a long history of nuclear issues and concerns with the WPA, and it is important that this is acknowledged and addressed in the Review.

Predominately these concerns have been around the siting, status and management of radioactive waste and the persistent and continuing commentary, promotion and expectation of potential expanded national, international, civil and military radioactive waste streams on the WPA.

ACF would welcome the Review providing clarification of the current status of radioactive waste inventories and management on the WPA, especially regarding CSIRO and Category S wastes.

ACF would also appreciate the Review providing clarity on the implementation status of previous recommendations – particularly those of the de Brouwer review - relating to WPA management, processes and operations.

The issue of future management of radioactive waste, including High Level Waste, arising from the Aukus agreement is a deep concern for ACF and needs to be clearly articulated and presented in the Review.

ACF has concerns that along with future Australian military waste the Aukus deal could see Australia host UK and US naval radioactive waste, including HLW. This risk was identified by a Senate Foreign Affairs, Defence and Trade Committee inquiry in May 2024 into the *Australian Naval Nuclear Power Safety Bill (2024)*.

Despite a clear Committee recommendation (recommendation 3) that the draft legislation be amended 'so that a distinction is made between Australia's acceptance of low-level nuclear waste from AUKUS partners, but non-acceptance of high-level nuclear waste', this has yet to occur.

ACF welcomes the Governments assurance that it has 'no intention' to accept HLW from our Aukus partners but political promises – unlike radioactive waste - are finite. This legislation must be amended to preclude any future Government exercising this option.

Given that the WPA has been publicly canvassed as a potential future Aukus waste site ACF urges that the Review explicitly address this concern.

ACF would further welcome the Review exploring and adopting key foundational or guidance principles in relation to radioactive waste management plans, practises and discourse on the WPA.

Fundamental among these must be consent, especially Traditional Owner consent.

Australia's experience of radioactive waste management and First Nations people's can be described as one of failed top-down imposition and successful bottom-up

resistance. This can be seen in multiple community campaigns over decades, mainly in South Australia and the Northern Territory.

It has also been recognised in the final report of a mission to Australia by the UN Special Rapporteur on Toxics – to be presented in Geneva in September 2024 and attached for the Reviews consideration.

(100) ***The Special Rapporteur notes, however, that there is a disconnect in narratives between authorities' efforts and the lived experiences of local communities, Indigenous Peoples, and workers in relation to toxics issues.*** *Indigenous Peoples have suffered grave maltreatment from radiation exposure due to nuclear testing, spraying of highly hazardous pesticides, uranium and other mining, and industrial activities with toxic impacts.* ***The proposed siting of radioactive wastes on the lands of Indigenous Peoples illustrates the lack of respect for rights contemplated in the United Nations Declaration on the Rights of Indigenous Peoples.***

And the Report further explicitly notes:
(69) ...***under the AUKUS security partnership deal between Australia, the United Kingdom and the United States of America, Australia will be responsible for the storage of high-level nuclear waste from naval reactors that will power Australian submarines. The introduction of high-level radioactive waste into Australian territory may pose significant additional management challenges.***

In relation to wider community consent considerations there is an extensive body of academic and technical reports and policy papers that note the importance of social license and community consent and the need to recognise, respect and respond to opposition on its merits rather than reflexively view criticism as vexatious, misinformed or 'emotional'.

The South Australian Royal Commission into the nuclear industry noted that radioactive waste management requires *both social consent for the activity and advanced technical engineering to contain and isolate the waste. Of the two, social consent warrants in planning and development much greater attention than the technical issues*.

The earlier UK Committee on Radioactive Waste Management (CORWM 2006) found that community involvement in any proposals for the siting of long-term radioactive waste facilities should be based on the principle of volunteerism i.e. an expressed willingness to participate and identified the failure of earlier 'top down' mechanisms (often referred to as Decide-Announce-Defend).

CORWM stated that it is generally considered that a voluntary process is essential to ensure equity, efficiency and the likelihood of successfully completing the process and that there is a growing recognition that it is not ethically acceptable for a society to impose a radioactive waste facility on an unwilling community. It further found that

communities should have the right to withdraw from siting processes up to a pre-defined point.

There is a growing recognition that it is not ethically acceptable for a society to impose a radioactive waste facility on an unwilling community - CORMW, 2006

Experience has shown that without this consent, the project will sooner or later be cancelled, stopped or indefinitely delayed – one way or the other - EU Nuclear Decommissioning Best Practice guidelines

For policy makers it is often easier to measure metrics and assess natural and technical features and properties than it is to do engage meaningfully with human values, attitudes and responses.

There are clear communities of interest that are not geographically defined but who need to be actively recognised and meaningfully engaged. This was recognised in the SA Nuclear Fuel Cycle Royal Commission finding that both *'broad social consent and specific community consent must be obtained for any new nuclear activity to commence in South Australia'.*

ACF urges the Review to recommend greater transparency, inclusion and respect for the fundamental pre-condition of consent in relation to any radioactive waste management issues or proposals on the WPA.

There are multiple ways this could be advanced including by:

- Operationalising the UN Declaration on the Rights of Indigenous People's Declaration Article 29 requirement that:

  States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.

- Not acting in a manner inconsistent with state or territory nuclear constraints or prohibitions
- Elevating transparency, reporting and public right to know provisions and processes
- Ensuring no foreign sourced radioactive waste is accepted for management, treatment or disposal

ACF thanks the Review for consideration of these comments and trust that they will help address the current and future challenges and issues.

[redacted]

Attachment: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes, September 2024

Australian Government
Defence

Woomera Prohibited Area Review 2024

Extract of classified Defence submission

September 2024

1. The Woomera Prohibited Area (WPA) is a key national asset, critical to the development, test and evaluation of advanced defence capabilities. Its large geographic size (122,000 square kilometres), low population density, and electromagnetic quietness make it an ideal location. The WPA's overarching legislative and governing framework includes:
   - *Defence Act 1903*: authorises use of the WPA for testing of war materiel;
   - Woomera Prohibited Area Rule 2014 (the Rule): regulates most third-party access to the WPA;
   - *Defence Force Regulations 1952*: sets out historical access arrangements for traditional owners and native title holders, pastoral lease holders, railway authorities, and a limited number of mining operators; and
   - WPA coexistence governance arrangements (Memorandum of Understanding between the Commonwealth of Australia and South Australian Government and the WPA Advisory Board).
2. The WPA Rule and WPA governance arrangements together form the 'coexistence framework'. This recognises that, while Defence requirements for the testing and evaluation of military systems are given precedence within the WPA, the area is also important for pastoral activity, resource exploration and production, Aboriginal native title and cultural heritage, and other activities such as tourism and scientific research.
3. The review of the WPA Coexistence Framework is timely to consider Defence needs as defined by the *National Defence Strategy* (NDS). Commensurate with the deteriorating strategic environment, Defence capability and deterrence requirements have evolved substantially since the Rule was established in 2014, and subsequently reviewed in 2018.
4. The NDS directs Defence to adopt a strategy of denial through deterrence and the pursuit of accelerated capability development and acquisition of advanced weapons systems.
5. Defence test and evaluation demand for the WPA will substantially increase over the next decade as the advanced capabilities identified in the Integrated Investment Program (IIP) begin to come online.
6. The 2010 Hawke Review identified the WPA as an important strategic asset and Defence as its primary user. The coexistence framework was recommended to balance competing economic and national security interests. It was imperative in 2010, and it is even more imperative now, that Defence retain meaningful access to the WPA. As the geostrategic situation presents deeper enduring challenges, considering how to re-calibrate our approach to coexistence is timely.
7. Australia's ability to realise the strategic potential of the WPA relies upon the application of appropriate security and regulatory settings that provide clarity of purpose and enable more flexible access for Defence that meets national security requirements. As such, Defence's position is guided by the following principles:
   - maintain primacy of Defence's use of the WPA and protect its unique characteristics that allow for essential testing and development of Defence capability;
   - maintain the spirit of coexistence through innovative ways to balance diverse interests;
   - reduce complexity in the governance and administration of the WPA; and
   - apply a pragmatic approach to security that is appropriately focussed and calibrated.
8. Defence requires a **security** framework, surveillance and monitoring powers, and enforcement capability that is appropriately focussed and resourced for the current and future strategic environment. Cognisant of resourcing pressures, practical recalibration of security settings is required to: maintain requisite safety standards; deter malign actors; and minimise regulatory burden.

a. **Defence must be able to proactively manage the introduction and use of technology in the WPA.** The current 'notifiable equipment' list detailed in the Rule is no longer fit for purpose and needs to be amended to incorporate current and emerging technologies now being developed and tested.

b. **Governance should be focussed and proportionate to the security risk.** Notwithstanding safety requirements, approvals to enter and operate within the WPA should be aligned with the realities of the security environment. The Coexistence Framework should not over-regulate in an attempt to achieve security objectives.

c. **The compliance system must be sufficiently credible to deter infractions, and fit-for-purpose for the security environment**. Improvements to the compliance system should seek to address capacity and complexity challenges.

9. The existing coexistence framework places a significant regulatory burden on all users of the WPA. **Streamlined and robust governance and regulatory arrangements** are required to set the conditions for Defence to achieve NDS objectives.

a. **Defence must be able to adapt plans for use of the WPA in a way that maximises allocated time.** The Rule stipulates that six months' notice must be given to resource production permit holders for a Green Zone closure. Once activated, the Green Zone must not be reactivated again for another three months. This also applies if an exclusion period is cancelled. Notice for Amber Zone 1 and 2 exclusion periods must be provided three months before the end of the financial year for the following financial year. This means that trials in the Amber Zones are being planned up to fifteen months in advance.

i. A reduced notification period would likely lead to fewer cancellations and allow Defence to provide greater fidelity to all users of the WPA. Reducing the length of the break between actions from 3 months to 21 days will further improve flexibility for Defence.

b. **Defence must be able to maximise outcomes from its use of the WPA while minimising the impact to non-Defence users.** Any testing in the WPA Green Zone (or Amber Zone 2) currently counts against total closure days for the entire area. A flexible green zone approach, as proposed in the 2018 Review, would allow relevant parts of the Green Zone to be closed in isolation of others. Amber Zone 2 would be absorbed into the Green Zone, as it can no longer be closed without concurrent green zone closures. A more flexible approach to the green zone would allow Defence greater use of the WPA and potentially reduce the impacts to non-Defence users.

c. **Defence must be able to take advantage of opportunities to collaborate with international partners when there is capacity.** Cooperative development of advanced capabilities is critical to both capability and deterrence outcomes for Australia.

d. **Stakeholder engagement mechanisms must be enhanced.** The 2018 Review recommended an ongoing focus on strong and productive relationships as the foundation of the coexistence framework. As we seek to achieve greater flexibility and streamlined governance, stakeholder engagement – and the mechanisms that enable it – will becoming increasingly important.

Friends of the Earth Adelaide
c/- Conservation Council of SA, 111 Franklin St, Adelaide SA 5000
adelaidefoe.org | facebook.com/foe.adelaide | e: adelaide.office@foe.org.au

Submission to the Review of the Woomera Prohibited Area Coexistence Framework

According to the Review web site, in addition to its Defence role, the Woomera Prohibited Area (WPA) "is also a place of national significance for Aboriginal cultural heritage, and home to pastoral and mining operations, while also hosting significant scientific and environmental research, prospecting and tourism."

Not mentioned on the web site are moves to make the WPA a storage and/or disposal site for radioactive waste, including spent nuclear fuel, from the AUKUS program.

Media reports suggest that the government is considering building a "facility on defence land at Woomera that could also accommodate high-level waste from the AUKUS submarines."[1] This would be consistent with Defence Minister Richard Marles' statement that the submarine waste would have to be stored on Defence Department land.[2] On the other hand, it would be inconsistent with advice given to the Senate by the Department of Defence (DoD) during deliberation on the National Radioactive Waste Management Amendment (Site Specification, Community Fund and Other Measures) Bill 2020. DoD then advised the Senate that "the siting of the National Radioactive Waste Management Facility at any of the four sites identified [including two within WPA] in the request could not be achieved."[3] However, former Senator Rex Patrick discovered through Freedom of Information that DoD subsequently set up a review "to identify locations in the current or future Defence estate suitable for the storage and disposal of intermediate and high level waste from Australia's nuclear-powered submarines".[4]

Notwithstanding Defence's equivocation, the sources quoted above provide ample grounds for the South Australian public to be concerned that spent nuclear fuel and other radioactive waste could be transported through the state to a storage and/or disposal site at WMA. This would be an additional function for WMA which should be accounted for in the governing framework.

We submit that the following principles should be adhered to in any deliberations and decisions about storage and disposal in the WPA of radioactive waste from the AUKUS program and that the WPA coexistence framework should affirm these principles.

---

[1] Phillip Coorey, 'Woomera looms as national nuclear waste dump site', *Australian Financial Review*, Aug 10, 2023
https://www.afr.com/politics/federal/woomera-looms-as-national-nuclear-waste-dump-site-20230810-p5dvle
[2] Ibid.
[3] Rex Patrick, 'Nuclear waste. Fifty years of searching, still nowhere to dump it', *Michael West Media*, Dec 15, 2023
https://michaelwest.com.au/nuclear-waste-fifty-years-of-searching-still-nowhere-to-dump-it/
[4] Ibid.

Principles

1) Traditional owners should be given a right of veto.
The Department of Defence's web site contains the following information:

> The WPA contains sites of enduring significance to Aboriginal people, including stone arrangements associated with traditional ceremony and ritual, rock art sites, ceremonial sites, cultural sites manifested in topographical features such as watercourses, and archaeological sites that show how people lived in and used their environment.
> Aboriginal people continue their traditions by accessing the WPA for traditional ceremonies, hunting, heritage site protection, and cultural activities.[5]

During past attempts to find a site for a National Radioactive Waste Management Facility, Traditional Owners have demonstrated strong opposition to the dumping of radioactive waste on their land. It can be expected that the Traditional Owners of the Woomera area will also show a strong interest in any proposal to store and/or dispose of AUKUS radioactive waste on their land.[6] Besides the potential for direct damage to Country, depending on the zoning classification applied to a site located within the WPA,[7] and given that "Defence requirements …are given precedence", access for the Traditional Owners could be denied or severely curtailed.

In this regard, the United Nations Declaration on the Rights of Indigenous Peoples is relevant. Article 29 states:

> States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.

The Australian Government should apply this principle when attempting to find a site for AUKUS radioactive waste.

2) State legislation and the wishes of the people of South Australia should be respected.
South Australian legislation prohibits "the establishment of certain nuclear waste storage facilities in this State" in order "to protect the health, safety and welfare of the people of South Australia and

---

[5] Department of Defence, 'History of the Woomera Prohibited Area' https://www.defence.gov.au/bases-locations/sa/woomera/about

[6] Ibid.
"The Woomera Prohibited Area (WPA) encompasses the traditional lands of six Aboriginal groups. Maralinga Tjarutja (MT) and Anangu Pitjantjatjara Yunkunytjatjara (APY) hold almost 30 per cent of the land in the west of the WPA as freehold title granted under South Australian legislation. Four other groups – Antakirinja Matu-Yankunytjatjara (AMY), Arabana, Gawler Ranges and Kokatha – hold native title over areas in the WPA."

[7] *Woomera Prohibited Area Rule 2014*, Articles 6, 7 & 8

to protect the environment".[8] That this legislation reflects the wishes of the general public has been demonstrated repeatedly. Public opposition has blocked several attempts to locate radioactive waste dumps in South Australia, most recently the proposed National Radioactive Waste Management Facility in Kimba. Also, in 2016 South Australia's Citizens' Jury on Nuclear Waste rejected a proposal to store and dispose of high-level nuclear waste from other countries.

The Commonwealth should not ride rough shod over state legislation and the will of the South Australian public. If it is unable to gain the acceptance of the State Parliament and the general public, it should not impose a radioactive waste facility on this state.

3) Consultation should involve *all* potentially affected people.

That includes the whole South Australian public. As a South Australian group our focus is on the South Australian public, but people in other states could also be affected, depending where the waste comes from.

The impact of a decision to store and/or dispose of AUKUS radioactive waste would not be limited to the destination area in the WPA. Everyone along the 500-kilometre route between Osborne and Woomera would be exposed to risk from potential accidents. That risk could also apply to people along the nearly 3,000-kilometre route from Garden Island in Western Australia.[9] The port where the spent nuclear fuel is unloaded from the submarine would be at particular risk. The much-vaunted multi-layer protection would be compromised when the spent fuel is being removed from the submarines. In a worst-case scenario, an accidental (or malicious) release of radioactive material could contaminate large swathes of land.

Bearing this in mind, the public should be fully consulted before any decision is made to store and/or dispose of AUKUS radioactive waste in the WPA.

4) International radioactive waste should not be accepted

That the South Australian public does not want to be burdened with international radioactive waste was demonstrated by the above-mentioned Citizens' Jury, which explicitly rejected a proposal to accept such waste.

The ALP National Platform (2021, Uranium p.96-98) also explicitly opposes acceptance of overseas nuclear waste:

> Labor will: 8. d. Remain strongly opposed to the importation and storage of nuclear waste that is sourced from overseas in Australia.

---

[8] *Nuclear Waste Storage Facility (Prohibition) Act 2000*

[9] 'ARPANSA approves siting licence for ASA Controlled Industrial Facility', ARPANSA Web Site, 17 July 2024 https://www.arpansa.gov.au/arpansa-approves-siting-licence-asa-controlled-industrial-facility?sfnsn=mo

On 9 August 2024, the Defence Minister Richard Marles said, “Nuclear waste won't end up in Australia, other than the waste that is generated by Australia.” Prime Minister Albanese said, “There will be no nuclear [waste] transfer from either the US or UK.”[10] However, the possibility of Australia accepting spent nuclear fuel from the UK and the United States is not ruled out in the Australian Naval Nuclear Power Safety Bill 2023. Furthermore, the status of spent fuel produced by second hand Virginia Class Submarines while they were owned by the United States, before they are transferred to Australia, remains vague.

There is a strong impression that the Australian public is being misled. A clear undertaking that Australia will not accept international nuclear waste should be codified in law in order to prevent future governments from welching on verbal commitments of previous ministers.

5) Any storage and/or disposal site must be amenable to IAEA nuclear safeguards

The nuclear fuel in the AUKUS submarines, both in the form of unused fuel and as spent fuel, can be used to make nuclear weapons. As such, it is a nuclear proliferation hazard. Would the Department of Defence be comfortable having IAEA inspectors fulfilling their safeguards duties on the militarily sensitive WPA?

The AUKUS agreement already threatens to undermine the nuclear non-proliferation regime by exploiting a dangerous loophole in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).[11] The (very inadequate) compromise is that while the nuclear fuel is in the submarines it will be exempted from IAEA safeguards, but the moment it is removed from the submarines as spent nuclear fuel it must be returned to IAEA safeguards.

Conclusion

Spent nuclear fuel is a form of radioactive waste that remains dangerous for tens of thousands of years. The Commonwealth Government should not take the view that the WPA, as Commonwealth land, is an easy solution to the radioactive waste produced as a result of AUKUS. There must be no short cuts. If Australia ever actually acquires nuclear submarines, the search for a solution to the radioactive waste problem should involve a full and transparent process of public consultation. No storage and/or disposal site should be selected that is not acceptable to the Traditional Owners, the State Parliament and the general public.

Philip White
For Friends of the Earth Adelaide

---

[10] Jake Evans and Kathleen Calderwood, ‘Defence Minister Richard Marles insists AUKUS milestone won't force Australia to accept foreign nuclear waste’, ABC, 9 Aug 2024 https://www.abc.net.au/news/2024-08-09/aukus-radioactive-waste-marles-denies-us-uk-obligation/104184608

[11] Frank von Hippel et al, Letter to President Biden, 6 October 2021 https://sgs.princeton.edu/sites/default/files/2021-10/AUKUS-Letter-2021.pdf

2024 Review of the Woomera Prohibited Area Coexistence Framework

Submission from the Government of South Australia to the Commonwealth Government, Department of Defence

September 2024

SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

Department for Energy and Mining
Level 4, 11 Waymouth Street, Adelaide
GPO Box 320, Adelaide SA 5001
Phone +61 8 8463 3000
Email dem.minerals@sa.gov.au
dem.petroleum@sa.gov.au
www.energymining.sa.gov.au

South Australian Resources Information Gateway (SARIG)
SARIG provides up-to-date views of mineral, petroleum and geothermal tenements and other geoscientific data. You can search, view and download information relating to minerals and mining in South Australia including tenement details, mines and mineral deposits, geological and geophysical data, publications and reports (including company reports).
map.sarig.sa.gov.au

Disclaimer
The contents of this report are for general information only and are not intended as professional advice, and the Department for Energy and Mining (and the Government of South Australia) make no representation, express or implied, as to the accuracy, reliability or completeness of the information contained in this report or as to the suitability of the information for any particular purpose. Use of or reliance upon the information contained in this report is at the sole risk of the user in all things and the Department for Energy and Mining (and the Government of South Australia) disclaim any responsibility for that use or reliance and any liability to the user.

Acknowledgement of Country
As guests here on Kaurna land, the Department for Energy and Mining acknowledges everything it does impacts on Aboriginal country, the sea, the sky, its people and their spiritual and cultural connection which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.

Date:	Comment:
25/11/2024	FINAL – Approved by Cabinet 25 November 2024.

Contents

1. Acknowledgement

As guests on Aboriginal land, the Department for Energy and Mining acknowledges everything it does impacts upon Aboriginal country, the sea, the sky, its peoples, and the spiritual and cultural connections which have existed since the first sunrise. Our responsibility is to share collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.

The word 'Woomera' refers to a spear-throwing device that extends the distance a spear can be thrown. The Woomera Range Complex's motto 'sharpen the spear' is a reference to this unique Aboriginal invention.

The Woomera Prohibited Area (WPA) encompasses the traditional lands of six Aboriginal groups. Maralinga Tjarutja (MT) and Anangu Pitjantjatjara Yunkuntjatjara (APY) hold almost 30 per cent of the land in the west of the WPA as freehold title granted under South Australian legislation. Four other groups – Antakirinja Matu-Yankunytjatjara (AMY), Kokatha, Arabana and Gawler Ranges – hold native title over areas in the WPA.

2. Executive Summary

The South Australian Government welcomes the opportunity to make a submission to the 2024 Review of the Woomera Prohibited Area Coexistence Framework (the 2024 Review). The South Australian Government is pleased with the appointment of Ms Skinner's to lead the review, and confident she holds the prior experience and depth of knowledge to oversee a robust and comprehensive process delivering high quality independent advice on the coexistence for all users of the WPA.

The 2024 Review is a timely opportunity for the South Australian Government to ensure that the interests of the Commonwealth Department of Defence (Defence) and Australian Government continue to be balanced with the interests of South Australians. This submission seeks to influence the on-going operation of a contemporary WPA coexistence framework for a strong Australian Government-South Australian Government partnership delivering outcomes focussed on national security, continued economic development, protection of Aboriginal heritage and the environment and sustainable regional growth in South Australia.

The South Australian Government recognises that as one of the largest and electromagnetically quietest military test ranges in the world, the WPA is a critical national and international asset, with significant importance to our allies for testing and trials. In a period of geostrategic instability and rapidly evolving technology, a large test and trials range is essential to Australia's strategic defence capability.

The WPA is an area of 122,000 square kilometres, roughly the size of England, encompassing the largest land-based military test range in the Western world. The WPA is also an area of strategic State significance delivering economic, cultural, social, and environmental value shared by all South Australians. South Australia has mineral and energy resources of national and global significance within the WPA, which are of vital importance to the future development of Australia's resource sector, mineral wealth security, and the future

contribution to the critical minerals needed for the technologies underpinning Australia's national security and that of our major allies.

The WPA Advisory Board (the Board) monitors and reports on the balance of national security and economic interests in the WPA and oversees implementation of the Coexistence Framework. The South Australian government considers the Board to be an effective mechanism to manage interactions between the State and Commonwealth with independent oversight from a Chair and Co-Chair.

There are three large scale mines currently operating within the WPA: the Prominent Hill iron oxide copper, gold, and silver mine (BHP), the Peculiar Knob iron ore mine (Peak Iron Mines) and the Buzzard iron ore mine (Peak Iron Mines). There are an additional two mines in care and maintenance: the Cairn Hill iron and copper mine (CU-River Mining Australia) and the Challenger gold and silver mine (Barton Gold Holdings Limited). In 2023/2024, mining operations in the WPA contributed over $39 million in royalty receipts to the South Australian economy and employed approximately 1,750 people[1].

Additionally, the Arckaringa, Officer and Eromanga basins which contain substantial hydrocarbon resources and half of Coober Pedy precious stone fields fall within the WPA boundaries.

Exploration is vital to identify the commercially viable resources necessary to underpin future resource operations and production. Geoscience Australia estimates 69% of Australia's known copper resources and 78% of known uranium resources are located within the WPA or the immediate surrounds. A review by the Department and Energy and Mining (DEM), Geological Survey of South Australia (GSSA) demonstrate that there are more than 260 mineral occurrences within the WPA area.[2] Geological models clearly indicate a correlation between the deposits within the WPA and highly prospective IOCGU (Iron Ore, Copper, Gold and Uranium) deposits east of the WPA, such as Carrapateena and Olympic Dam. Other key prospective mineral targets within the WPA include gold and heavy mineral sands (titanium, zircon, rutile, ilmenite).

Further work is required to define specific exploration targets and enhance the understanding of potential mineral resource targets within the WPA. There are important leadership and investment roles for the Australian and South Australian Government in this regard.

The WPA retains important Aboriginal cultural heritage values for the Maralinga Tjarutja, Anangu Pitjantjatjara Yunkuntjatjara, Antakirinja Matu-Yankunytjatjara, Kokatha, Arabana and Gawler Ranges groups.

The pastoral industry, including those pastoral enterprises operating within the WPA, generate an estimated annual output of $226 million. The South Australian Dog Fence transecting the WPA is a key piece of infrastructure protecting a $4.3 billion livestock industry. Rebuilding

[1] 2022/23 Annual Report: Woomera-Annual-Report-2022-2023

[2] Davies, M., Fairclough, M., Dutch, R., Katona, L., South, R. and McGeough, M.: 2008. Mineralisation and mineral potential of the Woomera Prohibited Area, central Gawler Province, South Australia. South Australia. Department of Primary Industries and Resources. Report Book 2008/18.

works to reduce the impact of wild dogs is estimated to create a net benefit $112.9 million over a 20-year period.

South Australia supports a balanced approach to management of the WPA; increasing demand for defence purposes should be balanced with demands from mining exploration and leases, pastoralists, traditional owners, tourism and other uses.

This submission to the 2024 Review references the detailed submission made by the South Australian Government during the 2018 WPA Review[3]. It builds on the improvements already implemented, highlights what is currently working well and should be maintained, and identifies the tasks required to support ongoing access to the WPA with the consideration of all stakeholder interests.

The 2018 Review of the Woomera Prohibited Area Coexistence Framework led to 12 recommendations, four of which have not been fully implemented:

1. That Defence and the South Australian government explore a grid-based zoning model for a Flexible Green Zone, including detailed modelling of testing activity to inform future development of a flexible Green Zone proposal.
2. Geological and economic analysis of the mineral, energy and groundwater resources potential of the Gawler Craton area, including the red zone within the WPA, should continue.
3. To modernise the administration of the WPA coexistence framework, a recommendation which is largely complete with an objective to develop a digital platform for access management remaining.
4. A further complete review of WPA arrangements by 2025, noting sunsetting of the *Woomera Prohibited Area Rule 2014* (the Rule) has been deferred from 1 October 2024 to 1 October 2026, effective 29 March 2024.

For the 2024 review, South Australia prioritises closing out the remaining four actions from the 2018 review and proposes additional recommendations to further enhance the coexistence framework and strengthen working relationships among all WPA users.

The recommendations for the 2024 review are:

1. Strengthening the role of the WPA Advisory Board, including the opportunity to consider impacts on other stakeholders. Consideration could be given to improved engagement by the Board with stakeholders to address emerging issues such as new technologies, biosecurity, environmental and cultural heritage management. Consider reviewing membership to include a senior representative from the South Australian Department of the Premier and Cabinet.

2. Defence and the South Australian Government should continue to employ a collaborative co-design process to determine a model which delivers a more flexible

[3] South_Australian_Government_Submission.pdf (energymining.sa.gov.au)

arrangement for access to and closure of the WPA green zone, and which would fold the existing Amber 2 Zone into a larger Green Zone

3. The South Australian Government seeks continued collaboration between Geoscience Australia, GSSA and Defence to deliver detailed geological and economic analysis of the mineral, energy and groundwater resources potential of the Gawler Craton area, including within the WPA red zone.

4. Consider on-going improvements to administration of the WPA coexistence arrangements, including formalising communication plans with key stakeholders and developing the proposed digital platform that support non-Defence users managing access requirements for the WPA.

5. The complete review of the WPA arrangements, particularly the review of the Rule by 1 October 2026, should ensure appropriate timeframes and engagement for stakeholders.

6. Consideration of mechanisms to deliver increased engagement opportunities with users of the WPA including guidance to enable early consideration on potential issues associated with the introduction and use of new technologies in the area such as drones, remote sensing, and autonomous mining and rail operations.

7. Given the significant costs involved with major mining project developments, consideration of mechanisms to provide early resource permit approvals (conditional or in principle) would build company confidence in progressing with the project development process, including seeking regulatory approvals.

8. Defence and Aboriginal groups in the WPA should continue to build on their relationships, including with respect to evaluating the management of cultural heritage and enhancing the partnerships with the different Aboriginal groups that access the WPA for cultural heritage and traditional land uses. The coexistence framework should lead the way in promoting and supporting further economic development opportunities for members of the Aboriginal communities in and around the WPA in alignment with Defence access frameworks.

9. Consideration should be given to reviewing the guidance for managing small parcels of land no longer suitable for pastoral activity, and guidance for pastoralists claiming compensation for losses due to Defence testing, including where the inability to use agricultural technologies is likely have financial implications.

10. Should access be further restricted, consideration of development of an equitable compensation framework for impacted users and the State.

3. Introduction

South Australia's economic success is underpinned by the resources, primary production and defence industries which fuel the prosperity and well-being of communities across the State. Additionally, these industries have the ability to fuel the development of regional centres, rural

towns and rail, road and coastal infrastructure. The WPA is significant to these three industries, and to traditional owners who use the WPA for cultural and traditional activities.

The WPA coexistence framework delivers positive interactions amongst the various stakeholders in the WPA and increased awareness and understanding of the many interests, rights, requirements and concerns of Defence, the South Australian Government, the minerals and energy resources sector, Aboriginal groups and traditional landowners, pastoralists, railway operators and other non-Defence users.

The WPA covers 12% of South Australia's landmass, approximately the size of England, and overlaps a large portion of SA's significant mineral resource potential including 30% of the Gawler Craton, one of the world's major mineral domains. Recent studies by the Geological Survey of South Australia (GSSA) with technical input from Geoscience Australia has identified more than 260 mineral occurrences within the WPA area, 35 of which are identified as essential to the economic and national security of the United States of America. In addition, the Coober Pedy Proclaimed Precious Stones field covers about 5,000 square kilometres, about 48 per cent of which falls within the WPA. The WPA Board has been effective in its primary role as an 'honest broker' and has been instrumental in building trust and confidence between key stakeholders and non-Defence users in the WPA. It has provided a formal forum for both Defence and non-Defence user groups to raise their issues and concerns be heard and facilitate outcomes. It has laid a strong foundation for relationship-building between and among key stakeholders in the WPA, having conducted one-one-one meetings with pastoralists, opal miners, exploration and mining companies, resource industry associations, environment groups, Aboriginal freehold landholders and native title claimant groups, railway owners and operators, and tourism operators.

4. Legislative Context

The WPA is operated under the following legislation.

- The Defence Act (Cth) 1903 authorises use of the WPA for testing of war material.
- The WPA Rule 2014 (the Rule) regulates most third-party access to the WPA.
- The Defence Force Regulations 1952 sets out historical access arrangements for traditional owners and native title holders, pastoral lease holders, railway authorities, and a limited number of mining operators.
- The WPA coexistence governance arrangements are within a Memorandum of Understanding (MOU) between the Commonwealth of Australia and South Australian Government and the WPA Advisory Board.

The Rule and WPA governance arrangements together form the 'Coexistence Framework'.

5. Terms of Reference – 2024 Review

The scope of the 2024 Review is set out within the Terms of Reference (TOR). Input into the review should focus upon qualitative and quantitative assessments of the balance of national interests over the short and medium (10-year) term with the interests of WPA stakeholders including opportunities to minimise regulatory burden and costs for third-party users. Accordingly, this submission assesses the current WPA Coexistence Framework, last

reviewed in 2018, to determine whether it remains fit for purpose considering the 2024 National Defence Strategy and the current strategic and economic environment. It considers national security, economic and cultural perspectives, and makes recommendations which emphasise the importance of the WPA to the people of South Australian and to the national interest, including to:

- Update coexistence governance arrangements; and
- Inform the remaking of the WPA Rule before it sunsets on 1 October 2026.

6. South Australian Strategic Context

The South Australian Government is committed to delivering a smart, sustainable, and inclusive economy that leverages its renewable energy, petroleum, and mineral resource endowments to deliver economic growth whilst also respecting our natural resources, progressing toward a net zero economy by 2050 and ensuring a better quality of life for all South Australians.

In 2024 the Government of South Australia announced the State Prosperity Project, a co-ordinated initiative to unlock the full potential of renewable energy, critical minerals, and green manufacturing to reindustrialise the upper Spencer Gulf region capitalising on a unique combination of solar and wind resources, valuable minerals including copper and magnetite iron ore, and steel manufacturing capability in alignment with the objectives of the Commonwealth's Future Made in Australia Bill.

South Australia is home to more than two-thirds of Australia's copper resource. The Gawler craton arguably hosts the world's most richly endowed iron oxide copper-gold ore province. With the proximity of the supergiant Olympic Dam deposit with its existing copper smelter, Carrapateena Prominent Hill and the emerging Oak Dam deposit, , South Australia has become a Tier 1 global copper province.

The South Australian Government is actively leveraging the forecast demand surge for copper required to supply the materials required for the global energy transition to deliver increased valuable exports, job creation and importantly, more complexity in the economy.

Industry confidence in the long-term value of the in-ground resources located within and adjacent to the WPA is clearly evidenced by BHP's substantial investments in the regions. An investment of over $9 billion in the purchase of OZ Minerals, including the Prominent Hill copper mine and the on-going strategic intent to increase copper production in South Australia are signals in the confidence industry holds in the ability to coexist in the WPA. BHP has outlined its intent to progress studies into increased copper production capacity at Olympic Dam to support the significant regional mining development plans. Capital expenditure associated with these projects is anticipated to be significant, in the billions.

South Australia is also actively developing its own Critical and Strategic Minerals Strategy in line with the Australian Government's efforts to establish secure and stable mineral supplies essential for industrial uses and as part of the clean energy transition. The establishment of new supplies of critical minerals and the development of a local critical mineral processing

sector will support the Australian and South Australian Governments to achieve multiple Defence, national security, resources and economic policy goals.

The South Australian Government has released the Green Iron and Steel Strategy, a key component of the State Prosperity Project. This initiative seeks to decarbonise steel production by leveraging the state's magnetite resources and renewable energy in the Upper Spencer Gulf. The strategy outlines South Australia's vision to become a leading global partner in sustainable steel manufacturing. The substantial identified magnetite resources within the WPA align with this initiative.

South Australia has delivered the *Hydrogen and Renewable Energy Act 2023* (HRE Act) which provides the regulatory framework to support the development of large-scale renewable energy and hydrogen projects.

Northern Water aims to deliver a reliable and sustainable new commercial water source to meet the growing needs of a broad range of resource, Defence, hydrogen and pastoral industries. Northern Water will unlock economic growth in industries and regions that are crucial to achieving net-zero targets and will reduce reliance on precious water resources like the Great Artesian Basin and the River Murray. This would be achieved by construction of a seawater desalination plant drawing water from the Spencer Gulf, connected by up to a 600km transfer pipeline to northern South Australia linking Eastern Eyre Peninsula, Whyalla, Port Augusta, Woomera, Carrapateena, Roxby Downs, Pimba, and Olympic Dam. The project is currently in the planning and assessment phase with a final investment decision subject to project approvals and agreements.

Whilst it is not anticipated that the Northern Water pipeline will be located within the WPA, the current proposed alignment, which is still subject to a site selection board process, runs through the Standing Permission Area within the Woomera Village and then runs north to Olympic Dam along the eastern side of the Olympic Dam Highway, adjacent to the WPA red zone. It is not anticipated that access within the red zone would be required to support construction activities. The Office of Northern Water Delivery is currently engaged with Defence on the potential for a future Stage 2 offtake agreement to deliver a reliable and sustainable water supply to support Woomera activities, as well as the immediate requirements to secure access for the pipeline construction, and subsequent operations and maintenance of the pipeline.

South Australia is key to the nation’s defence sector, with approximately 25 % of the nation’s defence industry in the state. In a period of geostrategic instability and increasing global tensions the availability of a large land-based test range is critical to the nation’s defence strategy. Rapid advances in technology and weaponry amongst our potential adversaries means that Australia needs to be able to test and trial a range of high technology capabilities in a secure and available environment. The WPA is the only area in Australia where many of these tests can be conducted.

South Australia acknowledges that the interests of all users of the WPA need to be balanced.

7. Importance of the WPA to South Australia's Economy

The WPA is situated on one of Australia's most endowed mineral provinces and has substantial demonstrated mineral deposits. The Warburton, Arckaringa and Arrowie sedimentary basins and Neoproterozoic Stuart Shelf overlie much of the Archaean to Mesoproterozoic basement rocks of the Gawler Craton. The geology supports demonstrated mineral deposit models include copper-gold-uranium-silver deposits, iron ore as magnetite and hematite skarn/replacement styles and iron ore as magnetite-bearing banded iron formation, orogenic gold and shear-hosted iron-oxide copper-gold. Copper, gold, iron, titanium, zirconium and silver are major known mineral commodities in the WPA.

Total annual exploration expenditure in the WPA averaged $40 million per year between 2005 and 2022, reaching a peak of $92.4 million in 2012. Mineral exploration expenditure in the WPA rose by 223% from $5.6 million in 2017 to $12.5 million in 2023.

The mineral occurrences, deposits, operating mines and petroleum wells in the WPA include:

- Three large scale mines currently operating within the WPA: the Prominent Hill iron oxide copper, gold, and silver mine (BHP), the Peculiar Knob iron ore mine (Peak Iron Mines) and the Buzzard iron ore mine (Peak Iron Mines).
- An additional two mines in care and maintenance: the Cairn Hill iron and copper mine (CU-River Mining Australia) and the Challenger gold and silver mine (Barton Gold Holdings Limited).
- Peak Iron are progressing the studies and regulatory applications to support the continued development of the Hawkes Nest area, focussing on the significant magnetite deposits.
- As an indicator of future mine development potential, 164 exploration leases are currently held by over 45 mineral exploration companies.
- For future petroleum and hydrogen resource development potential, three petroleum wells have been drilled (with oil shows), and nine petroleum exploration licenses are held in the WPA by three companies. Additionally, three petroleum exploration license applications within the WPA are specifically focused on hydrogen.

One of the key recommendations of the 2018 review of the WPA Coexistence Framework was the re-assessment of the economic value potential of the mineral prospectivity within WPA following the acquisition of considerable geoscientific datasets. In 2023, DEM contracted Scyne Advisory (formerly PwC Consulting Australia) to undertake an updated review of the WPA's mineral and energy resource potential and economic assessment for developing those potential future resources (Appendix A).

The updated 2023 resource prospectivity assessment of mineral, hydrogen and petroleum resources confirms that there is high potential for further discovery of copper, gold, silver, iron, titanium, zirconium, uranium and nickel and there is moderate potential for sedimentary-hosted copper and cobalt deposits in the WPA.

The 2023 economic assessments estimate the current WPA's Economic Demonstrated Resources (EDR) for the established and developing mines have a Net Present Value (NPV)

of $14.2 billion. The 2023 EDR NPV of $14.2 billion is a significant increase from the estimated $5.9 billion in 2018. This increase is primarily driven by an increase in the copper, gold and silver EDR at Prominent Hill and changes in commodity price forecasts. Under scenarios for possible future mines and energy resources, the NPV models for Low, Best and High scenarios for WPA development possibilities estimated returns of $3.1 billion, $12.2 billion and $23.4 billion respectively.

The 2018 review also recommended that the results of desktop assessments of mineral and petroleum potential of the WPA are tested in the field, with follow-up geoscientific surveys and the collection of precompetitive data inclusion of geological and geophysical datasets acquired since the 2010 Geoscience Australia assessment. The 2023 economic assessment addresses these recommendations by including data from the South Australian Government projects.

To realise the economic opportunities for South Australia, maintaining a coexistence framework that delivers certainty of access to the WPA is vital to secure on-going investment. Building flexibility into the framework is critical to support the transition from exploration activities to the development of profitable mining projects. Confidence in the workability of the framework translates to increased certainty that investment will deliver the economic benefits to industry and the people of South Australia.

DEM commissioned prospectivity report and economic assessment of resource potential is part of the deliverables of the 2018 WPA Review that DEM/South Australian Government is tasked as lead agency. As mentioned above, the DEM commissioned updated prospectivity report will form part of information and data that will be used to inform the recommended review of the WPA coexistence arrangements in 2025.

Many weapons, missile, rocket and technology tests conducted at the WPA are by overseas forces, sponsored by the Australian Department of Defence. The economic benefit of these activities to the state economy are significant, however they are difficult to quantify are the South Australian Government often has little visibility of the events at WPA.

8. Minerals and Energy Resource Sector

Mineral resources sourced from stable geopolitical environments are increasingly in demand, supporting responsible manufacturing and delivering low financial and social risk profiles. South Australia is recognised globally as a stable geopolitical jurisdiction.

The South Australian Government welcomes the opportunity to work with Defence in relation to national security concerns highlighted in the Australian Government 2024 National Defence Strategy which made clear that, in response to our deteriorating strategic circumstances, Australia – and in particular Defence – must accelerate capability development and acquisition, including of long-range strike, and investment in emerging technologies. The mineral resources industry is renowned for its innovation and welcomes opportunities for research and development of technologies including for unmanned and semi-autonomous systems. Overlapping technological enhancement across the sectors will assist with addressing issues associated with remote operations in often harsh environments made more so by climate change.

8.1 Mineral Production

Major mines such as the Prominent Hill copper-gold mine, Peculiar Knob iron ore mine, Buzzard iron ore mine, Challenger gold mine, and Cairn Hill magnetite iron ore mine are located within the WPA which have generated over 2000 full times jobs and contributed $200 million to the State accounts and contribute almost a quarter of total mineral royalty payments.

Production from Prominent Hill, Peculiar Knob, Challenger, Breadknife Hill Quarry and Fitzgerald's Dam Sandpit all located within the WPA together contributed over $39 million in royalty receipts in 2023/2024.

Prominent Hill Copper-Gold Mine

Owned and operated by BHP, the Prominent Hill mine produces one of the highest grades of copper concentrate in the world with a production rate of ~4.0Mtpa. The mine also produces silver and gold from a deposit of iron oxide copper gold style mineralisation.

The Prominent Hill mine is central to BHP's plans to grow copper production out of South Australia. An expansion plan is underway to instal a vertical hoisting shaft (the Wira shaft) at a capital cost of more than $600 million, to assist in maximising values from the mines approximately 140 million tonnes of underground copper-gold-silver resource. The shaft will increase production at Prominent Hill to 6.5 million tonnes per annum.

Investment in supporting infrastructure includes access roads, concentrate export road, bore field, electricity transmission lines, plant and equipment, airstrip and accommodation village.

Prominent Hill is a significant employer delivering substantial socio-economic benefits to the region and to the State. The Prominent Hill Pre-Employment Training Program facilitates employment opportunities for surrounding communities by providing educational support and training. The program focuses on long-term unemployed participants, and both indigenous and non-indigenous people who may have never worked within the mining industry. Training opportunities are provided to local workers to facilitate their growth and achieve nationally accredited qualifications. Indigenous employment and training programs involve collaboration with APY Lands, TAFE, and Bungala Aboriginal Corporation.

Peculiar Knob Iron Ore Mine

The Peculiar Knob Iron Ore mine contained an estimated 16.7 million tonnes (Mt) of hematite (iron ore) to a vertical depth of 175 metres. Iron ore is extracted at a rate of approximately 2.4 million tonnes per annum with ore hauled to a rail siding at Wirrida to be crushed onsite then transported to the Port of Whyalla ready for export.

Southern Iron Pty Ltd, a wholly owned subsidiary of Peak Iron Mines Pty Ltd, operates the mine via an open pit with the use of contract mining, crushing, and logistics service providers employing over 120 personnel directly, and indirectly supports employment and businesses in the WPA, Whyalla and in the region.

Mining operations are progressing towards the end of the life of mine plan which are expected to reach the end of economic extraction in 2025-26. Following completion of extractive activities the operation will transition into the closure and completion phases of the project.

Buzzard Iron Ore Mine

The Buzzard Iron Ore Mine has commenced mining operations. It comprises an open pit iron ore (hematite) mine and associated infrastructure. The Buzzard deposit global resource is 21.26 Mt of high-grade hematite.. The Buzzard open pit is expected to be 185 metres deep. The mining process will involve drilling and blasting the ore and waste material and loading onto haul trucks for removal from the pit. Waste will be placed into a waste rock dump (WRD) and ore will be stockpiled on the Run of Mine Pad (ROM) for processing and transport off the proposed Mining Lease (ML).

Peak estimate the project will generate 160 full time jobs and contribute $50 million to the South Australian economy in royalty payments over an initial 5 year mine life. It is noted that

Cairn Hill Iron Ore Mine

The Cairn Hill iron ore mine is situated in the northern Gawler Craton within the WPA. Iron Ore (magnetite), with associated copper and gold, is recovered via open pit operations with concentrate transported via haul road hauled to the Rankin Dam Rail Siding on the main North-South rail line. The mine is owned by CU-River Mining which has recently undergone a change of ownership. Operations were placed into care and maintenance in 2023 subject to on-going reviews of mine plans and near mine exploration activities to determine potential future operational scenarios.

Challenger Gold Mine

The Challenger gold mine is owned by Barton Gold and is located in the WPA. The Challenger gold mine is maintained in a state of care and maintenance and comprises the Challenger Mine (open pit and underground), the Challenger Mill, a mine village and associated infrastructure.

The Challenger Mine was discovered in 1995 by Dominion Mining and produced ~1.2Moz Au in operations from 2002 – 2018. The Challenger Mill is a ~650ktpa processing plant for production of gold. Due to the depth of the mine and requirement for substantial investment to renew the geological understanding of the deposit at depth, investigations into future development is not a priority focus for Barton.

The Challenger Mill presents an opportunity for processing of regional mineralisation in the vicinity of the mill. It also provides an attractive option for trucking and processing of ore from the Company's Tarcoola Project, which was previously undertaken during 2017 and 2018. The Challenger Mill is maintained in a state of care and maintenance.

Extractive Industry

Several smaller extractive mines operate within the WPA producing materials for construction, roads, mining and other industries, including for Defence use. Fifty-eight mineral tenements

held by ten mineral tenement holders produce a range of products including aggregates, sand, granite, calcrete, and gravel, and support employment in the quarrying and construction sectors.

Coober Pedy Opal Mining

The Coober Pedy Proclaimed Precious Stones field covers about 5,000 square kilometres of which approximately 50% falls within the WPA. Around $5.5 million worth of opals has come from this field with opal mining underpinning tourism in the region. Coober Pedy welcomes over 150,000 tourists every year adding to the local economy.

8.2 Resource Exploration

Approximately 300 mineral exploration licences were granted since the Coexistence Framework was implemented in 2011. As at 1 August 2024, there are 164 active mineral exploration licences in the WPA held by junior explorers, and by major mining companies including BHP and FMG Resources. From 2005 to 2022, total annual resource exploration expenditure in the WPA totalled more than $40 million per annum.

Explorers continue to seek out the WPA area for future projects with 13 Exploration Licence Applications currently under assessment covering a broad range of mineral targets.

The commodities pursued within the WPA via exploration and resource evaluation activities range from copper, gold, silver, platinum, iron, nickel, heavy mineral sands, uranium, lead, zinc, utile, magnetite, lead, tungsten, base and precious metals, rare earths, tin, nickel, titanium, diamonds, salt, cobalt, halloysite, palladium, potash, evaporites.

Exploration activities are conducted via ground and airborne geophysical surveys, geochemical surveys, environmental and cultural surveys, drilling, and drill site rehabilitation. Research conducted by the South Australian Government since 2018 has provided new and updated datasets for the benefit of all stakeholders. These datasets include: Gawler Craton Airborne Survey (and derivative products), magnetotelluric (MT) data from the Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP), releases from Gawler Phase 2: Next Generation Mineral Systems Mapping including the data acquisition project (gravity and magnetotellurics), a new Hiltaba Suite layer in SARIG, Neodymium map and new structures from SA Discovery Mapping.

8.3 Renewable Energy and Hydrogen Industry

The WPA is located in the Far North of the State where there is excellent coincident wind and solar resources. The South Australian Government is committed to leveraging its renewable energy resources and has brought forward its net 100% renewable electricity target by 3 years to 2027 and has implemented the HRE Act.

Preliminary industry engagement has identified several moderate to large companies expressing an interest in utilising remote areas which are in close proximity to the railway line between Adelaide and Darwin as it would allow for low-cost production of hydrogen and access to transport infrastructure linking to end use sites in both Adelaide and Darwin.

Consideration of how these new industries may seek to interact with the WPA and early identification of any constraints should be factored into the coexistence framework.

Given the high energy demand from operations including Olympic Dam and Carrapateena and the distance to electricity generation there is strong interest in the potential to develop renewable energy infrastructure in the vicinity of the WPA. Under AEMO's 2022 ISP Step Change Scenario, the projected electricity generation capacity in the Roxby Downs Renewable Energy Zone which is within the WPA is 700 MW.

Early engagement and an in-depth understanding of the interests of all parties can facilitate the consideration at the fundamental design stage and inform the type and location of potential new renewable energy infrastructure.

8.4 Petroleum and Gas Exploration

Petroleum exploration has occurred sporadically in the WPA between 2005 and 2017. Exploration targets have included conventional and shale gas and oil, and coal seam gas and potential coal gasification projects. However, more recently interest in natural hydrogen increased due to changing trends in energy exploration. There are currently 9 petroleum exploration licenses held in the WPA by three companies, and 18 petroleum exploration licence applications, including 3 licences with a specific focus on hydrogen exploration (as of 2022).

9. Primary Industries

Information provided by the South Australian Department of Primary Industries and Regions (PIRSA) highlights the significance of the WPA to the agricultural sector in addition to economic and regional development, and the preservation of the environmental health and biosecurity of the area.

The pastoral industry operates on Pastoral Leases issued over Crown Land under the *Pastoral Land Management and Conservation Act 1989* (PLMC Act). The Pastoral Board of South Australia is responsible to the Minister for Climate, Environment and Water for the administration of the PLMC Act and is supported by the Pastoral Unit in the Department for Environment and Water (DEW). The Pastoral Unit undertakes land condition assessments, regulates lessees against their lease conditions and manages lease tenure dealings (e.g. consents for transfers, mortgages, sub-leasing).

The WPA contains substantial sections of the South Australian Dog Fence, a key piece of infrastructure in wild dog management, protecting a $4.3 billion livestock industry, employing 15,000 South Australians with a value chain worth $1.3 billion annually.[4] The Dog Fence is 2,150km long and currently 1,600km is being rebuilt. These activities, commencing in 2020, aim to deliver the objective of reducing the impact of wild dogs and creating a net benefit to the community of between $56.4million and $112.9million over a 20-year period.[5]

[4] pir.sa.gov.au/__data/assets/pdf_file/0006/438513/sa-wild-dog-management-strategy.pdf

[5] Microsoft Word - A3891656 - Dog Fence Economic Analysis_Final_181221 (002).docx (pir.sa.gov.au)

Biosecurity is critical to maintaining the productivity of our primary industries and protecting our natural environments. PIRSA Biosecurity division manages the risks posed to South Australia by animal and plant pests and diseases, food borne illnesses and the misuse of rural chemicals. The pastoral industry, including those pastoral enterprises operating within the WPA, generate an estimated annual output of $226 million. Biosecurity risks are a continual challenge to animal health and the department undertakes disease response and animal surveillance programs as a key part an approach to protect and improve market access, increase farm productivity, protect public safety; some of these activities occur within the WPA or may occur within the WPA into the future.

Building on the existing relationships, Defence, PIRSA and DEW will continue to review and develop protocols which ensure operational efficiency for all parties and outline how they will respond to critical incidents including those associated with biosecurity risks.

10. Defence Use

The WPA is unique in the western world and must be maintained as a strategic asset. The Australian Government and allies can conduct tests and trial on the WPA that cannot be done anywhere else in the world. This capability is critical in the current unstable geopolitical environment where the development of technology by potential adversaries continues apace and must be countered and exceed by national capabilities.

The WPA is frequently accessed by the Defence Science and Technology Group, the Royal Australian Air Force local researchers and defence industry. This contributes to the development of national capability and is in the nation’s interests.

11. Indigenous WPA Users

The WPA is the traditional land of a number of Aboriginal groups - two Aboriginal groups (Maralinga Tjarutja and Anangu Pitjantjatjara Yankunytjatjara) with freehold land ownership over a significant portion of the WPA and four native title holders (Antakirinja Matu-Yankunytjatjara, Arabana People, Gawler Ranges People and Kokatha People). Generally, Aboriginal groups access the WPA for their traditional ceremonies, hunting, heritage site protection, and cultural activities. Like pastoralists, they are exempt from the WPA Rule, their occupation implicitly authorised under the Defence Force Regulations.

12. Tourism Industry

The WPA often draws tourists on their travels throughout outback South Australia due to its historical significance and beautiful landscape. The Woomera Village’s Heritage Centre, History Museum and Rocket Park are all popular tourist destinations depicting the WPA’s rich history, with 550 tourist permits issued during 2022-2023.

13. Recommendations

The WPA Coexistence Framework is functioning well, but ongoing improvements are essential to facilitate flexible access arrangements and instil confidence in users. Commercial ventures, particularly mining and exploration activities, rely on secure access to resource areas within

the WPA. Without certainty, confidence diminishes, leading to reduced investment and fewer capital-raising opportunities, ultimately hindering economic growth.

The 2018 review of the Woomera Prohibited Area Coexistence Framework resulted in 12 recommendations, four of which remain unimplemented. There is still room to further strengthen the framework. The South Australian Government presents the following recommendations, including the incomplete 2018 actions, to ensure a balanced consideration of national security, cultural, and economic interests in the WPA. These recommendations also aim to enhance the partnership between the South Australian and Australian governments, fostering sustainable regional growth and environmental management.

1. Strengthening the role of the WPA Advisory Board, including the opportunity to consider impacts on other stakeholders. Consideration could be given to improved engagement by the Board with stakeholders to address emerging issues such as new technologies, biosecurity, environmental and cultural heritage management. Consider reviewing membership to include a senior representative from the South Australian Department of the Premier and Cabinet.

2. Defence and the South Australian Government should continue to employ a collaborative co-design process to determine a model which delivers a more flexible arrangement for access to and closure of the WPA green zone, and which would fold the existing Amber 2 Zone into a larger Green Zone

3. The South Australian Government seeks continued collaboration between Geoscience Australia, GSSA and Defence to deliver detailed geological and economic analysis of the mineral, energy and groundwater resources potential of the Gawler Craton area, including within the WPA red zone.

4. Consider on-going improvements to administration of the WPA coexistence arrangements, including formalising communication plans with key stakeholders and developing the proposed digital platform that support non-Defence users managing access requirements for the WPA.

5. The complete review of the WPA arrangements, particularly the review of the Rule by 1 October 2026, should ensure appropriate timeframes and engagement for stakeholders.

6. Consideration of mechanisms to deliver increased engagement opportunities with users of the WPA including guidance to enable early consideration on potential issues associated with the introduction and use of new technologies in the area such as drones, remote sensing, and autonomous mining and rail operations.

7. Given the significant costs involved with major mining project developments, consideration of mechanisms to provide early resource permit approvals (conditional or in principle) would build company confidence in progressing with the project development process, including seeking regulatory approvals.

8. Defence and Aboriginal groups in the WPA should continue to build on their relationships, including with respect to evaluating the management of cultural heritage and enhancing the partnerships with the different Aboriginal groups that access the WPA for cultural heritage and traditional land uses. The coexistence framework should lead the way in promoting and supporting further economic development opportunities for members of the Aboriginal communities in and around the WPA in alignment with Defence access frameworks.

9. Consideration should be given to reviewing the guidance for managing small parcels of land no longer suitable for pastoral activity, and guidance for pastoralists claiming compensation for losses due to Defence testing, including where the inability to use agricultural technologies is likely have financial implications.

10. Should access be further restricted, consideration of development of an equitable compensation framework for impacted users and the State.

14. Conclusion

The South Australian Government welcomes the opportunity to participate in the 2024 Review of the Coexistence Framework and recognises the significant opportunity for the South Australian Government to ensure that Defence and Australian Government interests are correctly balanced with the interests of South Australians.

The Recommendations set out above seek to enhance the implementation of improvements to ensure a contemporary WPA coexistence framework for a stronger Australian Government-South Australian Government partnership towards national security, protection of Aboriginal heritage and the environment, sustainable regional growth, and continued economic development in South Australia.

The South Australian Government recognises that the WPA is an important national security asset used to advance strategic priorities and capability development to protect Australia's national security as well as being an area of strategic mineral significance, and of critical importance to the traditional owners, to its' pastoralists and of environmental importance.

In addition to the Recommendations set out above, the South Australian Government welcomes the opportunity to work with Defence in relation to national security concerns highlighted in the Australian Government 2024 National Defence Strategy which made clear that, in response to our deteriorating strategic circumstances, Australia – and in particular Defence – must accelerate capability development and acquisition, including of long-range strike, and investment in emerging technologies. The mineral resources industry is renowned for its innovation and welcomes opportunities for research and development of technologies including for unmanned and semi-autonomous systems. Overlapping technological enhancement across the sectors will assist with addressing issues associated with remote operations in often harsh environments made more so by climate change.

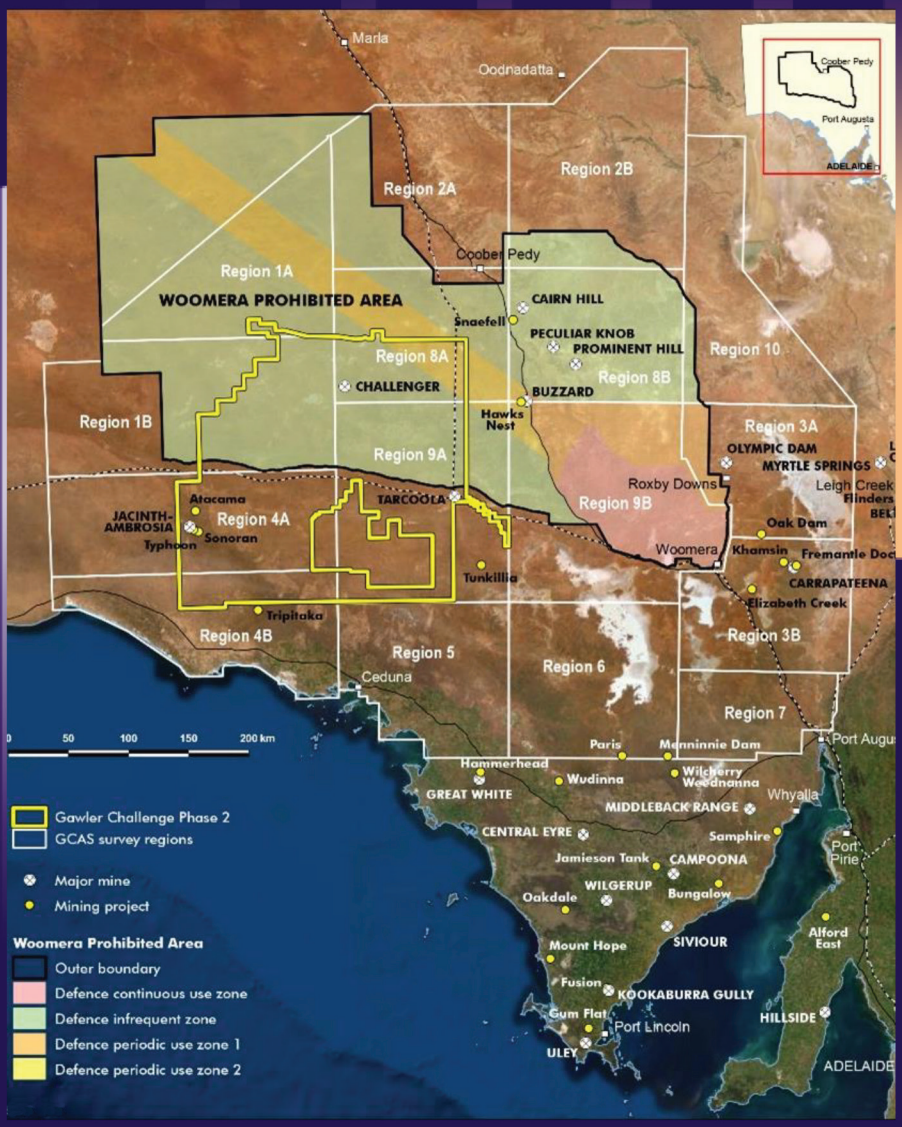
The WPA Advisory Board remains a critical component of the Coexistence Framework playing an important role in ensuring a forum for the interests of users to be communicated. The South

Australian Government is also committed to continuing discussions at Board meetings in addition to participating in the planned review of the Rule (which is sunsetting on 1 October 2026), to ensure the Rule and supporting coexistence arrangements are fit-for-purpose, as well contributing to the further wholesale Review of the WPA Coexistence arrangements by 2025.

South Australia is key to the nation's defence sector, with approximately 25% of the nation's defence industry in the state. In a period of geostrategic instability and increasing global tensions the availability of a large land-based test range is critical to the nation's defence strategy. Rapid advances in technology and weaponry amongst our potential adversaries means that Australia needs to be able to test and trial a range of high technology capabilities in a secure and available environment. The WPA is the only area in Australia where many of these tests can be conducted.

South Australia acknowledges that the interests of all users of the WPA need to be balanced.

Appendix A – WPA Resource Prospectivity and Economic Assessment



Woomera Prohibited Area Resource Prospectivity and Economic Assessment

Government of South Australia
Department for Energy and Mining

Department for Energy and Mining
Level 4, 11 Waymouth Street, Adelaide
GPO Box 618, Adelaide SA 5001
Phone +61 8 8463 3000
Email DEM.GSSA@sa.gov.au
DEM.CustomerServices@sa.gov.au
www.energymining.sa.gov.au

South Australian Resources Information Gateway (SARIG)
SARIG provides up-to-date views of mineral, petroleum and geothermal tenements and other geoscientific data. You can search, view and download information relating to minerals and mining in South Australia including tenement details, mines and mineral deposits, geological and geophysical data, publications and reports (including company reports).
map.sarig.sa.gov.au

Disclaimer
This report has been prepared by an author external to the Department for Energy and Mining (and the Government of South Australia) with input from DEM staff including Mitchell Bockmann, Adrian Fabris, George Gouthas, Jonathan Irvine, Carmen Krapf, Andrew Manson, Anna Petts and Tom Wise. Any statements or opinions expressed in this report are those of the author, and do not represent the views of the Department for Energy and Mining (or the Government of South Australia).

The contents of this report are for general information only and are not intended as professional advice, and the Department for Energy and Mining (and the Government of South Australia) make no representation, express or implied, as to the accuracy, reliability or completeness of the information contained in this report or as to the suitability of the information for any particular purpose. Use of or reliance upon the information contained in this report is at the sole risk of the user in all things and the Department for Energy and Mining (and the Government of South Australia) disclaim any responsibility for that use or reliance and any liability to the user.

Acknowledgement of Country
As guests on Aboriginal land, the Department for Energy and Mining (DEM) acknowledges everything this department does impacts on Aboriginal country, the sea, the sky, its people, and the spiritual and cultural connections which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.

Contributions
DEM would like to acknowledge the contributions of staff towards the compilation and analysis of the resource prospectivity and economic assessment; in particular – Adrian Fabris, Tom Wise, Carmen Krapf, Andrew Manson, Cathy Lacar, George Gouthas, Jonathan Irvine, Bronwyn Camac and Anna Petts.

Preferred way to cite this publication
Scyne Advisory 2025. *Woomera Prohibited Area resource prospectivity and economic assessment*, Report Book 2024/00032. Department for Energy and Mining, South Australia, Adelaide.

Preface

In 2023 the Department for Energy and Mining (DEM) committed to delivering an updated version of the 2010 and 2018 Woomera Prohibited Area (WPA) Coexistence Framework review of mineral and petroleum resource prospectivity by the Office of the Chief Economist (OCE) in the then Department of Industry, Innovation and Science. The 2018 Mineral and Petroleum Resources and Potential report compiled by Geoscience Australia (GA) recommended that a re-assessment of the WPA using the entire catalogue of existing available geoscientific data and information, including new data acquired since the 2018 report, using updated assessment methods be undertaken within a 5-year timeframe.

DEM commissioned Scyne Advisory to undertake the resource prospectivity review and economic assessment, with considerable input from DEM subject matter experts. The review has been based on updating previous reviews with data generated since 2018 (including GCAS, Gawler Phase 2: next generation mineral systems mapping) and all other geological investigations and geoscientific studies undertaken since the last review) plus historic and current exploration, drillholes and samples, interpretive datasets and key research papers, and groundwater data.

There is now international recognition of the strategic and critical role of mineral and energy resources in implementing the global energy transition. In the past 5 years there has been a dynamic shift in commodity interest (and inclusion of newly defined 'resources' as exploration targets) within the WPA. Therefore, in addition to the previously identified mineral commodity types in the WPA there is an increased potential for the discovery and development of additional resources in the future, especially for critical minerals. The resource potential assessment aims to quantify and discuss the potential for undiscovered mineral and energy resources, the assessment of extractive materials, and the assessment of groundwater resources within the WPA.

The reported economic potential for solar renewable energy within the WPA are estimates of the net present value of energy capacity development scenarios in the region considered by the Australian Energy Market Operator (AEMO) in its roadmap for the energy transition in the National Electricity Market (NEM) over the next 20 years.

Additional transmission investment required for such capacity to be grid connected has not been considered here, nor has the AEMO identified advantages of developing renewable energy projects outside the WPA, including in the South-East and Mid North of South Australia.

DEM also prioritised the inclusion of a whole of economy impact assessment of future resource developments within the WPA. The assessment included direct and indirect economic impacts of increased mining of 'known' mineral and energy resources (Economic Demonstrated Resources), possible future mineral and energy resource discoveries, and the potential for increased productivity of mining within the WPA with greater use of local renewable energy generation.

Any exploration or development planning within the WPA must take into consideration the legislative provisions of the *Woomera Prohibited Area Rule 2014 (the Rule).* The Rule

prescribed four access zones. Defence's powers to issue permits, declare exclusion periods and issue penalties are outlined in the Rule. The Rule applies to people seeking access permits for:

- Resources exploration and production
- Tourism
- Opal mining
- Research, environmental and other activities.

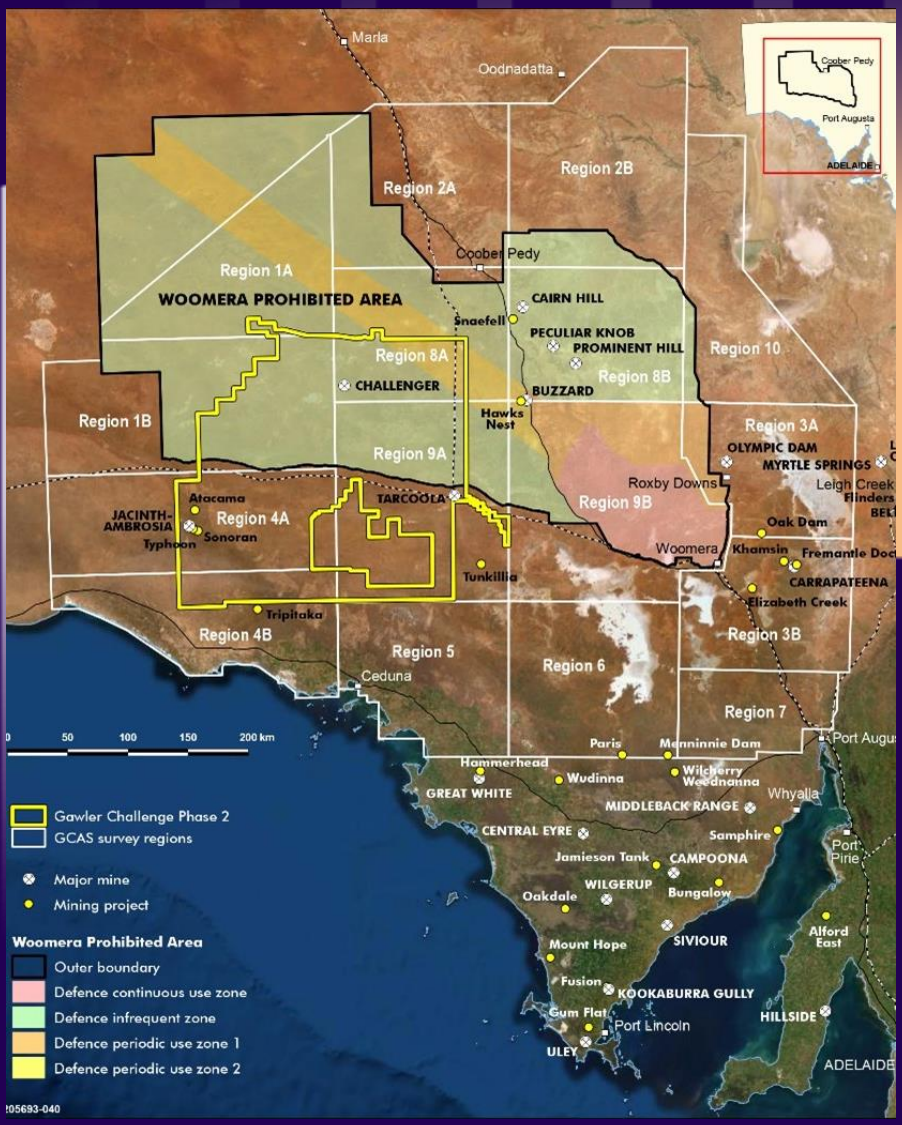
More information may be found here: https://www.defence.gov.au/bases-locations/sa/woomera.

scyne ADVISORY

Department for Energy and Mining

Woomera Prohibited Area Resource Prospectivity and Economic Assessment

October 2024



scyne.com.au

Disclaimer

This report is not intended to be read or used by anyone other than the South Australian Government Department for Energy and Mining.

We prepared this report solely for the South Australian Government Department for Energy and Mining's use and benefit in accordance with and for the purpose set out in our engagement letter with the South Australian Government Department for Energy and Mining dated 13 June 2023. In doing so, we acted exclusively for the South Australian Government Department for Energy and Mining and considered no-one else's interests.

We accept no responsibility, duty or liability:

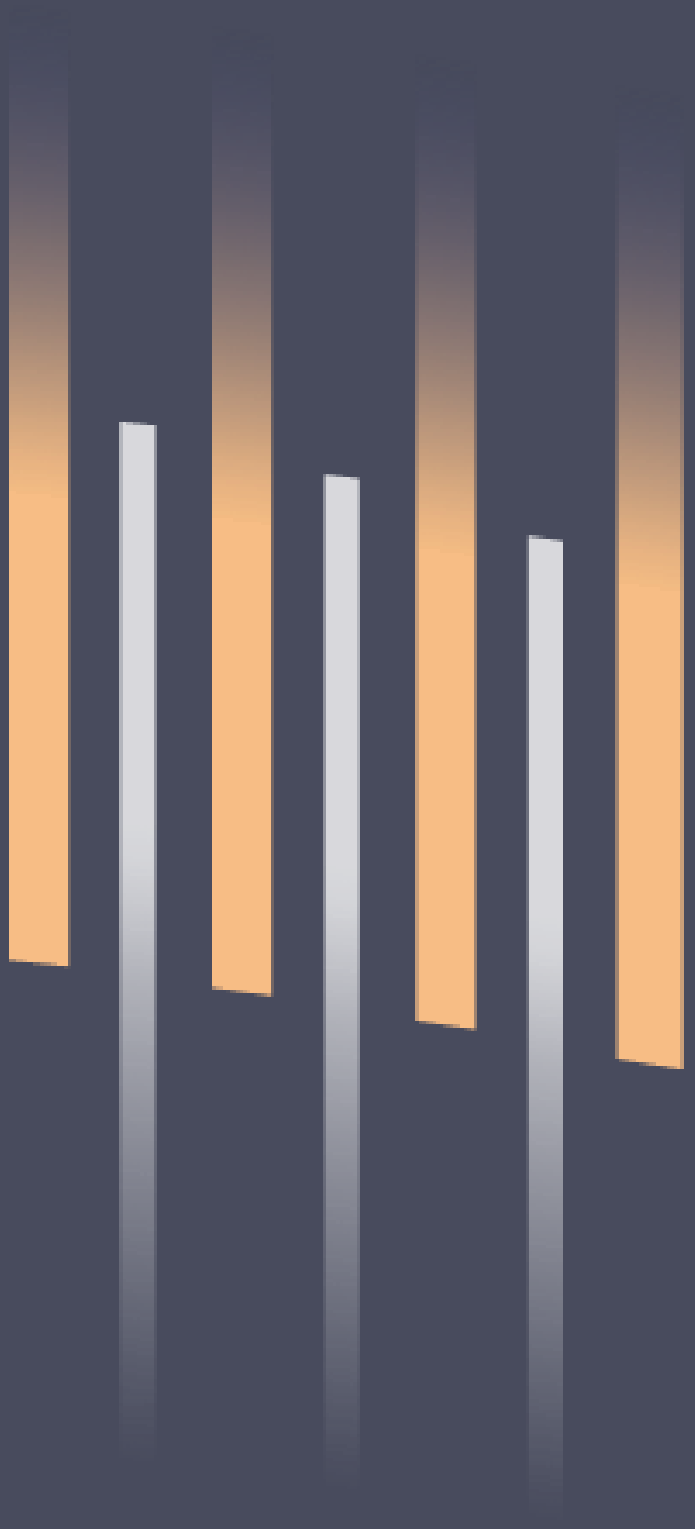
- to anyone other than the South Australian Government Department for Energy and Mining in connection with this report
- to the South Australian Government Department for Energy and Mining for the consequences of using or relying on it for a purpose other than that referred to above.

We make no representation concerning the appropriateness of this report for anyone other than the South Australian Government Department for Energy and Mining. If anyone other than the South Australian Government Department for Energy and Mining chooses to use or rely on it they do so at their own risk.

This disclaimer applies:

- to the maximum extent permitted by law and, without limitation, to liability arising in negligence or under statute; and
- even if we consent to anyone other than the South Australian Government Department for Energy and Mining receiving or using this report.

Liability limited by a scheme approved under Professional Standards legislation.



Executive summary

Context and purpose of this report

The Woomera Prohibited Area (WPA) lies approximately 450 kilometres (km) northwest of Adelaide in central South Australia (SA) and covers an area of approximately 122,191 km^2. The WPA is a major Australian military and civil aerospace and testing facility and a key asset in Australia's defence capability development. It is also an area of potential economic importance in terms of its natural resources, home to Aboriginal communities and pastoralists, and is increasingly an asset as a tourism destination.

Given the unique nature of the WPA, periodic reviews of its resource prospectivity have been undertaken in recent years and this report provides an update of these reviews. In 2010, the Australian Government undertook a review of the WPA that led to the establishment of a coexistence framework that balances the interests of all stakeholders in the area. This was followed by a review in 2016, evaluating the effectiveness of the framework established in 2014, and again in 2018. For the 2010 and 2018 reviews, the Office of the Chief Economist within the Department of Industry, Science and Resources undertook an economic assessment of mineral and petroleum resources in the WPA, in collaboration with Geoscience Australia's review of mineral and energy resource prospectivity. In this report, the SA Department for Energy and Mining (DEM) has contracted Scyne Advisory (formerly PwC Consulting Australia) to undertake an updated review of the WPA's mineral and energy resource potential and prospectivity as well as an economic assessment of developing those potential resources.

The WPA is located within one of Australia's most endowed mineral provinces, the Gawler Craton. Many of the known resources and deposits within the WPA occur within the Archean to Mesoproterozoic basement rocks of the Gawler Craton, which are covered by the Warburton, Arckaringa and Arrowie sedimentary basins. Demonstrated mineral deposit models include iron-oxide copper-gold-uranium-silver (Prominent Hill), iron ore as magnetite and hematite skarn/replacement styles (Peculiar Knob, Snaefell), iron ore as magnetite-bearing banded-iron formation (Hawks Nest), orogenic gold (Challenger) and shear-hosted iron-oxide copper-gold (Cairn Hill). Copper, gold, iron, titanium, zirconium and silver are major known mineral commodities in the WPA, and with cobalt and uranium deposits nearby (Figure. 1).

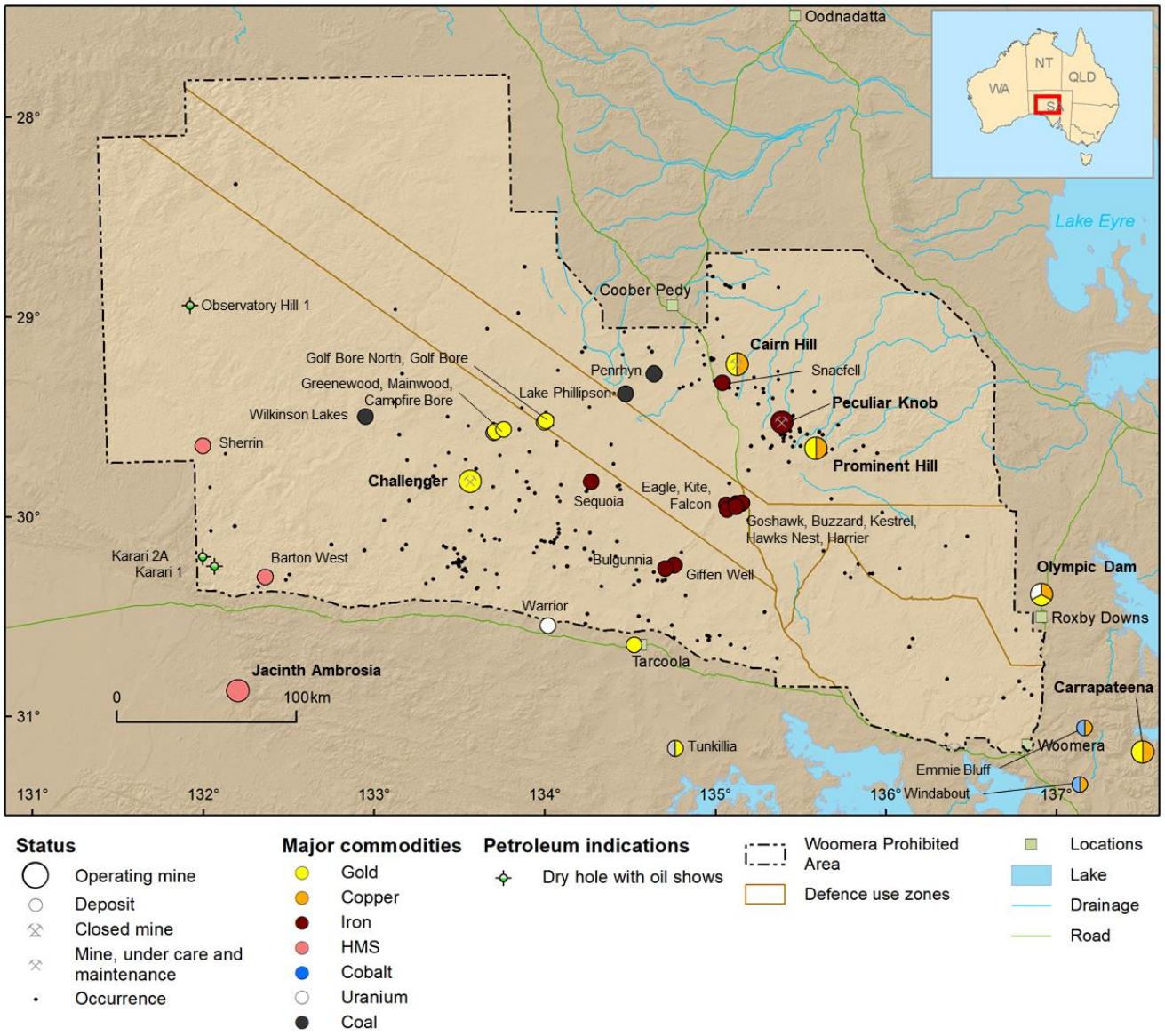
The mineral occurrences, deposits, operating mines and petroleum wells that explore and extract the WPA's resources include:

- There are two operating mines – the Peculiar Knob iron ore mine and the Prominent Hill iron-oxide copper gold and silver mine.
- There are two mines in a state of care and maintenance – the Challenger gold and silver mine and the Cairn Hill iron and copper mine.
- As an indication of future mine developments, 174 exploration leases are currently held by over 40 mineral exploration companies. Exploration expenditure in 2022 stood at $16 million; a slight recovery since 2017 (provide number $). Buzzard, a hematite iron ore body within the Exploration licence of Hawks Nest, is a priority for development by Peak Iron Mines.
- Following indicators of future energy resource developments include: three petroleum wells (with oil shows); nine petroleum exploration licenses held in the WPA by three companies; a further three petroleum exploration licence with a specific focus on hydrogen exploration in application status. With the sole exception being a technical evaluation costing $50,000 in 2022, no petroleum exploration and expenditure has occurred within the WPA since 2016.

In this report, the SA Department for Energy and Mining (DEM) has contracted Scyne Advisory (formerly PwC Consulting Australia) to undertake an updated review of the WPA's mineral and energy resource potential and economic assessment of developing those potential future resources. One of the key recommendations of the Geoscience Australia 2018 review of the WPA was the re-assessment of the WPA utilising the entire catalogue of recently available geoscientific data and information using updated assessment methods be undertaken. The 2018 review also recommended that the results of desktop assessments of mineral and petroleum potential of the WPA are tested in the field, with follow-up geoscientific surveys and the collection of precompetitive data inclusion of geological and geophysical datasets acquired since the 2010 Geoscience Australia assessment. The 2023 assessment addresses these recommendations by including data from the Gawler Craton Airborne Survey (GCAS) (and derivative products), magnetotelluric (MT) data from the Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP), releases from Gawler Phase 2: Next Generation Mineral Systems Mapping including the data acquisition project (gravity and magnetotellurics), the new Hiltaba Suite layer in SARIG, Neodymium map and new structures from SA Discovery Mapping.

The following pages (5-19) were removed from this PDF due to accidental duplication in the original document.

Figure 1: Known or demonstrated mineral occurrences, deposits and operating mines, and petroleum wells with shows, in and around the WPA.



Approach to the 2023 update

One of the key recommendations of the Geoscience Australia 2018 review of the WPA was the re-assessment of the WPA be undertaken utilising the entire catalogue of recently available geoscientific data and information using updated assessment methods. The 2018 review also recommended that the results of desktop assessments of mineral and petroleum potential of the WPA are tested in the field, with follow-up geoscientific surveys and the

collection of precompetitive data inclusion of geological and geophysical datasets acquired since the 2010 Geoscience Australia assessment.[1]

Furthermore, the following tasks have been undertaken as part of the 2023 review:

- documented exploration activities in the WPA
- updated the prospectivity analysis using new datasets and included additional deposit styles and commodities: sedimentary-copper, high purity alumina, clay-hosted rare earth elements, lithium, extractive materials and the emerging energy resources of solar, wind and natural hydrogen
- developed a quantitative approach to assessing undiscovered resource potential using the mapped prospective areas and representative grade and tonnage models of the various deposit styles that have a relatively high potential for discovery in the WPA
- assessed the known economic demonstrated resources (EDR) and potentially undiscovered mineral resources
- provided a net present value (NPV) analysis of the known mineral resources and potential future mine and energy developments in the WPA
- provided an economic assessment of the potential future mine and energy developments in the WPA.

Resource prospectivity assessment

The updated resource prospectivity assessment of mineral, hydrogen and petroleum resources, shown in Figure 2, concludes that there is high potential for further discovery of copper, gold, silver, iron, titanium, zirconium, uranium and nickel and there is moderate potential for sedimentary-hosted copper and cobalt deposits in the WPA. These prospectivity ratings are relative and are based on the presence of favourable geological criteria for the respective deposit model and the presence of known deposits of the type. Specific areas in the WPA, denoted in Figure 2, feature:

1. **North-west:** Moderate potential for natural hydrogen and moderate-high potential for petroleum accumulations, and generally low potential for most mineral deposit types
2. **South-west:** High potential for Heavy Mineral Sands deposits (this is the only area with potential for heavy mineral sands deposits in the WPA)
3. **Central:** Areas of high prospectivity for orogenic gold and iron ore deposits, with high potential for petroleum and coal towards Coober Pedy
4. **North-east:** Areas of high prospectivity for iron-oxide-copper-gold (IOCG) deposits (which could contain copper, gold, uranium, silver and REEs), iron ore, nickel deposits and petroleum accumulations
5. **South-east:** Areas of moderate-high potential for IOCG and nickel deposits, and moderate potential for sediment-hosted copper deposits (which could also contain cobalt and silver)

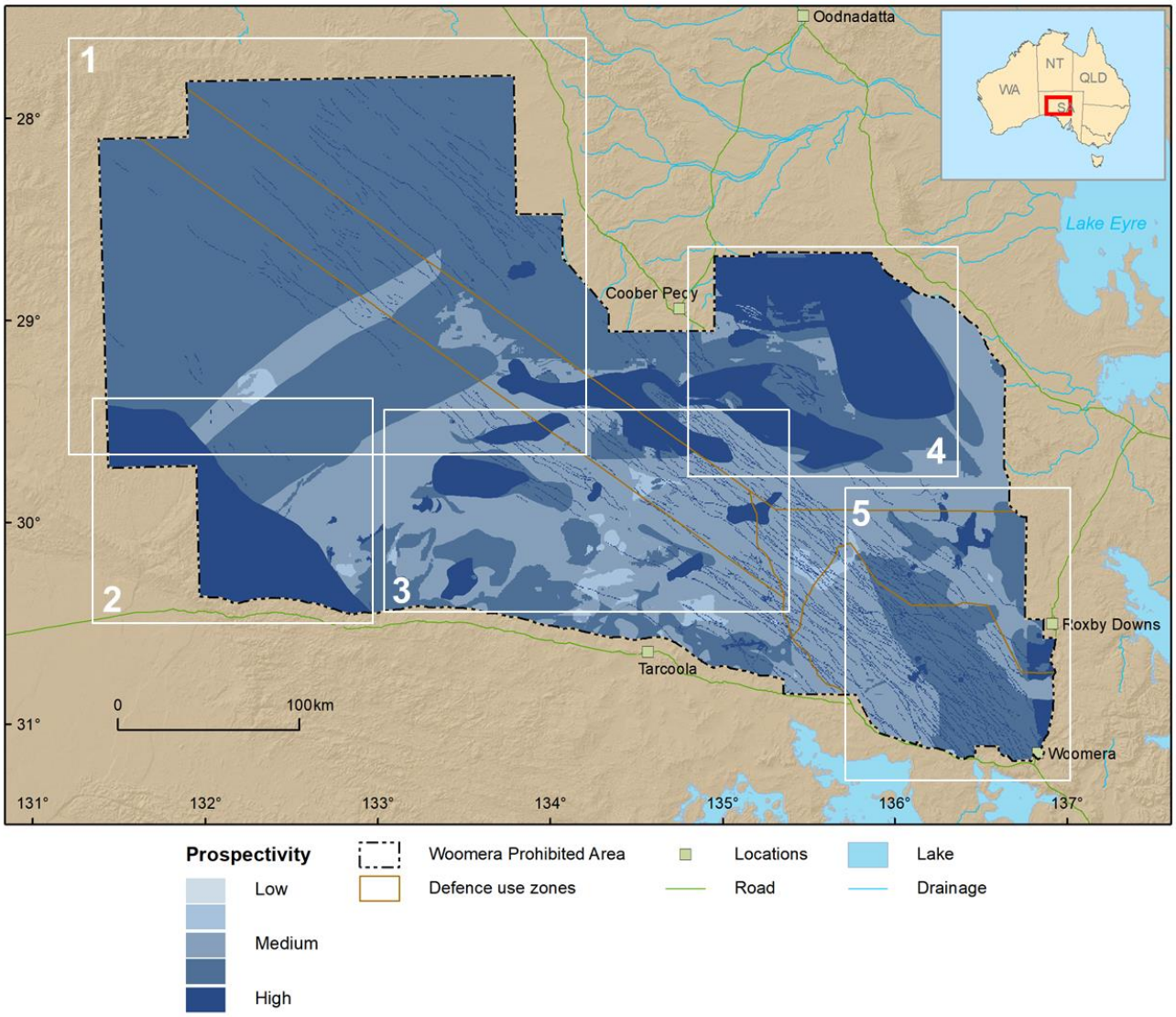
This resource prospectivity assessment does not assess factors that influence the economic viability of future deposits, such as proximity to existing infrastructure and depth of occurrence. Depth to basement can have significant implications for the development cost, and therefore the commercial viability, of extracting the target mineral and energy resource, but it does not impact the geological potential for mineral and energy resource deposits to exist.

Some of these deposits may also contain economic rare-earth elements (REE). Although no critical commodities are currently being produced in the WPA, the energy transition is driving demand for rare-earths, nickel, cobalt and

[1] This assessment includes data from the Gawler Craton Airborne Survey (and derivative products), magnetotelluric (MT) data from the Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP), releases from Gawler Phase 2: Next Generation Mineral Systems Mapping including the data acquisition project (gravity and magnetotellurics), the new Hiltaba Suite layer in SARIG, Neodymium map and new structures from SA Discovery Mapping.

heavy mineral sands. The energy transition also has implications for the type of energy developments that have been considered for development in the WPA in this assessment. Most of the Roxby Downs Renewable Energy Zone falls within the WPA, and the projected generation potential of solar resources under the Australian Energy Market Operator (AEMO) 2022 Integrated System Plan (ISP) scenarios has been included in the NPV analysis and economic assessment of this study.

Figure 2: Combined resource potential for the WPA (including mineral and energy resources)



Undiscovered resources potential and Net Present Value

A quantitative approach to undiscovered resources for copper, gold, iron, uranium, heavy mineral sands (titanium and zirconium), cobalt and silver was developed, and these estimates provide an upper bound constraint on the potential quantities that could be discovered in the WPA. Analogue mines were identified through a workshop with DEM to determine the NPV of future developments, estimated using projected commodity prices from the March

2023 edition of the *Resources and Energy Quarterly*[2] and the July 2023 release of S&P Market Intelligence's Commodities Estimates, and publicly available data on costs and resource life.

Consistent with the 2018 report, an economic assessment has been undertaken only for possible future mineral and energy resource developments in the WPA. Three scenarios were modelled, developed from the Low, Best and High estimates of the potential undiscovered resources in the WPA.

- **Low scenario:** The 'Low' scenario assumes 1-2 deposits of each modelled deposit style could be discovered and developed in the WPA. These discoveries are sized within the constraints of the low estimate of undiscovered resources. It is a conservative scenario that reflects limited future potential of the modelled commodities in the WPA.
- **Best scenario:** The 'Best' scenario expands on the Low Scenario, assuming multiple deposits across the assessed deposit styles could be discovered and developed within the WPA, sized within the constraints of the median estimate of undiscovered resource. It reflects a 'most likely' scenario based on remaining undiscovered resources and a range of possible mine developments.
- **High scenario:** For most commodities, the 'High' scenario expands on the Best Scenario to twice the number of deposits across multiple deposit styles that could be discovered and developed within the WPA within the constraints of the High estimate of undiscovered resources. It is an optimistic scenario where a greater number of discoveries is made across high value commodities, including a substantial IOCG deposit.

The WPA's EDR is estimated to be a NPV of $14.2 billion (Table 1). The NPV of possible future mines and energy resources in the WPA is estimated to be $3.1 billion, $12.2 billion and $23.4 billion for the Low, Best and High scenarios.

The EDR NPV has significantly increased from the $5.9 billion estimated in 2018 to $14.2 billion (this study). This increase is primarily driven by an increase in the copper, gold and silver EDR at Prominent Hill and changes in commodity price forecasts. The estimated NPV for mineral resources in the Low, Best and High scenarios also capture a wider range in NPV potential compared to the estimated $6.4 billion and $19 billion in the Conservative and Optimistic scenarios respectively in 2018. The approach to constraining potential resource production in each scenario is probabilistic in the 2023 analysis, and different commodity pricing forecasts and the inclusion of additional commodities (cobalt, nickel and solar) also affect the calculated NPV. Given this potential resource range has been determined through a methodology enabled by the inclusion of new datasets, the uplift in volumes and in financial value, as per NPV demonstrate what a significant value these pre-competitive geoscience datasets provide.

Table 1: Summary of NPV of economic demonstrated resource and potential undiscovered resource scenarios, by commodity ($ million)

Commodity	2023 EDR NPV	Low NPV	Best NPV	High NPV
Copper	8,593	1,559	5,697	11,394
Gold	4,870	360	1,851	3,702
Iron	553	131	393	1,378
Uranium	N/A	440	1,605	3,210
Heavy mineral sands (zircon, rutile, ilmenite)	N/A	241	894	1788
Nickel	N/A	267	1,409	872
Cobalt	N/A	8	49	97
Silver	194	27	138	277
Solar	N/A	71	147	693

2 Office of the Chief Economist, 2023, Resources and Energy Quarterly, March 2023, Department of Industry, Science and Resources, Australian Government

Commodity	2023 EDR NPV	Low NPV	Best NPV	High NPV
Total	**14,211**	**3,106**	**12,183**	**23,411**

Source: Scyne Advisory and DEM analysis, 2023
Note: NPV uses a real discount rate of 7%

Economic impact assessment

An economic assessment has been undertaken to quantify the direct and indirect economic impacts associated with possible future mineral and energy resource developments in the WPA. The assessment reflects the total economy-wide impacts by using a specialised model for this purpose.

The economic modelling framework employed is a computable general equilibrium (CGE) model, which is a sophisticated, multivariate model that measures the effect an investment or initiative has on the national and state/territory economies. A CGE model takes into account the direct and indirect effects as well as the resource constraints of the economy by recognising that increased demand for labour and capital in some sectors comes at the expense of other sectors. The specific model used is the Victoria University's Regional Model (VURM). This contains multiple regions, industries and commodities and therefore provides a highly disaggregated representation of the Australian economy. A dynamic version of the model is used, which enables an analysis of the impacts of the possible future mineral and energy resource developments in the WPA over its development and operations.

Three scenarios are analysed here – the low, best and high scenarios described above. The key inputs into the economic assessment include, for each of the three scenarios, the development phase costs of exploration expenditure for mining projects and capital expenditure for both mining and energy resource projects. Additionally, inputs are included for the economic saving that comes from solar energy generation enabling a reduction in the mining sector's use of diesel. Apart from the renewable energy source substitution, we have not assumed any complementary policy adjustments affecting mining inputs or productivity that would exogenously drive growth of the mineral mining sector in Australia. To that effect, the results present the economic impact of the project itself – rather than accounting for any external factors that may lead to additional economic growth.

State level results are the focus of this assessment. As states exist in an economy competing nationally for capital and labour, the gains to the state where possible future mineral and energy resource developments are located typically means a relative loss of resources from other states.

The analysis shows significant impacts to gross state product (GSP) and jobs in the SA economy, as well as supporting growth in Australia's gross domestic product (GDP). A summary of the economic impact results is presented in Table 2.

Table 2: Summary of economic impacts

Outcome modelled		Low scenario	Best scenario	High scenario
SA GSP ($2022-23, discounted at 7%)	Development phase (2023/24 – 2033/34)	$4.4bn	$9.4bn	$18.2bn
	Operation phase (2034/35 – 2060/61)	$5.4bn	$14.6bn	$27.4bn
	Total (2023/24 – 2060/61)	$9.8bn	$24.0bn	$45.6bn
Australian GDP ($2022-23, discounted at 7%)	Development phase (2023/24 – 2033/34)	$1.0bn	$2.3bn	$4.4bn
	Operation phase (2034/35 – 2060/61)	$0.3bn	$0.5bn	$2.4bn
	Total (2023/24 – 2060/61)	$1.3bn	$2.8bn	$6.8bn

Outcome modelled		Low scenario	Best scenario	High scenario
SA employment (FTE)	Development phase – Average annual (2023/24 – 2033/34)	3,000	6,700	12,900
	Development phase – Peak investment year (2033-34)	5,400	15,300	33,800
	Operation phase – Average annual (2034/35 – 2060/61)	3,600	10,400	18,800
SA state royalties ($2022-23, undiscounted)	Operation phase – Average annual (2034/35 – 2060/61)	$0.1bn	$0.3bn	$0.5bn
	Operation phase – Total (2034/35 – 2060/61)	$1.7bn	$6.3bn	$12.7bn

Source: Scyne Advisory analysis (2023) using Victoria University's VURM CGE model

Key updates from the 2010 and 2018 analysis

This study is an updated review of the mineral and energy resource prospectivity of the Woomera Prohibited Area (WPA) following the acquisition of pre-competitive datasets earlier in 2023 and was done in a highly collaborative manner across the Department for Energy and Mining (DEM) and Scyne Advisory (formerly PwC Consulting Australia).

DEM outlined an approach that adopted the resource prospectivity and NPV approach undertaken by Geoscience Australia in 2010 and 2018, with an objective to incorporate the prospectivity maps into the methodology for determining undiscovered potential volumes and use Computable General Equilibrium (CGE) modelling to determine the economic impact of the resources in the WPA. This required ongoing collaboration across data inputs; methodology; testing and refinement of assumptions; peer review and discussion on results and their interpretation. There was a "one team" approach between Scyne Advisory and DEM.

Specifically, across the three phases of work, there were some key aspects of this approach to highlight:

Resource Prospectivity Analysis

Prior to the commencement of the study, DEM reviewed the deposit models used in the two prior reviews conducted by Geoscience Australia and documented which commodities would require updates or new inputs following the acquisition of pre-competitive data in the area. DEM prepared a 'WPA Atlas 2023' ArcGIS project, containing these datasets and the other inputs required to develop the deposit models. This data, and the deposit models were provided to Scyne Advisory.

The process for generating the prospectivity maps was very iterative – Scyne Advisory generated the prospectivity maps based on the inputs provided by DEM, with regular check-ins with DEM on the approach used. DEM reviewed the outputs maps, inputs used and any interpretations made by Scyne Advisory to delineate areas of different potential.

One of DEM's objectives for this report was to develop a more robust, quantitative approach to determining the undiscovered resource potential in the Woomera Prohibited Area (WPA). DEM provided Scyne Advisory with a quantitative assessment methodology[3] developed by Donald A. Singer, a prominent United States Geological Survey (USGS) geologist, known as the USGS three-part assessment system[4]. Scyne Advisory and DEM agreed to

[3] Singer, D. A. (2010). Progress in integrated quantitative mineral resource assessments. *Ore Geology Reviews*, *38*(3), 242-250.

[4] Porwal, A. K., & Kreuzer, O. P. (2010). Introduction to the special issue: mineral prospectivity analysis and quantitative resource estimation. *Ore Geology Reviews*, *38*(3), 121-127.

replicate the approach used by Singer and Kouda[5], and DEM reviewed the outputs of the model for each commodity, which generated a P90, median and P10 estimate of undiscovered resource by commodity.

Net Present Value Analysis

The 2018 approach to determining NPV was to use analogue mines to provide the life of mine, cost and production inputs for the NPV calculation. These mines were determined by a judgement by Geoscience Australia on *"the likely maximum number of deposits that could be discovered and developed within the WPA in the short to long term"* in a Conservative and Optimistic Scenario[4].

For this study, the combined team identified appropriate analogue mines for each deposit style, constrained by the outputs of the undiscovered resource potential analysis. Because the methodology for determining undiscovered resource produced a P90, median and P10 estimate of undiscovered resource, three scenarios of analogue mines, described as Low, Best and High, were developed. DEM and Scyne Advisory held two workshops during this process, to identify and test the analogues and number of analogues selected for each scenario.

There was also consistent collaboration across DEM and Scyne Advisory to collect the data inputs and assumptions made in the NPV calculations. Production and cost input data was collated by Scyne Advisory, with assistance from DEM, for new analogue mines in the 2023 analysis. The combined team agreed to maintain consistency with the 2018 study and apply a real 7 per cent discount rate for the NPV calculation.

Economic Impact Assessment

This study uses CGE analysis as the basis for the economic impact assessment, which differs from the input-output modelling approach undertaken in the 2018 study. As a result, the new methodology involved set up of a new model and drove a new set of outputs. To support this process, the DEM team included economists, and as such there were key review points during this phase of work to test assumptions, inputs and results, and provide feedback to the Scyne Advisory team.

Specifically, Scyne Advisory and DEM agreed on economic modelling inputs and assumptions (e.g. exploration times and costs, increased investment in South Australia in specific industries relating to the commodities included in the scenarios (Iron Ore Mining; Non-Ferrous Metal Ore Mining) and increased investment in South Australia's renewable electricity sector (Other Electricity Generation)).

More detail on the specific approach taken for each of the three major phases of work is provided in a supplementary appendix to this report.

---

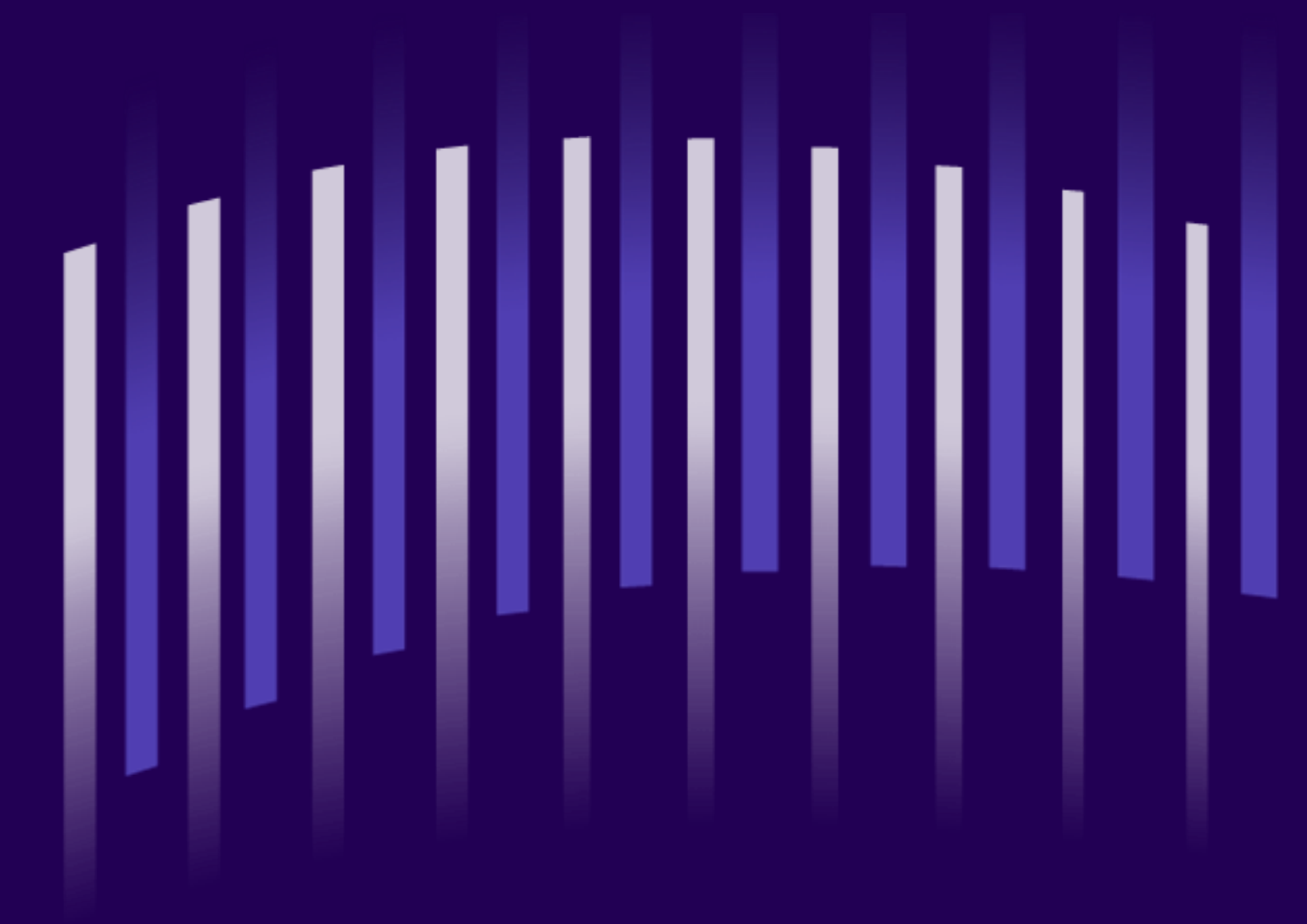
5 Singer, D. A., & Kouda, R. (2011). Probabilistic estimates of number of undiscovered deposits and their total tonnages in permissive tracts using deposit densities. *Natural Resources Research*, *20*, 89-93.

Contents

Abbreviations

Abbreviation	Description
1VD	First Vertical Derivative
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AusLAMP	Australian Lithospheric Architecture Magnetotelluric Project
ASTER	Advanced Spaceborne
CGE	Computable General Equilibrium
DEM	Department for Energy and Mining
DNI	Direct Normal Irradiation
EDR	Economic Demonstrated Resources
EM	Electromagnetic
FTE	Full-time Equivalent
GCAS	Gawler Craton Airborne Survey
GDP	Gross Domestic Product
GSP	Gross State Product
GVA	Gross Value Add
HMS	Heavy Mineral Sands
IOCG	Iron-Oxide-Copper-Gold
ISP	Integrated Systems Plan
JORC	Joint Ore Reserve Committee
LAB	Lithosphere-Asthenosphere Boundary
LMBA	London Metal Bullion Association
LME	London Metal Exchange
MT	Magnetotelluric
MVT	Mississippi Valley Type
NPV	Net Present Value
PACE	Plan for Accelerating Exploration
PGE	Platinum Group Elements
PV	Photovoltaics
REE	Rare Earth Elements
REZ	Renewable Energy Zone
RTP	Reduced-to-Pole
SA	South Australia
SARIG	South Australian Resources Information Gateway
SEG-Y	Society of Exploration Geophysicists-Y file format
SWIR	Short Wave Infrared
SWL	Shallow Groundwater Depth
TDS	Shallow Groundwater Salinity
TMI	Total Magnetic Intensity
VNIR	Visible and Near Infrared
VRTP	Variable Reduction to the Pole
VURM	Victoria University's Regional Model
WA	Western Australia
WPA	Woomera Prohibited Area

01 Strategic context



1 Strategic context

1.1 Strategic context findings

The Woomera Prohibited Area (WPA) lies approximately 450 kilometres (km) northwest of Adelaide in central SA and covers an area of approximately 122,191 km2. The WPA is an area used for the testing of war material and is a key asset in Australia's defence capability development. It is also an area of potential economic importance in terms of its natural resources, home to Aboriginal communities and pastoralists, and is increasingly an asset as a tourism destination.

Given the unique nature of the WPA, periodic reviews of its resource prospectivity have been undertaken in recent years and this report seeks to update those analyses. In 2010, the Australian Government undertook a review of the WPA that led to the establishment of a coexistence framework that balances the interests of all stakeholders in the area. This was followed by a review in 2016, evaluating the effectiveness of the framework established in 2014, and again in 2018. For the 2010 and 2018 reviews, the Office of the Chief Economist within the Department of Industry, Science and Resources undertook an economic assessment of mineral and petroleum resources in the WPA, in collaboration with Geoscience Australia's review of mineral and petroleum prospectivity.

The WPA has substantial demonstrated mineral deposits with one of Australia's most endowed mineral provinces sitting beneath its surface. The Warburton, Arckaringa and Arrowie sedimentary basins and Neoproterozoic Stuart Shelf overlie much of the Archaean to Mesoproterozoic basement rocks of the Gawler Craton, in the WPA area. In the WPA, demonstrated mineral deposit models include copper-gold-uranium-silver deposits (Prominent Hill), iron ore as magnetite and hematite skarn/replacement styles (Peculiar Knob, Snaefell) and iron ore as magnetite-bearing banded-iron formation (Hawks Nest), orogenic gold (Challenger) and shear-hosted iron-oxide copper-gold (Cairn Hill). Copper, gold, iron, titanium, zirconium and silver are major known mineral commodities in the WPA, with cobalt and uranium deposits nearby.

The mineral occurrences, deposits, operating mines and petroleum wells that explore and extract the WPA's resources include:

- There are two operating mines – the Peculiar Knob iron ore mine and the Prominent Hill iron-oxide copper gold and silver mine.
- There are two mines in a state of care and maintenance – the Challenger gold and silver mine and the Cairn Hill iron and copper mine.
- As an indication of future mine developments, 174 exploration leases are currently held by over 40 mineral exploration companies. Exploration expenditure in 2022 stood at $16 million; a slight recovery since 2017 (provide number $). Buzzard, a hematite iron ore body within the Exploration licence of Hawks Nest, is a priority for development by Peak Iron Mines.
- Following indicators of future energy resource developments include: three petroleum wells (with oil shows); nine petroleum exploration licenses held in the WPA by three companies; a further three petroleum exploration licence with a specific focus on hydrogen exploration in application status. With the sole exception being a technical evaluation costing $50,000 in 2022, no petroleum exploration and expenditure has occurred within the WPA since 2016.

In this report, the SA Department for Energy and Mining (DEM) has contracted Scyne Advisory (formerly PwC Consulting Australia) to undertake an updated review of the WPA's mineral and energy resource potential and economic assessment of developing those potential future resources. One of the key recommendations of the Geoscience Australia 2018 review of the WPA was the re-assessment of the WPA utilising the entire catalogue of recently available geoscientific data and information using updated assessment methods be undertaken. The 2018 review also recommended that the results of desktop assessments of mineral and petroleum potential of the WPA are tested in the field, with follow-up geoscientific surveys and the collection of precompetitive data inclusion of geological and geophysical datasets acquired since the 2010 Geoscience Australia assessment. The 2023 assessment addresses these recommendations by including data from the Gawler Craton Airborne Survey (GCAS) (and derivative products), magnetotelluric (MT) data from the Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP), releases from Gawler Phase 2: Next Generation Mineral Systems Mapping including the data acquisition project (gravity and

magnetotellurics), the new Hiltaba Suite layer in SARIG, Neodymium map and new structures from SA Discovery Mapping.

1.2 Assessment context

This Report was commissioned by the DEM in June 2023. The purpose of the assessment was to provide a resource prospectivity analysis of the Woomera Prohibited Area (WPA) and an economic assessment of the impact of current and future resource developments in the WPA, for SA.

The Report follows two relevant prior studies of the WPA, these are the report *Mineral and Petroleum resources and potential of the Woomera Prohibited Area*[6]*(2018),* and the report *Mineral Resource Potential Assessment of the Woomera Prohibited Area, South Australia*[7] *(2010).* An overview of these reports is provided in section 1.7 below.

The relevance of these prior studies to this Report is their provision of geological and resource information, on which this new analysis further develops and improves through analysis of revised and new geological and resource inputs. The findings presented here are an updated resource potential study, reflecting new and additional inputs - including pre-competitive data acquisition, such as the Gawler Craton Airborne Survey and Gawler Phase 2, new data inputs and also new methodologies and resource types and commodities, as well as including an inaugural quantitative assessment of wind and solar resources in the WPA. As a result, this Report provides an analysis of the current economic value of the known mineral and energy resources in the WPA, and a three scenarios for the value of possible future mines, processing plants and other resource developments in the WPA.

1.2.1 Policy context

One of the recommendations of the 2018 WPA Review (Recommendation 12, page 14) is the review of the WPA Coexistence Framework in 2025 (7 years after). This recommendation is in the full 2018 WPA Review report. This updated prospectivity report which has been commissioned by DEM will be used to inform the recommended review of the WPA Coexistence Framework.

The DEM commissioned prospectivity report and economic assessment of resource potential is part of the deliverables of the 2018 WPA Review that DEM/South Australian Government is tasked as lead agency. As mentioned above, the DEM commissioned updated prospectivity report will form part of information and data that will be used to inform the recommended review of the WPA coexistence arrangements in 2025. DEM will propose to close off recommendation no. 5 (see above) and transition to 'business-as-usual' to indicate the need for ongoing government funded/supported geological investigations in the Gawler Craton including the WPA at the 1st of December, 2023, WPA Advisory Board meeting.

1.3 Introduction

The WPA lies approximately 450 km northwest of Adelaide in central SA and covers an area of approximately 122,191 km^2. The WPA is a major Australian military and civil aerospace and testing facility and a key asset in Australia's defence capability development. It is also an area of potential economic importance in terms of its natural resources, home to Aboriginal communities and pastoralists, and is increasingly an asset as a tourism destination.

In May 2010, the Australian Government announced the Woomera Review to examine the short- and long-term (20–30 years) national security and economic interests in the WPA. The 2010 Review led to the establishment of a coexistence framework that balances the interests of all users in the area. In 2018, the then Minister for Defence and the Minister for Resources and Northern Australia, commissioned a review of coexistence arrangements in the WPA. This Review sought to ensure the coexistence framework is contemporary and appropriately supported the operational requirements of the Department of Defence, and the needs of non-defence users, consistent with Australia's national security requirements.

---

6 Geoscience Australia, 2018, Mineral and petroleum resources and potential of the Woomera Prohibited Area, 2018. Professional Opinion 2018/08. Geoscience Australia, Canberra. http://dx.doi.org/10.11636/978192584831

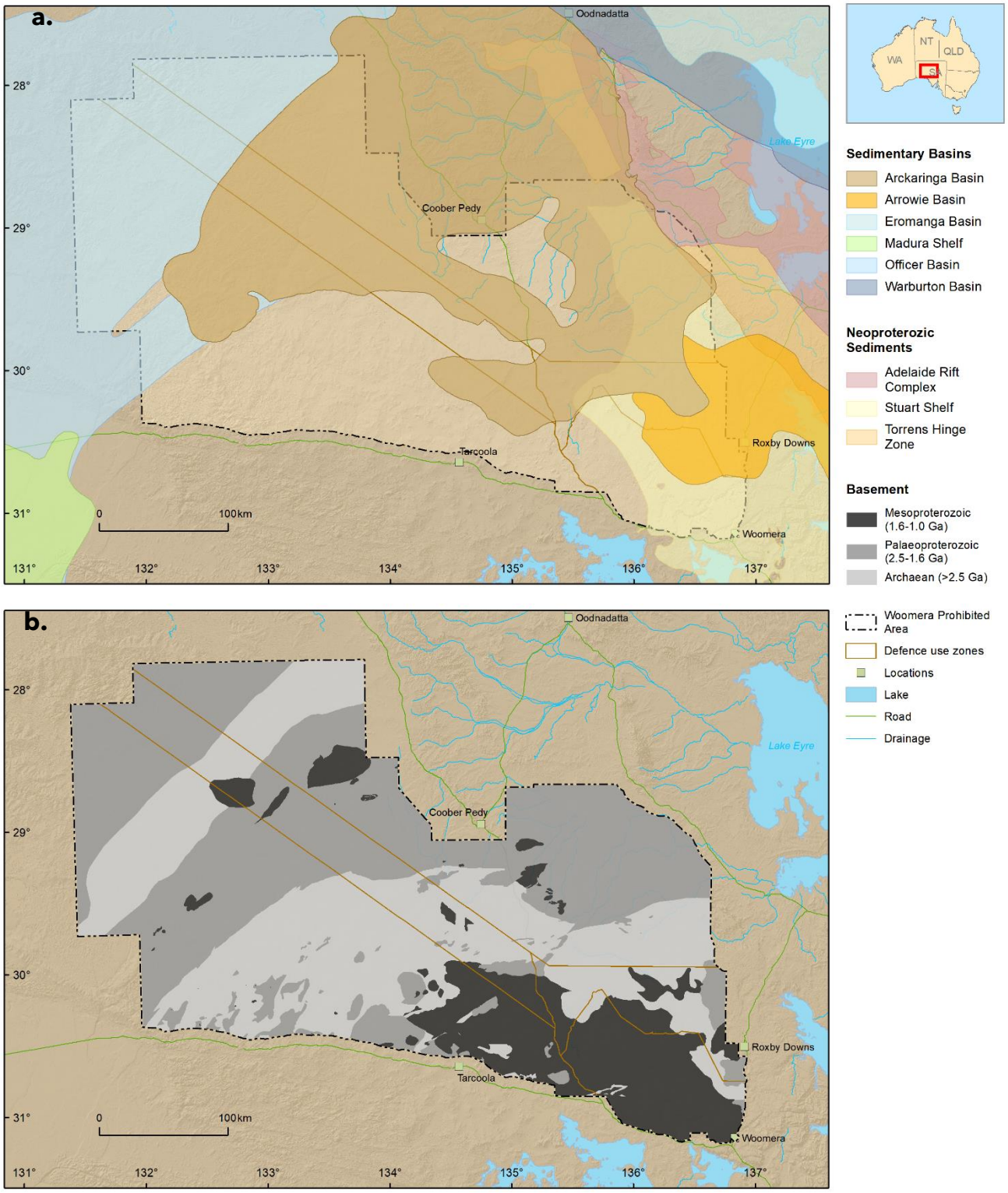
7 Geoscience Australia, 2010, Mineral Resource Potential Assessment of the Woomera Prohibited Area, South Australia. Report the Department of Resources Energy and Tourism, July 2010. Canberra.

For the 2023 assessment, Scyne Advisory and DEM have undertaken a review of, and where appropriate updated, the approach undertaken by Geoscience Australia for the 2018 report. Updates and additions have been made to provide an improved understanding of the future resource potential (including emerging critical minerals and commodities) in the WPA. New geological and geophysical information used in this assessment is outlined in this Chapter. A number of major new pre-competitive geoscientific datasets have been acquired since the 2018 Review. This revised geological and resource information has been used to inform the resource potential mapping, the analysis of the current economic value of the known mineral and energy resources in the WPA, and also the value of possible future mines and processing plants and other resource developments in the WPA.

1.4 Geology

The generalised geology of the WPA is presented in Figure 3. The maps show the distribution of the Neoproterozoic sediments of the Adelaide Rift Complex, Stuart Shelf and Torrens Hinge zone, and the Arckaringa, Arrowie, Eromanga, Madura Shelf, Officer and Warburton sedimentary basins (Figure 3a) that overlie the Archean to Mesoproterozoic basement rocks of the Gawler Craton (Figure 3b).

Figure 3: Geology of the WPA, showing (a) sedimentary basins and (b) distribution of basement rocks.



The Gawler Craton is SA's largest and oldest geological province. Co-located with the lithospheric boundary in the eastern Gawler Craton is the Olympic Cu-Au metallogenic province, which hosts the world class Olympic Dam iron-oxide-copper-gold-uranium deposit, the Carrapateena copper-gold deposit and the Prominent Hill copper-gold-

uranium-silver deposit, one of the most significant deposits in the WPA[8]. Other demonstrated mineral exploration models include iron ore as magnetite and hematite skarn/replacement styles (Peculiar Knob, Snaefell) and iron ore as magnetite-bearing banded-iron formation (Hawks Nest), orogenic gold (Challenger) and shear-hosted copper-gold-uranium (Cairn Hill).

1.4.1 Key changes to datasets since 2010 and 2018

This 2023 report includes updated and new datasets available since 2018. These are outlined in Table 3 below. All data used in this report has been compiled by DEM and provided to Scyne Advisory. All data is open file.

Table 3: Updated and new datasets available for the WPA region since 2018

Datasets		
Land Access and Administration		
Gas Storage Tenements – Current	**Coal Deposits**	**Precious Stones Field**
Geothermal Tenements – Current	**Petroleum Exploration Licence Applications**	**Petroleum Exploration Licence – Expired**
Active Petroleum Exploration Licences		
Geology		
Surface Geology 2M	**Prescribed Wells Areas**	**2019 Au Deposits & Mineral Systems**
Surface Geology Legend	**Shallow Groundwater Depth (SWL)**	**Groundwater Monitoring Networks**
Groundwater Basins	**Shallow Groundwater Yield**	**Groundwater Resources Salinity**
Groundwater Resources Aquifers	**Shallow Groundwater Salinity (TDS)**	
Geophysics Datasets		
Gravity*	**Geophysical Spatially Coincident Residual TMI and Gravity Anomalies**	**AusLAMP SA Gawler Craton Magnetotellurics**
Residual Gravity	*Pseudo Gravity of TMI*	**GP2 program sample sites**
Total Magnetic Intensity (TMI)	*Tilt of TMI*	**2D Seismic Lines with SEGY Data**
SA TMI VRTP	*Gawler Craton Airborne Surveys*	**Passive Seismic**
SA TMI VRTP 1VD	**Magnetic Source Depths Estimates**	**Seismic Lines**
WPA – TMI (RTP) 1st Vertical Derivative	**Airborne EM Survey Areas**	**Magnetic Source Depths Estimates**
WPA – Gravity overlain by 1st Vertical Derivative of TMI (RTP)	**Geophysical Electrical Surveys2D Seismic Lines with SEG-Y Data**	**Magnetic Source Cover Thickness grid**
Magnetotelluric and Airborne Electromagnetic Survey coverage	**Lithosphere-Asthenosphere Boundary 170 km contour**	**Radiometrics – KthU**
Radiometrics – Uranium	*Radiometrics – U2/Th*	**Radiometrics – Dose**
Radiometrics – Thorium	*Radiometrics – Total Count*	**Mafic Nd sites**
Radiometrics – Potassium	**Felsic Nd sites**	**Mafic WPA Nd eps**
Felsic WPA Nd eps	**Felsic WPA Nd tdm**	**Global Solar Atlas**
Global Wind Atlas		
Drillholes and Rock Samples		
Geochem_maxdh_u	**Geochem_maxdh_fe**	**Geochem_maxdh_zn**
Geochem_maxdh_ag	**Geochem_maxdh_au**	**Geochem_maxdh_pb**
Geochem_maxdh_ni	**Geochem_maxdh_cu**	**Geochem_maxdh_co**
Geochem_maxdh_li	**Petroleum Wells**	**Water Wells**
National Weathering Intensity Model	**Biostratigraphy Analysis**	**Petrology Analysis**
Geochronology		

8 Reid, A. (2019). The Olympic Cu-Au Province, Gawler Craton: A Review of the Lithospheric Architecture, Geodynamic Setting, Alteration Systems, Cover Successions and Prospectivity

Source: DEM, 2023
Note: **Bold -** datasets are new data either produced/compiled or acquired since 2018
* denotes post-2018 DEM funded data acquisition

A high-level summary of the evolution in information, and model inputs, from 2010 to 2018 and then to 2023, is provided in Table 4.

Table 4: Comparison of 2010, 2018 and 2023 approaches

2010	2018	2023
• The commodity assessment was performed by determining the deposit styles permitted by the geology. Only deposit types judged to be the most likely to constitute significant resources were assessed. Professional judgements of geoscientists involved in the assessment was used to rank the mineral resource potential of the area.	• The 2018 assessment included the addition of nickel, potash and platinum group elements and updates to the tenements, wells and drillholes in the WPA. Prospectivity assessments from 2010 were unchanged. • The 2018 assessment included an evaluation of the economic value of both 'known' mineral resources and possible future mine developments, based on an assessment of undiscovered resources by subjective determination.	• The 2023 assessment included 7 new commodities, 4 additional deposit styles for existing commodities, updates of 8 previously assessed deposit models. 10 assessments remained unchanged. • Assessment includes new datasets, including the GCAS (and derivative products), releases from GP2 including the DEM data acquisition project (Gravity and MT), the new Hiltaba Suite layer in SARIG, Nd map and new structures from SA Discovery Mapping. • A quantitative assessment has been developed to determine undiscovered resource potential.

Source: DEM, Scyne Advisory, 2023

Table 5 summarises the implication of these new datasets for the commodities and resource analysis in this report. The commodities and resources covered include minerals, metals, hydrocarbons, extractive materials and quarrying operations and renewable resources. The table also summarises the relevant prior WPA prospectivity assessments, and key updates and changes in the 2023 Report. It is important to note that key changes in 2023 include the addition of new datasets and deposit models.

Table 5: Commodities and resources included in the WPA resource prospectivity assessment in 2023

Commodity or resource	Included in 2010	Included in 2018	Changes in 2023 analysis	Undiscovered resource potential assessment type
Mineral Resources				
Copper	✓	✓	• Dataset updates and the addition of magnetotellurics • Addition of sedimentary-hosted copper as a deposit style	• Quantitative
Gold	✓	✓	• Addition of drillhole geochemistry and host rocks of the Sleafordian, Kimban and Kararan gold mineral systems	• Quantitative
Iron ore	✓	✓	• Dataset updates	• Quantitative
Nickel	✓	✓	• Unchanged from 2018	• Quantitative
Uranium	✓	✓	• Addition of calcrete sample geochemistry • Addition of Calcrete-hosted channel type deposit style	• Quantitative
Titanium	✓	✓	• Unchanged from 2018	• Quantitative
Zirconium	✓	✓	• Unchanged from 2018	• Quantitative
Rare Earth Elements (REE)	-	✓	• Update to Iron-oxide-copper-gold associated REEs • Addition of clay-hosted REE deposit style	• Qualitative
Platinum Group Elements (PGE)	-	✓	• Unchanged from 2018	• Qualitative
Potash	-	✓	• Unchanged from 2018	• Qualitative
Silver	-	✓	• Update to iron-oxide-copper-gold associated silver • Addition of sedimentary-hosted copper associated silver	• Qualitative
Chromium	-	✓	• Not included	
Lead	-	✓	• Updated deposit model	• Qualitative
Zinc	-	✓	• Updated deposit model	• Qualitative
Lithium	-	-	• New addition	• Qualitative
Cobalt	-	-	• New addition	• Quantitative
High purity alumina	-	-	• New addition	• Qualitative
Extractive materials (incl. salt)	-	-	• New addition	• Qualitative
Energy Resources				
Natural hydrogen	-	-	• New addition	• Qualitative
Solar	-	-	• New addition	• Quantitative
Wind	-	-	• New addition	• Quantitative
Geothermal	✓	-	• Unchanged from 2010	• Qualitative
Petroleum	✓	✓	• Unchanged from 2018	• Qualitative
Coal	✓	✓	• Unchanged from 2018	• Qualitative
Oil Shale	✓	-	• Unchanged from 2018	• Qualitative
Groundwater Resources				
Groundwater	✓	✓	• Unchanged from 2018	• Qualitative

Source: DEM, Scyne Advisory, 2023. * Prior studies refer only to the Geosciences Australia 2018 and 2010 reports on the resource prospectivity of the WPA.

1.5 Exploration

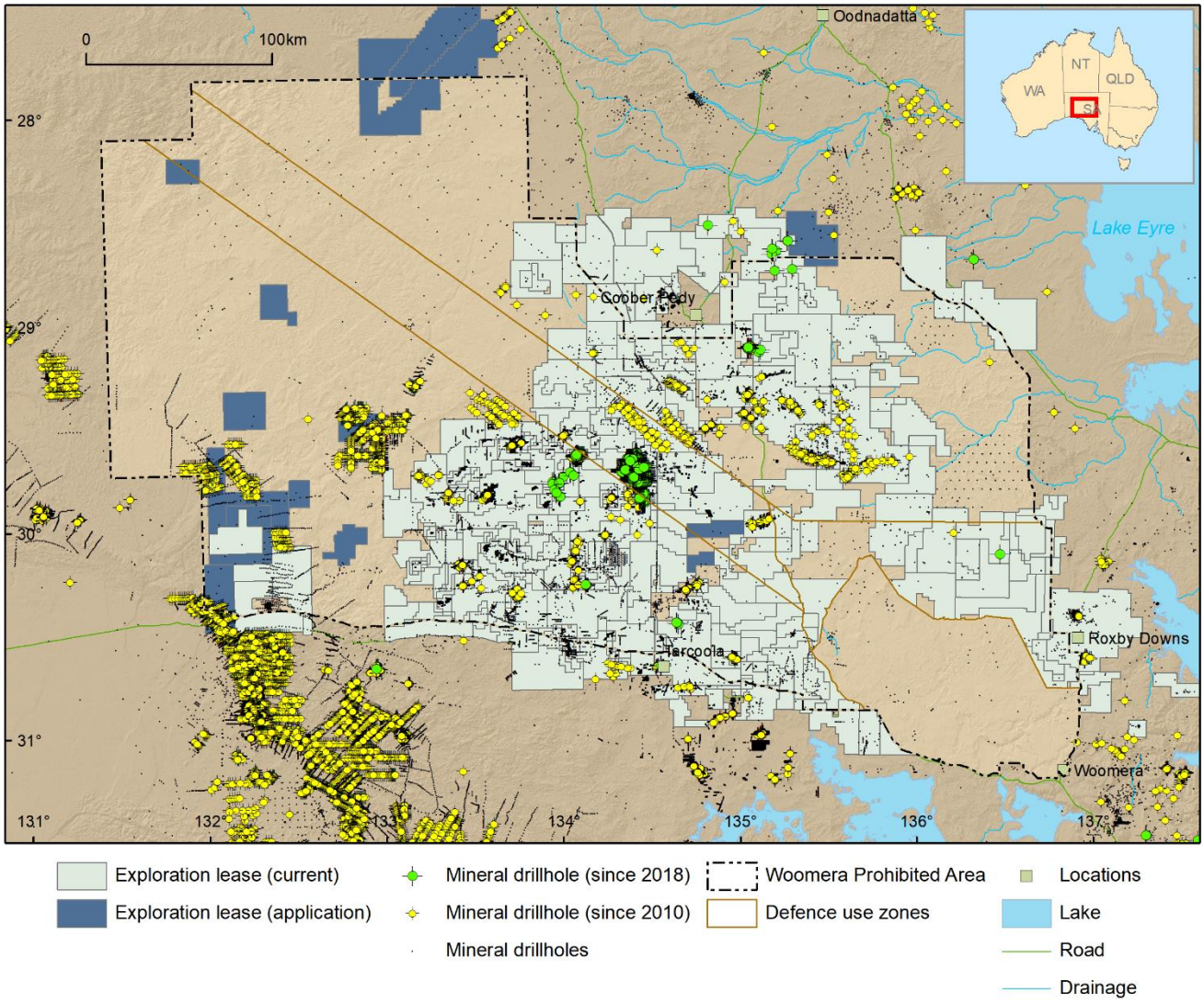
Industry carries out exploration activities to search for new mineral or energy sources; the discovery of these new resources provides a pipeline of projects that can be developed into new mines or energy projects. Roughly $55,628 million was spent on mineral and onshore petroleum exploration in Australia between 2005 and 2022, averaging $3,090 million per year, and peaking at $4,679 million in 2012.[9] Approximately 11 per cent of this was spent in SA, and one per cent in the WPA. Total annual exploration expenditure in the WPA averaged $40 million between 2005 and 2022, reaching a peak of $92.4 million in 2012. Nationally, the search for minerals accounted for almost 78 per cent of onshore exploration expenditure between 2005 and 2022, only falling below 75 per cent of total expenditure for three years between 2013 and 2015, when mineral exploration accounted for approximately 61 per cent of exploration expenditure nationally. In SA, the division of expenditure between minerals and petroleum exploration is almost equal, with mineral exploration account for approximately 48 per cent of total expenditure. In the WPA, expenditure is heavily focused on mineral exploration, with no petroleum exploration expenditure having occurred since 2016, other than a technical evaluation costing $50,000 in 2022.

1.5.1 Mineral exploration

A wide range of mineral commodities are explored for within the WPA. These include gold, copper, iron ore, coal, heavy mineral sands, diamonds, nickel, tin, graphite, kaolin and uranium. In 2022, the top three commodities by exploration expenditure in the WPA were gold, copper and iron ore. There are currently 174 mineral exploration licenses, held by over 40 companies within the WPA, shown in Figure 4.

9 Australian Bureau of Statistics (June 2023), Mineral and Petroleum Exploration, Australia, ABS Website, accessed 21 September 2023.

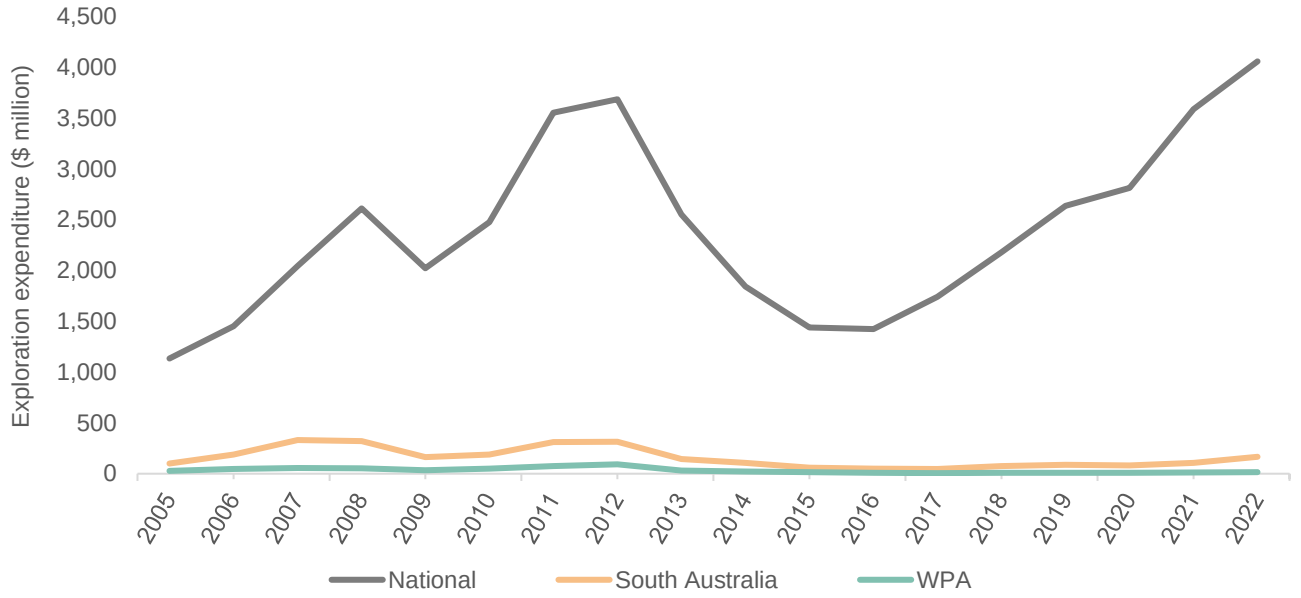
Figure 4: Mineral exploration licenses and drillholes in and near the WPA.



Total mineral exploration expenditure in Australia has increased significantly since 2017, rising by 133 per cent from $1,740. million to $4,057 million in 2022 (Figure 5). Mineral exploration expenditure in the WPA rose by 187 per cent from $5.6 million in 2017 to $16 million in 2022, while mineral exploration expenditure in SA rose by 256 per cent from $46.5 million to $165.4 million in the same period. Mineral exploration expenditure in the WPA as a share of state expenditure decreased by 2 per cent from 12 per cent in 2017 to 10 per cent in 2022. SA exploration expenditure accounted for 4 per cent of national exploration expenditure, representing a 1 per cent increase since 2017, while the WPA accounted for 0.4 per cent of national exploration expenditure, representing a 0.1 per cent increase since 2017.

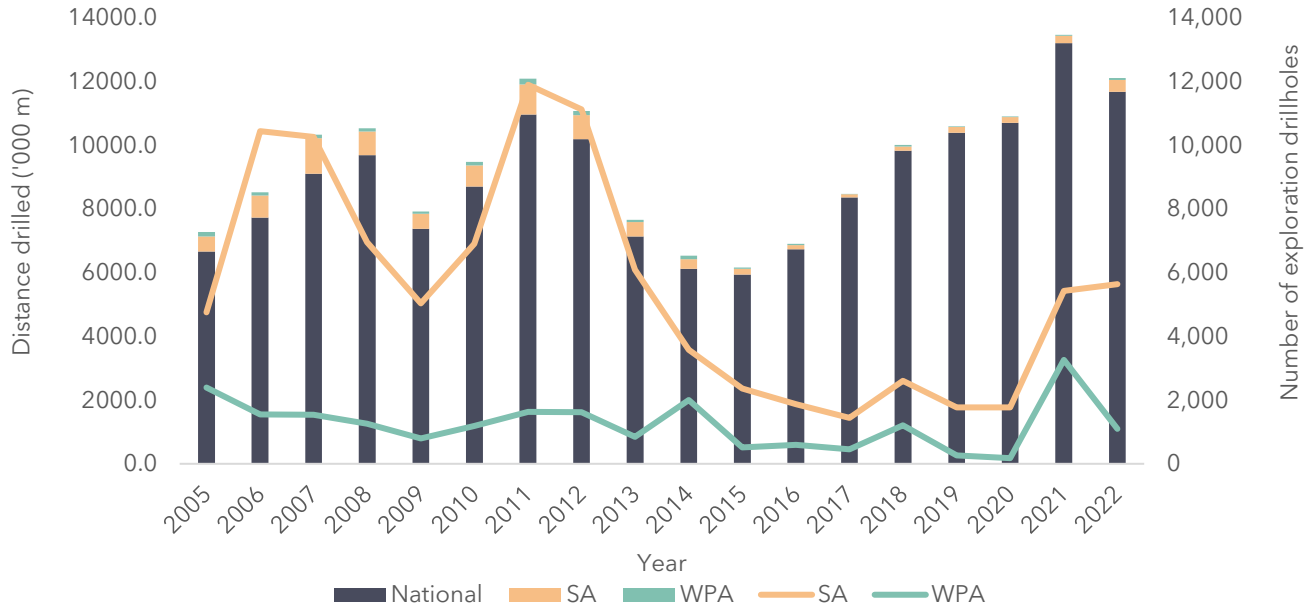
Exploration drilling in the WPA in 2022 amounted to 56,000 metres across 1,100 drillholes, this represents a 469 per cent increase compared to 10,000 metres of drilling across 457 drillholes in 2017. Within SA, exploration drilling increased by 261 per cent from 102,000 metres across 1,442 drillholes to 368,000 metres across 5,641 drillholes (Figure 6). Exploration drilling in the WPA accounted for 15% of state exploration drilling in SA, a 5 per cent increase from 2017. Mineral exploration drilling has been evenly distributed across the WPA, apart from in the north-western corner. Drilling completed since 2020 has been largely focused on gold and rare-earth element mineralisation in the centre of the WPA.

Figure 5: Mineral exploration expenditure in the WPA, SA and nationally 2005–2022.



Source: SA and WPA exploration expenditure statistics 2005-2022 compiled by the SA Government (2023); National exploration expenditure data are from the ABS Mineral and Petroleum Exploration Dataset, March 2023.
Note: WPA expenditure statistics include data from Andamooka, Billa Kalina, Barton, Coober Pedy, Curdimurka, Giles, Kingoonya, Murloocoppie, Tallaringa, Tarcoola, Warrina map sheets.

Figure 6: Mineral exploration wells and metres drilled in the WPA, SA and nationally 2005–2022.

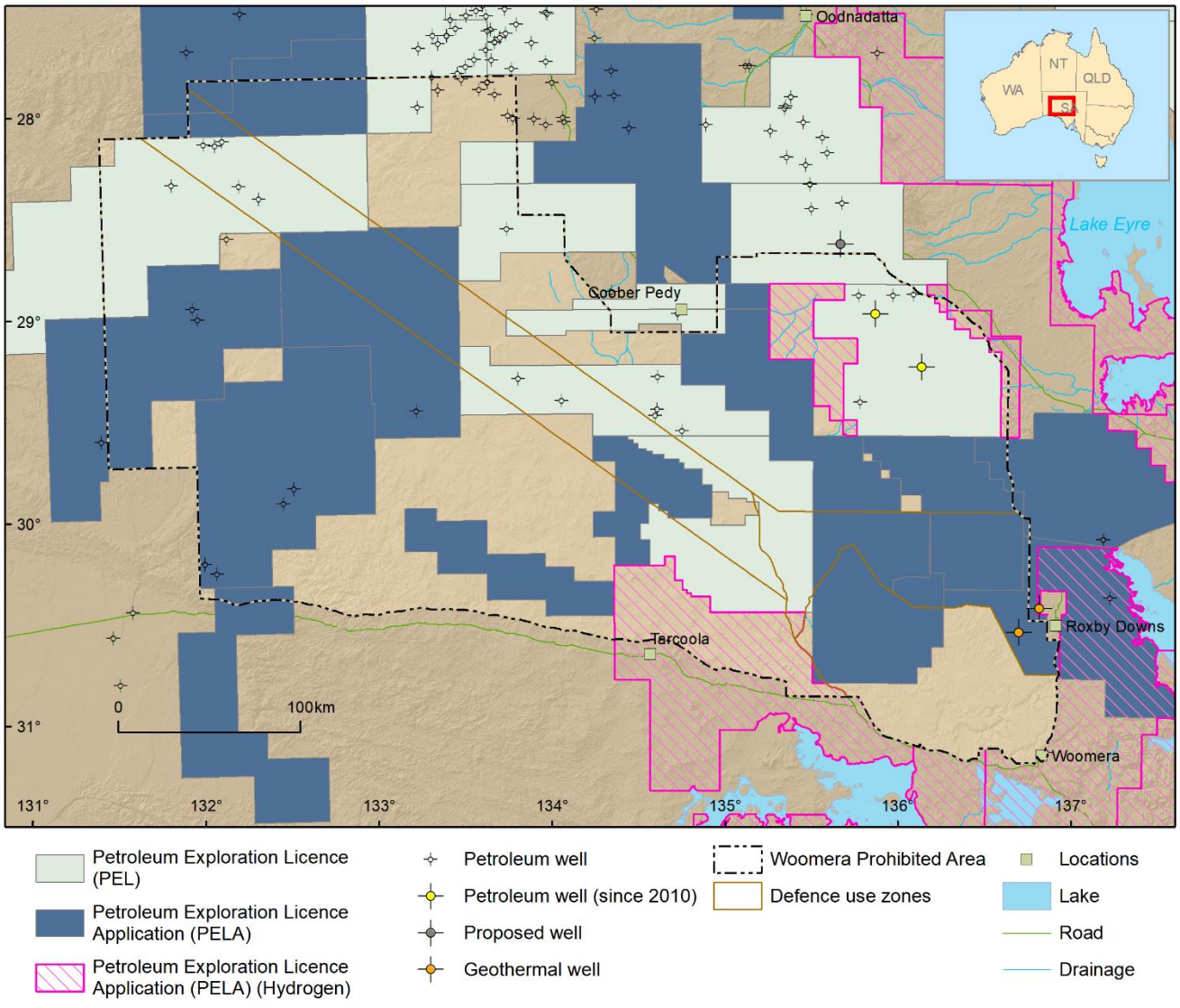


Source: SA and WPA exploration expenditure statistics 2005-2022 compiled by the Australian Government (2023); National exploration expenditure data are from the ABS Mineral and Petroleum Exploration Dataset, March 2023.
Note: WPA expenditure statistics include data from Andamooka, Billa Kalina, Barton, Coober Pedy, Curdimurka, Giles, Kingoonya, Murloocoppie, Tallaringa, Tarcoola, Warrina map sheets

1.5.2 Petroleum exploration

Petroleum exploration has occurred only sporadically in the WPA between 2005 and 2017, with petroleum licences having been suspended almost continuously from 2018 onwards. Exploration targets have included conventional and shale gas and oil, and coal seam gas and potential coal gasification projects. However, more recently interest in natural hydrogen increased due to changing trends in energy exploration. There are currently 9 petroleum exploration licenses held in the WPA by three companies, and 18 petroleum exploration licence applications, including 3 licences with a specific focus on hydrogen exploration (Figure 7).

Figure 7: Petroleum and hydrogen exploration licences, and petroleum wells in and around the WPA.



National onshore petroleum exploration expenditure has continued to gradually recover after its dramatic decline between 2014 and 2016, where expenditure fell from $1,427.3 million to $321.3 million (Figure 8). National expenditure measured at $598.7 million in 2022, an 86 per cent increase since 2016. In line with the national trend, SA petroleum exploration

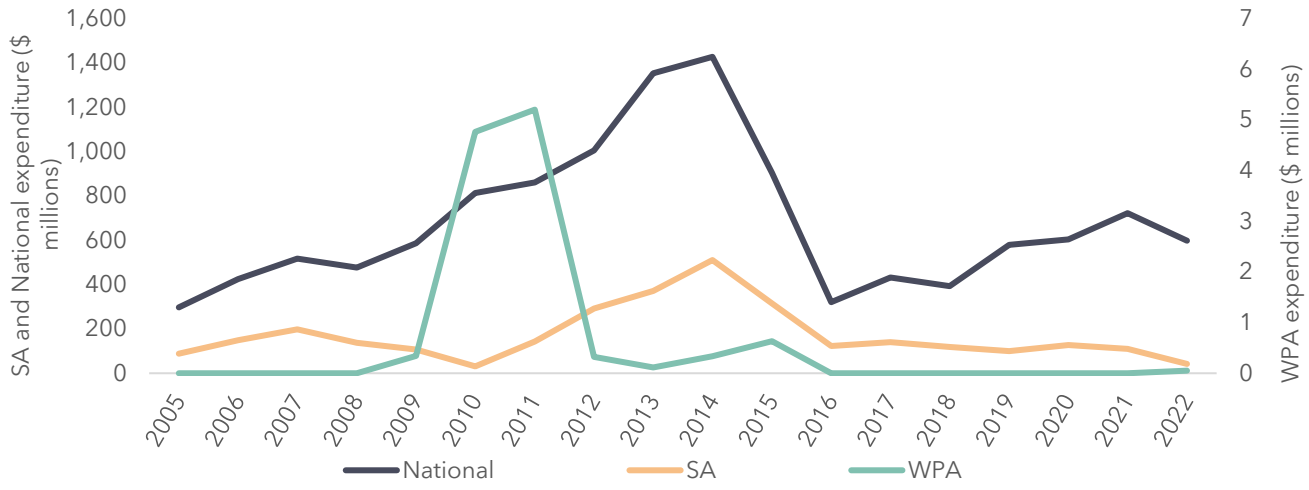
expenditure also saw a significant decline during the same period, falling from $510.6 million to $123.4 million and has continued to decline gradually, measuring at $109.3 million in 2021.[10]

Between 2005–2008 and 2016–2022, no on ground petroleum expenditure occurred in the WPA. In 2010–2011, petroleum expenditure in the WPA peaked, reaching approximately $5 million and accounting for almost 8 per cent of the total petroleum expenditure in SA. It should be noted that WPA, and SA, expenditure figures represent a very different regulatory and exploration environment to other state and national expenditure data.

Three petroleum exploration wells were drilled inside the WPA in the period between 2005–2022. While this is less than 0.3 per cent of the 1,085 petroleum wells drilled across South Australia in the same period, it is still significant activity in a frontier basin (Figure 9). For example, during this same period, no petroleum exploration wells were drilled in the frontier Simpson, Pedirka and Arrowie basins. Comparing drilling statistics between mature basins and frontier basins is not meaningful. Different acreage management regimes apply between Australian jurisdictions and also within South Australia. The Cooper-Eromanga and Otway have the benefit of a significant body of knowledge, data and infrastructure to support access. Companies can only apply for Petroleum Exploration Licences (PELs) when DEM initiates acreage releases and need to submit material and competitive work programs to win a block. In frontier basins, such as the Arckaringa and Officer basins, vacant acreage has been available at any time for non-competitive,' 'over the counter' PEL applications (i.e. 'first in best dressed'). This changed in late 2022, when new competitive tender regions have been gazetted in some basin including the Arckaringa and south-eastern Officer basins. In addition, DEM has been encouraging companies to explore data-poor frontier basins where the chance of success (discoveries) is lower – as a result frontier work programs are typically less material than those in producing basins.

Petroleum exploration drilling is sparse across the WPA, but is most concentrated in the north-western portion that covers parts of the Officer Basin, and over the Phillipson, Penrhyn, Wallira and Boorthanna troughs targeting conventional oil and gas in the Officer Basin as well as potential oil shale and shale gas plays and coal (potential coal seam methane or in situ gasification). Approximately 0.06 per cent of the total petroleum exploration metres drilled in SA 2005–2022 were in the WPA. WPA petroleum exploration drilling meterage as a proportion of the state-wide metres drilled total peaked in 2010 at 1.4 per cent when William Creek 1 (914 m) was drilled.

Figure 8: Onshore petroleum exploration expenditure in the WPA, SA and nationally 2005-2022

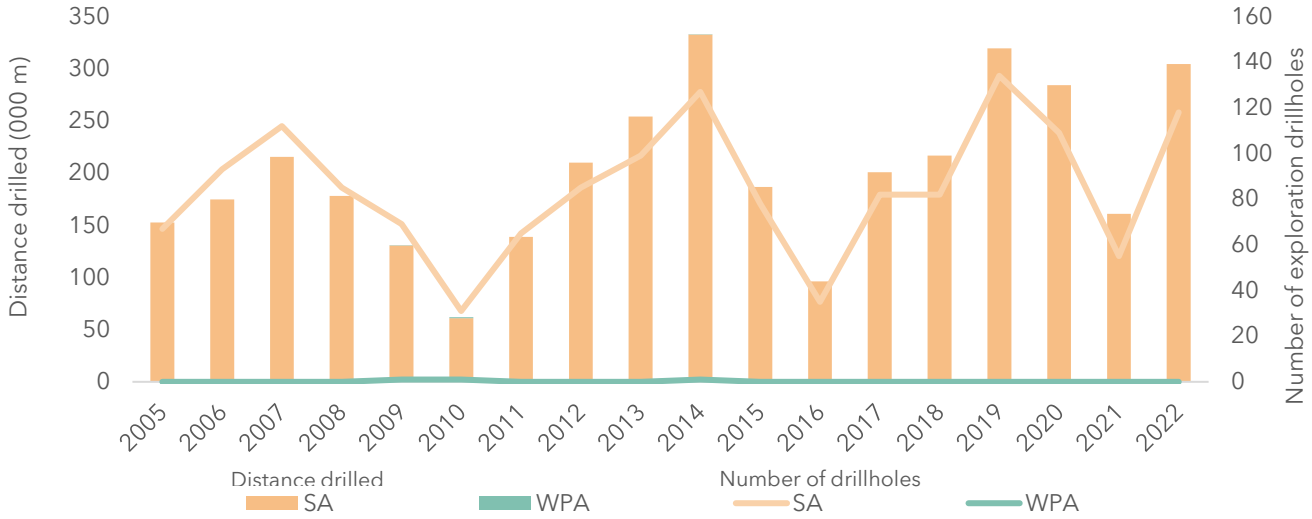


Source: SA and WPA exploration expenditure statistics 2005-2022 compiled by the SA Government (2023); National exploration expenditure data are from the ABS Petroleum Exploration dataset, 2023.
Note: WPA expenditure statistics include data from the Billa Kalina, Barton, Coober Pedy, Giles, Kingoonya, Tallaringa

[10] 2021 data has been used due to estimates of South Australian petroleum exploration expenditure being withheld from publication in the December and September quarters of 2022.

and Tarcoola map sheets; SA statistics include geothermal drilling, and represent drilling plus basic evaluation expenses.

Figure 9: Petroleum exploration wells and metres drilled in the WPA and SA, 2005-2022

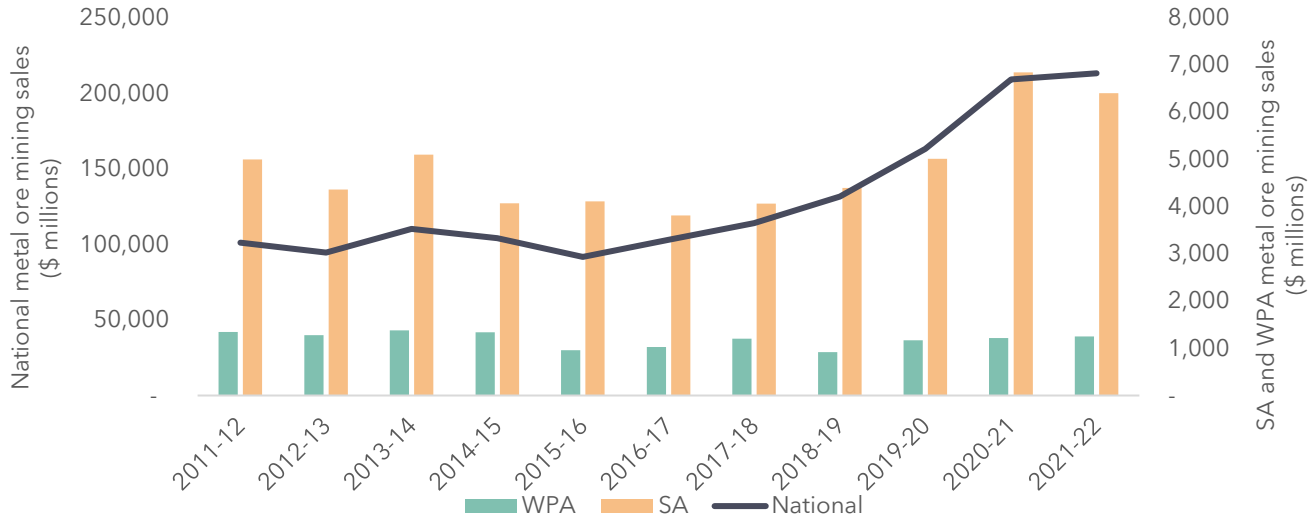


Source: SA and WPA exploration expenditure statistics 2005-2022 compiled by the SA Government (2023).
Note: WPA expenditure statistics include data from the Billa Kalina, Barton, Coober Pedy, Giles, Kingoonya, Tallaringa and Tarcoola map sheets; SA statistics include geothermal drilling and represent drilling plus basic evaluation expenses.

1.6 Historical sales of mineral commodities

The sale of mineral commodities from the WPA has occurred at a consistent rate since the 2011-12 financial year. The value of all mineral commodity sales in the WPA has ranged from $900 million to $1.4 billion over the last 10 years, while the value of all mineral commodity sales in Australia has grown rapidly in the last few years, peaking at over $210 billion in FY2021-22 (Figure 10). On average, the WPA has produced 25 per cent of the total sales value of mineral commodity sales in SA since the 2011-12 financial year, contributing as much as a third of total sales value in its peak year of 2014-15. WPA sales as a share of SA sales has reduced in recent years, contributing 19.5 per cent of total SA sales value in the 2021-22 financial year at $1.25 billion.

Figure 10: Historical sales of mineral commodities in the WPA, SA and nationally FY2012-FY2022



Source: WPA and SA historical mineral sales data compiled by the SA Government (2023); National mineral sales data are from the ABS Australian Industry dataset, 2023

1.7 Relevant prior reports

This study builds on two prior prospectivity assessments for the WPA, as referenced in Section 1.1. These assessments included a combination of quantitative and qualitative analyses that are the foundations for this 2023 Report.

An overview of these reports is provided here, for reference in reviewing the 2023 findings. Note that this is not an exhaustive list of resource prospectivity assessments; it reflects only those that are the foundation for this current report.

1.7.1 Mineral Resource Potential Assessment of the Woomera Prohibited Area, South Australia (Geoscience Australia, 2010)

In June 2010, Geoscience Australia undertook a qualitative mineral resource potential assessment of the WPA, in collaboration with the Department of Primary Industries and Resources, South Australia (PIRSA). The mineral resource potential assessment determines the deposit types likely to occur within geological frameworks known or interpreted to exist in the WPA. Geologically prospective areas that contain particular types of deposits are identified and ranked low to high potential, and similarly the level of certainty categorised from lowest (A) to highest (D).

Key findings

The 2010 study identifies the potential of the WPA to host a range of commodities in a diverse range of mineral deposit types and geological settings. Those considered to have the greatest potential are uranium, copper, gold, coal, iron ore, and mineral sands. There is also potential for geothermal energy and groundwater resources.

The major findings in this study are:

- The Gawler Craton is characterised by a range of identified mineral resources occurring in different mineral deposit types and geological environments. Known deposits within the WPA account for only modest proportions of Australia's total mineral resources – 2.3% of copper resources, 0.7% of gold resources and 1% of iron ore resources. The potential is significant, with the WPA and 50 km buffer zone containing 75.4% of Australia's uranium resources, 62% of copper resources, 18% of gold resources and around 6% of Australia's mineral rutile resources, 0.8% of ilmenite resources and 0.8% of Australia's zircon resources.

- There is high potential for discovery of substantial copper-gold-(uranium) deposits in the extension of the geological province that hosts the Prominent Hill deposit and the world class Olympic Dam deposit. Whilst these deposits lie under significant amounts of sediments (overburden), advances in technology have enabled discovery and mining.
- There is a high potential for discovery of small- to medium-sized gold deposits similar to the Challenger gold deposit in the northwest of the WPA.
- In the southern and western regions of the WPA there is high potential for discovery of sandstone-hosted uranium deposits in paleochannels that have incised sedimentary rocks overlying the oldest basement rocks of the Gawler Craton, similar to the Warrior uranium deposit lying immediately south of the WPA.
- There is potential for further discoveries of small- to medium-sized iron ore deposits similar to the Peculiar Knob and Hawks Nest deposits in the southeast of the WPA.
- Similarly, there is high potential for discovery of additional coal deposits similar to the Phillipson deposit, sub-bituminous coal, in the Arckaringa Basin in the central northern part of the WPA. Similar coal deposits in the northern part of the basin immediately north of the WPA are being investigated for potential coal-to-liquids, coal seam gas, and underground gasification projects. The Officer Basin is one of the last remaining onshore frontier for conventional hydrocarbon accumulations and lies in the north-western area.
- The WPA was assessed for hot rock and hot sedimentary aquifer geothermal resources for electricity generation. Moderate hot rock geothermal potential, as a result of sedimentary rock thickness and high heat-producing granites, is interpreted to exist along the eastern margin and in the western third of the WPA. There are some areas in the east of the WPA that have a moderate- and moderate to high-potential for hot sedimentary aquifers due to favourable sedimentary rock thickness and thermal resistance characteristics.
- Groundwater is an important resource in the development of any project. The overall potential of usable groundwater supplies within the WPA varies from high to low. High potential areas in terms of aquifer yield occur in paleovalleys in the southwestern and western parts of the WPA, however, the groundwater is saline. Moderate to high potential sandstone aquifer with moderately high groundwater yields of fresh to brackish water occur in the north central area of the WPA.

1.7.2 Mineral and Petroleum resources and potential of the Woomera Prohibited Area (Geoscience Australia, 2018)

The WPA has a coexistence framework, established in 2014. This seeks to balance the interests of all users in the Area, with access to the WPA for Defence and a range of non-Defence users, including Aboriginal groups, the resources sector, pastoralists and tourists, also provided for. As part of the 2018 WPA Review, Geoscience Australia, together with the Office of the Chief Economist, prepared the resources and potential assessment, which involved:

- updating the current understanding of the region's geology
- assessing the known Economic Demonstrated Resources (EDR) and potentially undiscovered mineral and petroleum resources (including critical commodities) and groundwater
- documenting resource exploration activities in the WPA
- develop an economic assessment of possible future mine developments in the WPA
- modelling of the economic impact of possible new mine developments was carried out for high-value commodities with high potential for discovery in the WPA. The commodities included in the possible future mine scenarios were gold, copper, silver, uranium, iron, titanium and zirconium. Two scenarios were modelled, conservative and optimistic.

Key findings

The NPV of EDR in the WPA was estimated to be $5.9 billion. The NPV of possible future mines in the WPA was estimated to be between $6.4 billion and $19 billion. Estimates of annual direct employment across the future possible mines ranged from 150 people to 1350 people per mine, with secondary employment between 70 people and 1250

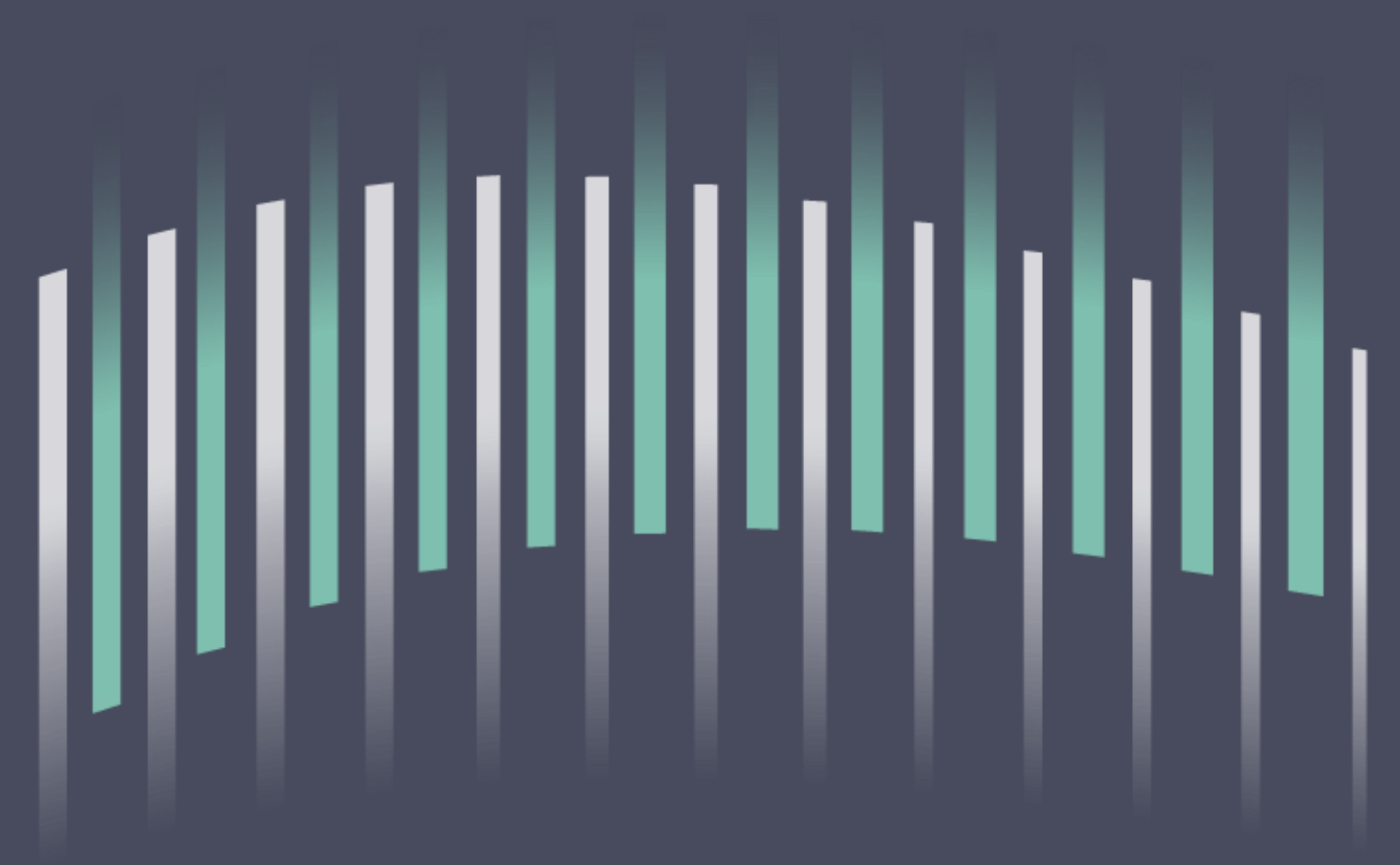
people. Annual value-add across the future possible mines ranged between $8 million per mine to $920 million per mine.

An assessment of the potential for undiscovered mineral and petroleum resources was also conducted, by considering the results of Geoscience Australia's 2010 WPA assessment and by updating those findings. Overall, this assessment confirmed the results of the 2010 assessment and showed that many parts of the WPA have moderate to high potential for the discovery of new mineral and petroleum resources.

Analysis of new data by this 2018 assessment also identified additional areas with potential for groundwater resources in the WPA. There was high potential noted for the discovery of new deposits, similar to those already known, especially of copper, gold, silver, iron, titanium and zirconium and uranium. Some of these deposits were noted to potentially contain economic REE and other critical commodities.

The 2018 assessment differs substantially in its treatment of the potential for discovery and development of a uranium mine in the WPA as compared to the 2010 assessment. Specifically, the 2018 assessment excludes the possibility that an iron oxide-copper-gold (IOCG) deposit of the grade and tonnage of Olympic Dam might be discovered and developed within the WPA, which was included in the 2010 report.

02 Resource Prospectivity



2 Resource Prospectivity

2.1 Resource productivity key findings

This resource prospectivity assessment is modelled off the approach taken by the 2018 Geoscience Australia assessment of the resource potential of the WPA, and was undertaken with the following objectives:

- update selected resource prospectivity maps with the inclusion of new data or additions to the mineral deposit model inputs
- develop a more robust, quantitative approach to undiscovered resources for Copper, Gold, Iron, Uranium, Heavy Mineral Sands, Cobalt and Silver
- expand the assessment to emerging energy resources of solar, wind and natural hydrogen
- include emerging critical minerals like High Purity Alumina, Clay-hosted Rare Earth Elements Lithium as well as Extractive Materials.

Currently, there are two operating mines in the WPA – the iron ore mine Peculiar Knob, and the iron-oxide copper gold silver mine, Prominent Hill. The gold and silver mine Challenger and iron and copper mine Cairn Hill are both in a state of Care and Maintenance. Buzzard, a hematite iron ore body within the Hawks Nest Exploration licence, is a priority for development by Peak Iron Mines. The NPV of the Economic Demonstrated Resource (EDR) of these mines and deposits in the WPA is estimated to be $14.2 billion.

The quantitative methodology used to determine undiscovered resources uses the mapped prospective areas and representative grade and tonnage models of the various deposit styles that have a relatively high potential for discovery in the WPA. These estimates provided an upper bound constraint on the potential quantities that could be discovered in the WPA, and analogue mines were identified to determine the NPV of future developments. Three scenarios were modelled, developed from the Low, Best and High estimates of the potential undiscovered resource in the WPA.

Low scenario

The 'Low' scenario assumes 1-2 deposits, across multiple deposit styles, could be discovered and developed in the WPA. These discoveries are sized within the constraints of the low estimate of undiscovered resources. It is a conservative scenario that reflects limited future potential of high value commodities in the WPA.

Best scenario

The 'Best' scenario expands on the Low Scenario, assuming multiple deposits across the assessed deposit styles could be discovered and developed within the WPA, sized within the constraints of the Median estimate of undiscovered resource. It reflects a 'most likely' scenario based on remaining undiscovered resources and a range of possible mine developments.

High scenario

For most commodities, the 'High' scenario expands on the Best Scenario to twice the number of deposits across multiple deposit styles that could be discovered and developed within the WPA within the constraints of the High estimate of undiscovered resources. It is an optimistic scenario where a greater number of discoveries is made across high value commodities, including a substantial IOCG deposit.

A number of identified analogues from across SA have been previously used in the 2018 study and have been used again for this current assessment. These include **Prominent Hill** for future gold, copper, silver and uranium deposits;

Challenger for future gold and silver deposits; **Beverley** for future uranium deposits; and **Jacinth-Ambrosia** for future heavy mineral sand deposits.

The NPV of possible future mines and energy resources in the WPA is estimated to be around $3.1 billion, $12.2 billion and $23.4 billion for the Low, Best and High scenarios respectively (Table 6). These values have been estimated using analogue mines, that reflect the best available data on costs, average annual production rate, mine life and projected commodity prices. Analogues selected represent what could reasonably be expected to be developed in a 15-20 year timeframe, with consideration for deposit style and other key characteristics. Analogues were also selected to fit within an upper bound potential volume for each of the Low, Best and High scenarios. While this is not definitive, it provides additional rigour to the selection process. More detail on analogues is provided in the *Resource prospectivity technical appendix*.

Compared to the 2018 study, there is a significant difference in the demonstrated and potential resources in the WPA, and in the NPV of these resources in the 2023 study. Overall, compared to 2018, there is a higher level of EDR and of undiscovered potential resources. Given the potential resource range in 2023 has been determined through a methodology enabled by the inclusion of new datasets, the uplift in volumes and in financial value, as per NPV demonstrate what a significant value these precompetitive geoscience datasets provide.

Table 6: Summary of undiscovered contained metal resource, potential solar energy generation capacity and Net Present Values (low-best-high scenario) by commodity

	Potential Resource			Net Present Value ($AUD million)		
Commodity	**Low**	**Best**	**High**	**Low**	**Best**	**High**
Copper	1,080 kt	5,020 k t	23,310 kt	1,559	5,697	11,394
Gold	98 t	453 t	2,104 t	360	1,851	3,702
Iron	39 Mt[a]	182 Mt[a]	847 Mt[a]	131	393	1,378
Uranium	75,800 t	351,700 t	1,632,500 t	440	1,605	3,210
Heavy Mineral Sands (Zircon, Rutile, Ilmenite)	595,000 t	2.76 Mt	12.8 Mt	241	894	1,788
Nickel	58,800 t	269,700	1,122,000 t	267	1,409	872
Cobalt	3,400 t	15,600 t	72,500 t	8	49	97
Silver	348 t	1600 t	7500 t	27	138	277
Solar	650 MW[b]	700 MW[b]	3,500 MW[b]	71	147	693
Total				**3,106**	**12,183**	**23,411**

a. Values represent undiscovered iron ore tonnage, not contained iron
b. Values represent projected generation capacity in the Roxby Downs Renewable Energy Zone

2.2 Methodology

2.2.1 Resource prospectivity and undiscovered tonnage

As described previously, this Resource Prospectivity assessment of the WPA builds on the 2010 and 2018 assessments undertaken by Geoscience Australia. The methodology used to determine the potential for the commodities described in this report is based on the method described in the 2010 Geoscience Australia assessment, using knowledge of how particular deposits form (mineral deposit models) to define a set of geological conditions that are used to delineate 'tracts' or areas within the WPA that are favourable for the formation of that particular mineral deposit, with some exceptions where published assessments were used for certain commodities, or for non-mineral commodities.

However, this report also differs from the 2018 study by adopting a quantitative approach to determining the potential undiscovered remaining resource within the WPA, using the quantitative assessment method defined by Singer and Kouda[11]. This method uses the spatial extent of the 'permissive tracts' or prospective areas and a representative grade and tonnage model for each mineral deposit model to produce a probabilistic assessment of undiscovered tonnage. The method, as applied in this report, is described in detail in the *Resource potential maps* section of the *Resource prospectivity technical appendix*.

With consideration to recently acquired data and progression in the geological understanding of these models, the DEM reviewed the 2010 and 2018 mineral deposit models and identified opportunities to make modifications or additions to the mineral deposit models described in the 2018 Geoscience Australia report.

Based on these updated inputs for 2023 and the level of confidence that these inputs could constrain a quantitative assessment, the commodities were split into 3 groups (Table 7):

- **Group A:** Commodities with sufficient inputs to constrain the mapping of permissive tracts as described by Singer and Kouda (2011)[12], or commodities associated with deposit styles already in Group A (Silver and Cobalt). The method produces a Low, Median and High case for undiscovered tonnage for a mineral deposit style.
- **Group B:** Commodities where our understanding of the mineral deposit model within the WPA was sufficient to support a quantitative assessment, but mapping could not be constrained sufficiently to use the approach of Singer and Kouda (2011)[13]. Instead, a similar approach to the 2018 report was used, identifying suitable analogue deposits/mines to represent the Low, Median and High estimates for those minerals. Solar and wind are also considered Group B commodities as the approach to determining generation potential has been quantitative but deterministic.
- **Group C:** There is insufficient data to constrain the geological model of this commodity in the WPA, or the approaches described above do not apply to that commodity (i.e., groundwater, geothermal).

11 Singer, D.A & Kouda, R. (2011) *Probabilistic estimates of number of undiscovered deposits and their total tonnages in permissive tracts using deposit densities*

12 Ibid.

13 Ibid.

Table 7: Commodity groupings, by methodology used to calculate undiscovered resource

Group	Commodities	Approach
A	Copper Iron Gold Uranium Heavy Mineral Sands (Zircon, Rutile, Ilmenite) Silver Cobalt	Quantitative assessment of potential undiscovered resource using the method described in Singer and Kouda (2011)
B	Nickel Solar and Wind Rare Earth Elements	Deterministic assessment of potential, using: • Australian analogue deposits or • AEMO 2022 Integrated Systems Plan Scenarios for Solar and Wind
C	Coal Petroleum (Oil & Gas) Potash Alumina Natural Hydrogen Chromium Lithium Platinum Group Elements Extractive materials Zinc Lead Groundwater Geothermal	Potential resource will not be determined due to insufficient data

Source: Scyne Advisory and DEM analysis 2023

2.2.2 Net Present Value

The approach to determining the NPV of 'known' mineral resources and possible future mine developments in the WPA is based on the approach used by Geoscience Australia in 2018, but also integrates the derived Low, Median and High estimate of undiscovered tonnage of Group A and Group B commodities in the WPA. As undiscovered tonnage is effectively an upper-bound of what could be discovered within the WPA, the Low, Best and High scenarios for NPV were determined using assessment of suitable analogues, under the constraints of the undiscovered tonnage. Further overview of the analogues, including their composition, and approach, is provided in the *Net Present Value methodology* section of the *Resource productivity technical appendix.*

NPV was not calculated for the commodities in Group C. Access to nearby construction materials, groundwater and renewable power generation infrastructure for the future mine developments described in this report could deliver value through the reduction in capital and operating costs or direct revenue. **Therefore, the inclusion of Groundwater, Extractive materials, Geothermal Energy and behind-the-meter Solar and Wind infrastructure could contribute to a higher NPV for the WPA than what has been calculated in this report.** However, as the cost assumptions in the NPV calculations are based on existing mines, to ensure consistency across the analogues, no adjustments have been made to determine the value of adjacent extractive materials, groundwater or renewable energy resources for these potential future projects.

The approach to calculating NPV is detailed in the *Net Present Value methodology* section of the *Resource productivity technical appendix.*

2.3 Summary results

A summary of resource prospectivity assessment results are given in Tables 8 to 12.

Table 8: Summary of undiscovered contained metal resource in the Woomera Prohibited Area, by commodity

	Economic Demonstrated Resource (EDR)		Undiscovered Potential Resource				
Commodity	**2018[a]**	**2023[b]**	**2018 Conservative[a]**	**2018 Optimistic[a]**	**Low**	**Best**	**High**
Copper	1,087,150 t	1,645,200 t	2,222,000 t	6,666,000 t	1,080,000 t	5,020,000 t	23,310,000 t
Gold	70.1 t	143.14 t	106 t	318 t	98 t	453 t	2,104 t
Iron	196.15 Mt*	220.4 Mt*	210 Mt	585 Mt	39 Mt	182 Mt	847 Mt
Uranium	N/A	N/A	43,000 t	75,000 t	75,800 t	351,700 t	1,632,500 t
Zircon	N/A	N/A	N/A	5,075,000 t	155,200 t	720,200 t	3,342,900 t
Rutile	N/A	N/A	N/A	541,000 t	39,400 t	182,800 t	848,600 t
Ilmenite	N/A	N/A	N/A	2,233,000 t	400,400 t	1,858,800 t	8,627,800 t
Rare Earth Elements	N/A	N/A	N/A	N/A	9,700 t	63,900 t	35,431,200 t
Nickel	N/A	N/A	N/A	N/A	58,800 t	269,700 t	
Cobalt	N/A	N/A	N/A	N/A	3,400 t	15,600 t	72,500 t
Silver	297 t	435.46 t	402 t	1207 t	348 t	1600 t	7500 t

Source: a. Mineral and petroleum resources and potential of the Woomera Prohibited Area, 2018, Geoscience Australia, b. Department for Energy and Mining, * EDR of iron reported as contained iron.

Table 9: Summary of NPV by commodity ($AUD, millions)

Commodity	**2018 EDR[a]**	**2018 Conservative[a]**	**2018 Optimistic[a]**	**2023 EDR[b]**	**Low[b]**	**Best[b]**	**High[b]**
Copper	1,543	3,541	10,623	8,593	1,559	5,697	11,394
Gold	822	1,089	3,268	4,870	360	1,851	3,702
Iron	3,169	745	2,116	553	131	393	1,378
Uranium	N/A	951	1,571	N/A	440	1,605	3,210
Heavy Mineral Sands (Zircon, Rutile, Ilmenite)	N/A	N/A	1,362	N/A	241	894	1788
Nickel	N/A	N/A	N/A	N/A	267	1,409	872
Cobalt	N/A	N/A	N/A	N/A	8	49	97
Silver	41	70	211	194	27	138	277
Solar	N/A	N/A	N/A	N/A	71	147	693
Total	**5,575**	**6,397**	**19,152**	**14,211**	**3,106**	**12,183**	**23,411**

Source: a. Mineral and petroleum resources and potential of the Woomera Prohibited Area, 2018, Geoscience Australia, b. Scyne Advisory and DEM analysis, 2023

Table 10: Quantities of future possible mines in the WPA in the Low Scenario.

Future mine	Commodity	Assumed total production over mine life
1 Prominent Hill (scaled to 110 Mt ore)	Copper Gold Silver Uranium	864 kt Cu 34 t Au 154 t Ag 17,100 t U
1 Emmie Bluff (scaled to 7.7Mt ore)	Copper Silver Cobalt	70,000 t Cu 50 t Ag 2775 t Co
1 Buzzard	Iron	12.5 Mt Fe ore
1 Jacinth-Ambrosia (scaled to 39 Mt ore)	Zircon Rutile Ilmenite	1,371 kt Zircon 142 kt Rutile 605 kt Ilmenite
1 Cassini (WA)	Nickel	49,920 t Ni

Source: Department for Energy and Mining, Scyne Advisory and DEM analysis, 2023

Table 11: Quantities of future possible mines in the WPA in the Best Case Scenario

Future mine	Commodity	Assumed total production over mine life
1 Challenger	Gold Silver	37.5 t Au 1.5 t Ag
1 Carrapateena	Copper Gold Silver	1,100 kt Cu 52 t Au 480 t Ag
1 Prominent Hill	Copper Gold Silver Uranium	2,222 kt 88 t Au 396 t Ag 44 kt U
1 Emmie Bluff	Copper Cobalt Silver	350 kt Cu 14 kt Co 254 t Ag
1 Beverley	Uranium	30.1 kt U
3 Buzzard	Iron	37.5 Mt Fe ore
1 Jacinth-Ambrosia	Zircon Rutile Ilmenite	5,082 kt Zircon 528 kt Rutile 2,244 kt Ilmenite
1 Nova-Bollinger (WA)	Nickel	2,668 kt Ni

Source: Department for Energy and Mining, Scyne Advisory and DEM analysis, 2023

Table 12: Quantities of future possible mines in the WPA in the High Scenario

Future mine	Commodity	Assumed total production over mine life
2 Prominent Hill	Copper Gold Uranium Silver	4,444 kt Cu 176 t Au 88 kt U 792 t Ag
2 Challenger	Gold Silver	75 t Au 3 t Ag
2 Carrapateena	Gold Copper Silver	104 t Au 2,200 kt Cu 960 t Ag

Future mine	Commodity	Assumed total production over mine life
2 Emmie Bluff	Copper Silver Cobalt	700 kt Cu 508 t Ag 28 kt Co
2 Beverley	Uranium	60.1 kt U
3 Buzzard	Iron	37.5 Mt Fe ore
1 Central Eyre Iron Project	Iron	537.5 Mt Fe ore
2 Jacinth-Ambrosia	Zircon Rutile Ilmenite	10,164 kt Zircon 1,056 kt Rutile 4,488 kt Ilmenite
1 Nebo-Babel (WA)	Nickel	686.4 kt Ni

Source: Department for Energy and Mining, Scyne Advisory and DEM analysis, 2023
Note: For the mapping presented through the remainder of Chapter 2, the terminology "Defence Use Zones" is used. This is done to ensure consistency with the Geoscience Australia (2018) report. However, it is noted that "WPA Access Zones" would be more appropriate terminology for the site.

2.4 Results by commodity

2.4.1 Copper

Copper resource prospectivity update from 2018

The assessment of potential for undiscovered copper-bearing mineral deposits has been updated from the 2018 Geoscience Australia report, with revisions to the map of IOCG deposits and the inclusion of sedimentary-hosted copper deposits as a prospective deposit style. The 2018 assessment of IOCG potential is equivalent to that present in the 2010 WPA assessment, based upon Geoscience Australia's earlier IOCG prospectivity map.[14] For 2023, the prospectivity assessment was updated to include magnetotelluric data from AusLAMP (data in SA was acquired between 2014 and 2017) and gravity and magnetic response data from GCAS, acquired in 2019.

This data was used in combination with the same inputs described in the Geoscience Australia 2010 report (Table 13) to delineate areas of potential for IOCG deposits through interpretation. Each geological criteria input is capture as a separate layer, where the spatial distribution of that input is classified in a binary way, where presence of that input is assigned a value of '1,' and where it is not present in the WPA is assigned a value of '0.' All the input layers for a deposit style are 'stacked' with an equal weighting, such that areas with the greatest number of geological criteria present for the deposit style are represented by the highest values in the output stack. Based on the density of relatively high values in an area of the WPA and an understanding of spatial geological trends, areas of varying potential are delineated through interpretation and then assigned a prospectivity rating between 1 – 5, or Low to High, based on the number of geological criteria present in the defined areas. This methodology is described in more detail in the *Resource productivity technical appendix*. Figure 11 shows the updated areas of potential for IOCG deposits.

Table 13: Geological inputs used to evaluate copper potential in the WPA

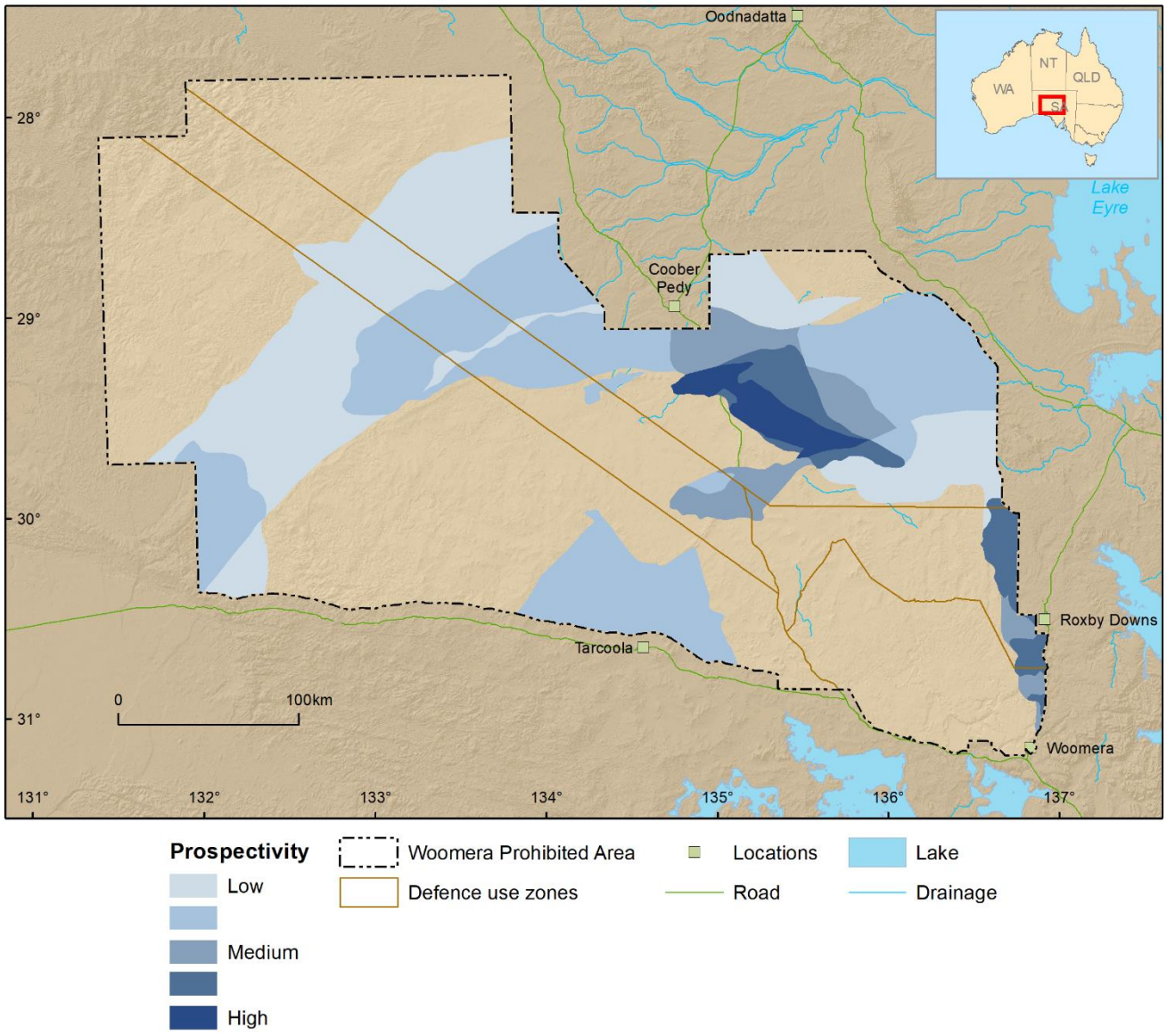
Deposit style	Geological Criteria	Inputs	Considerations
Iron-oxide-copper-gold-uranium	Key host units and fluid sources	• Hiltaba Suite • Donington Suite • Mount Woods Complex • Wallaroo Group • Hutchison Group • Banded Iron Formations	
	Faults	Archean to Early Mesoproterozoic faults	1 km buffer

[14] Skirrow, et al. (2006) *Iron oxide Cu-Au (-U) potential map of the Gawler Craton, South Australia, 1: 500 000 scale*

Deposit style	Geological Criteria	Inputs	Considerations
	Drillhole Geochemistry	Locations where maximum drillhole geochemistry indicate Copper > 10 times crustal abundance	2km buffer added around drillhole location
	Geophysics	• Co-incident gravity and magnetic anomalies • Magnetotellurics	23.5 to 26.2 km depth slice used for MT response
Sedimentary hosted Copper	Geology	Neoproterozoic	
	Geology	Presence of Stuart Shelf sediments	
	Drillhole Geochemistry	Locations where maximum drillhole geochemistry where Copper > 10 times crustal abundance and Cobalt > 10 times crustal abundance	2 km buffer added around drillhole location
	Lithosphere-Asthenosphere Boundary (LAB)	LAB depth 170 km	100 km buffer around 170 km depth

Source: DEM, Geoscience Australia

Figure 11: Copper potential in the iron-oxide-copper-gold-uranium mineral system



The 2010 and 2018 Geoscience Australia reports did not include an assessment of sediment-hosted copper deposits in the WPA. The Neoproterozoic sedimentary succession of the Adelaide Rift Complex, including the Stuart Shelf, which extends into the eastern part of the WPA, has considerable potential for sedimentary-hosted copper deposits due to similarities with the world-class African Copperbelt. The historic SA copper mines of Kapunda, Blinman and Mount Gunson are hosted in Neoproterozoic sediments. Given the presence of Neoproterozoic sediments in the WPA, an assessment of the potential of sedimentary-hosted copper deposits was performed using the inputs described in Table 13. Figure 12 shows the areas of prospectivity for sedimentary-hosted copper deposits in the WPA.

An assessment of the copper-bearing potential of mafic intrusion-hosted nickel-copper-PGE deposits was not performed for this report due to differences in the approach for mapping prospective areas that meant the quantitative methodology for determining potential resource could not be used, therefore the overall copper potential within the WPA, depicted in Figure 13, only considers IOCG or sedimentary-hosted copper deposits.

Figure 12: Copper potential in sedimentary-hosted copper deposits

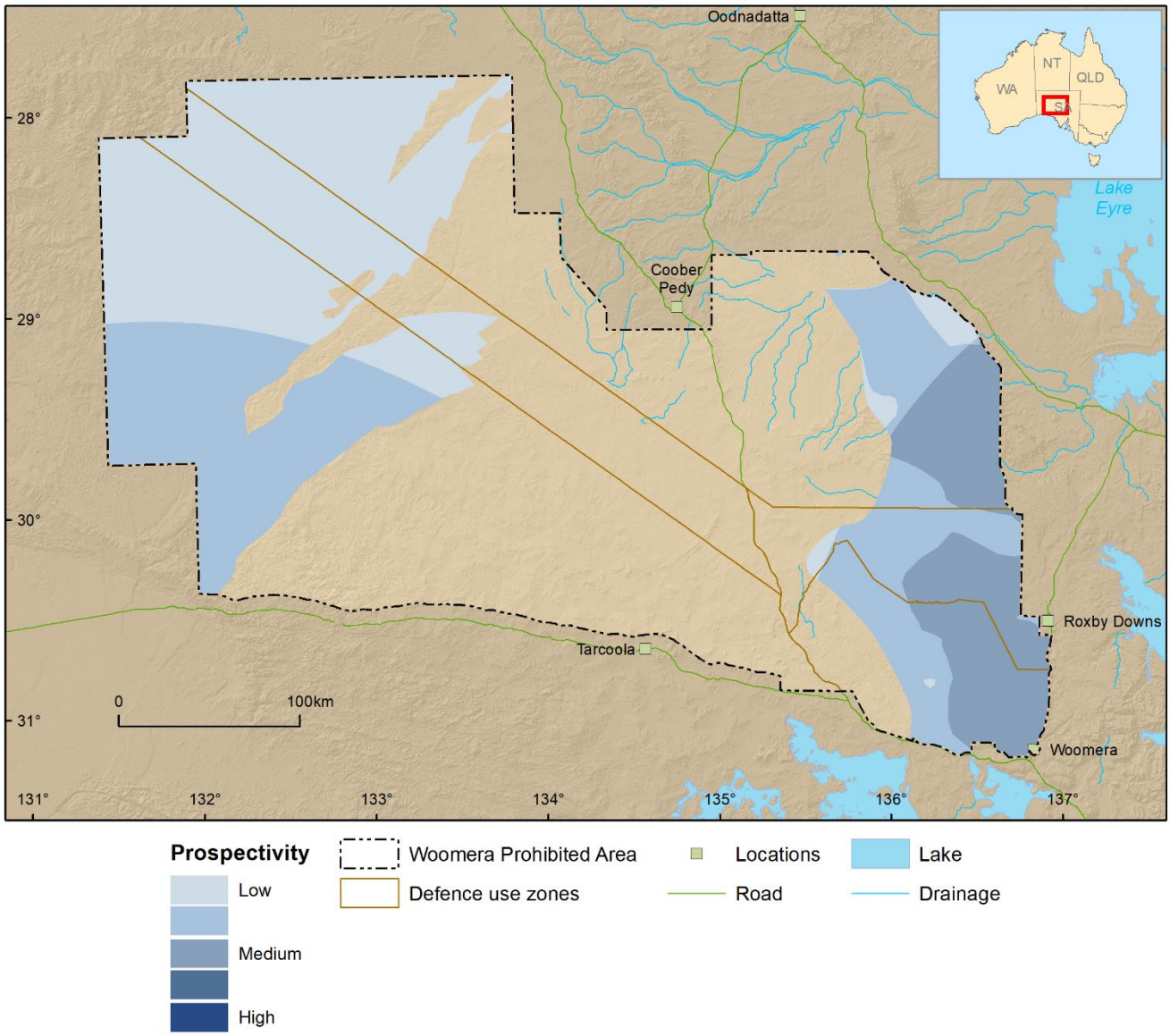
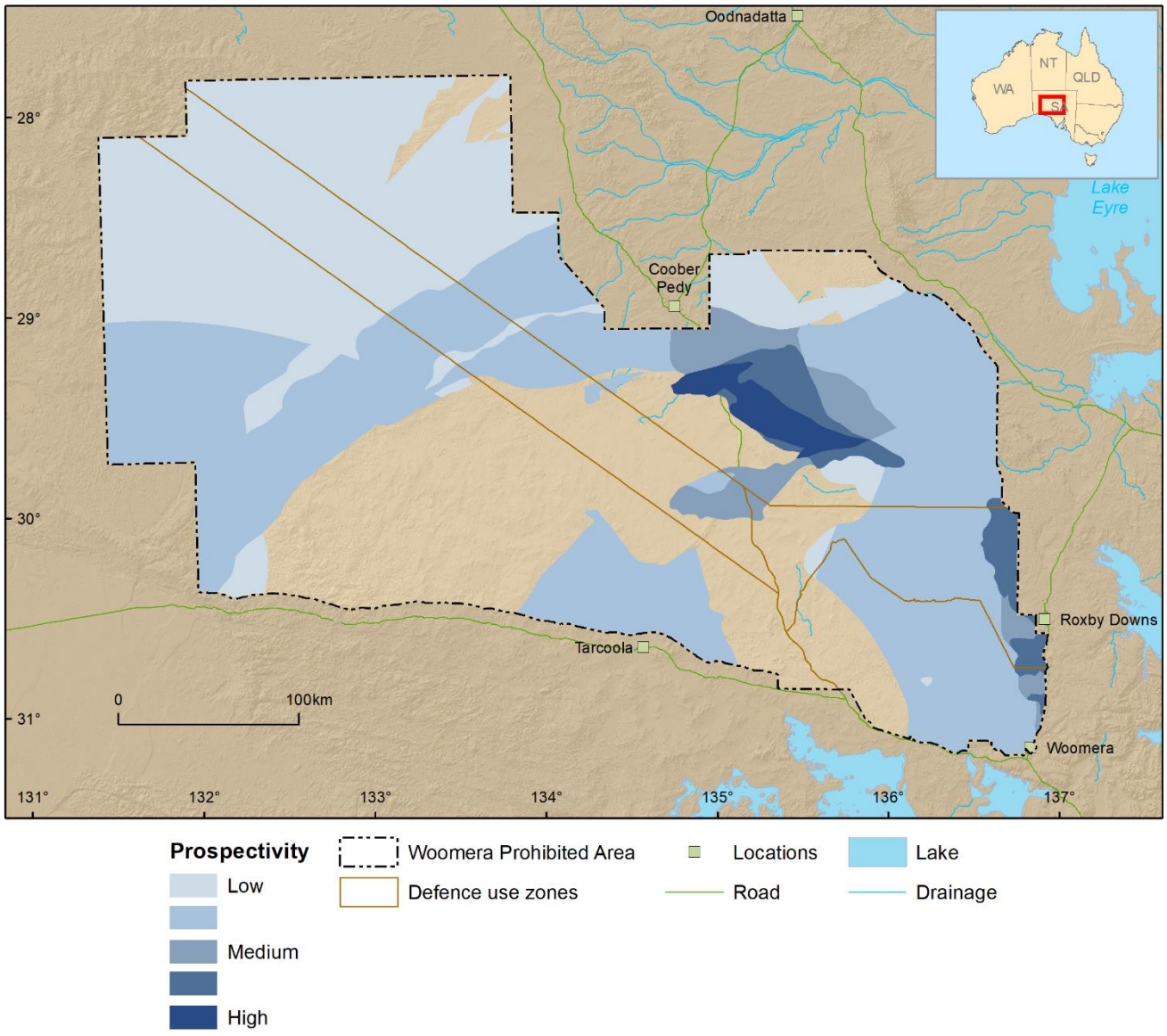


Figure 13: Copper potential in the WPA



Economic Demonstrated Resources

As of 30 June 2022, the EDR of copper within the WPA is 1.65Mt (Table 14).

Table 14: Copper deposits with EDR within the WPA

Deposit	Company	EDR (t)
Prominent Hill	BHP Group Ltd	1,600,000
Cairn Hill	CU-River Mining Australia Pty Ltd	45,200
Total		**1,645,200**

Source: DEM, 2023
Note: EDR = Economic Demonstrated Resource; t = tonnes of contained resource

Future potential for copper in the WPA

The thickness of cover above deposits can have significant implications on mine development complexity and cost. Figure 14 depict the areas where the depth to basement is between 500-1000 m, and greater than 1000 m, above the prospective areas for IOCG copper deposits. Although cover thickness does not impact the area of highest prospectivity for IOCG copper deposits, there is more than 500 m of cover along the eastern margin of the WPA, where the Olympic Cu-Au province extends into the WPA and the potential of deposits is Moderate/High.

Figure 14: Economic potential of IOCG copper deposits in the WPA

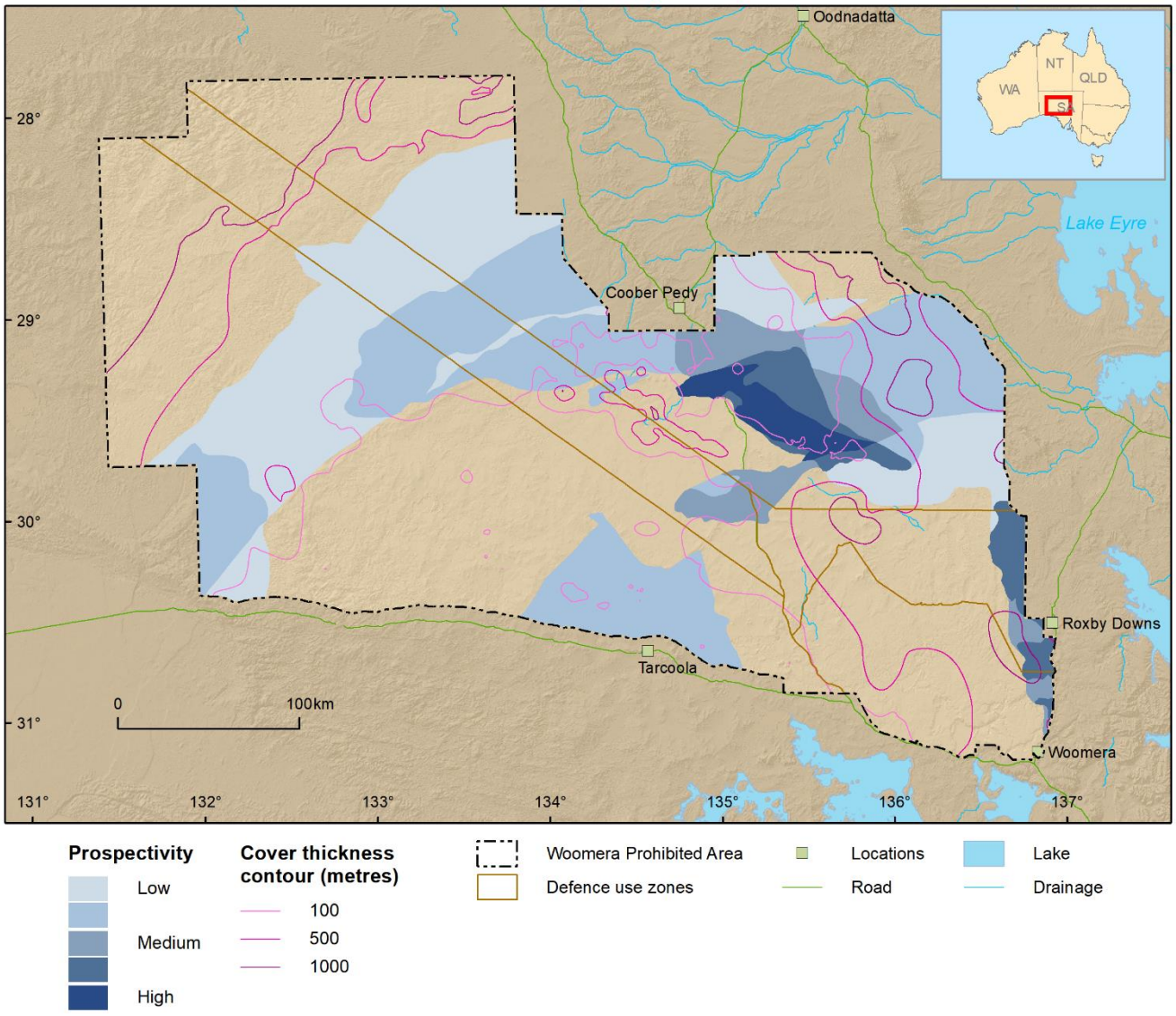


Figure 15 depicts the depth of cover to the top surface of the Neoproterozoic sediments in which sedimentary-hosted copper deposits could form in the WPA. As with IOCG copper, cover is thick in the south-eastern corner of the WPA, near Roxby Downs and Woomera, which could impact the economic viability of a deposit in the Moderate prospectivity rated Stuart Shelf sediments in this area. Cover does thin as you move westwards and northwards from Roxby Downs and Woomera. The Neoproterozoic sediments in the north-west corner of the WPA are beneath a thick layer of cover > 1000m.

Table 15 presents the outputs of the quantitative assessment of undiscovered contained copper tonnage in IOCG and sedimentary-hosted deposit styles.

Figure 15: Economic potential of sedimentary-hosted copper in the WPA

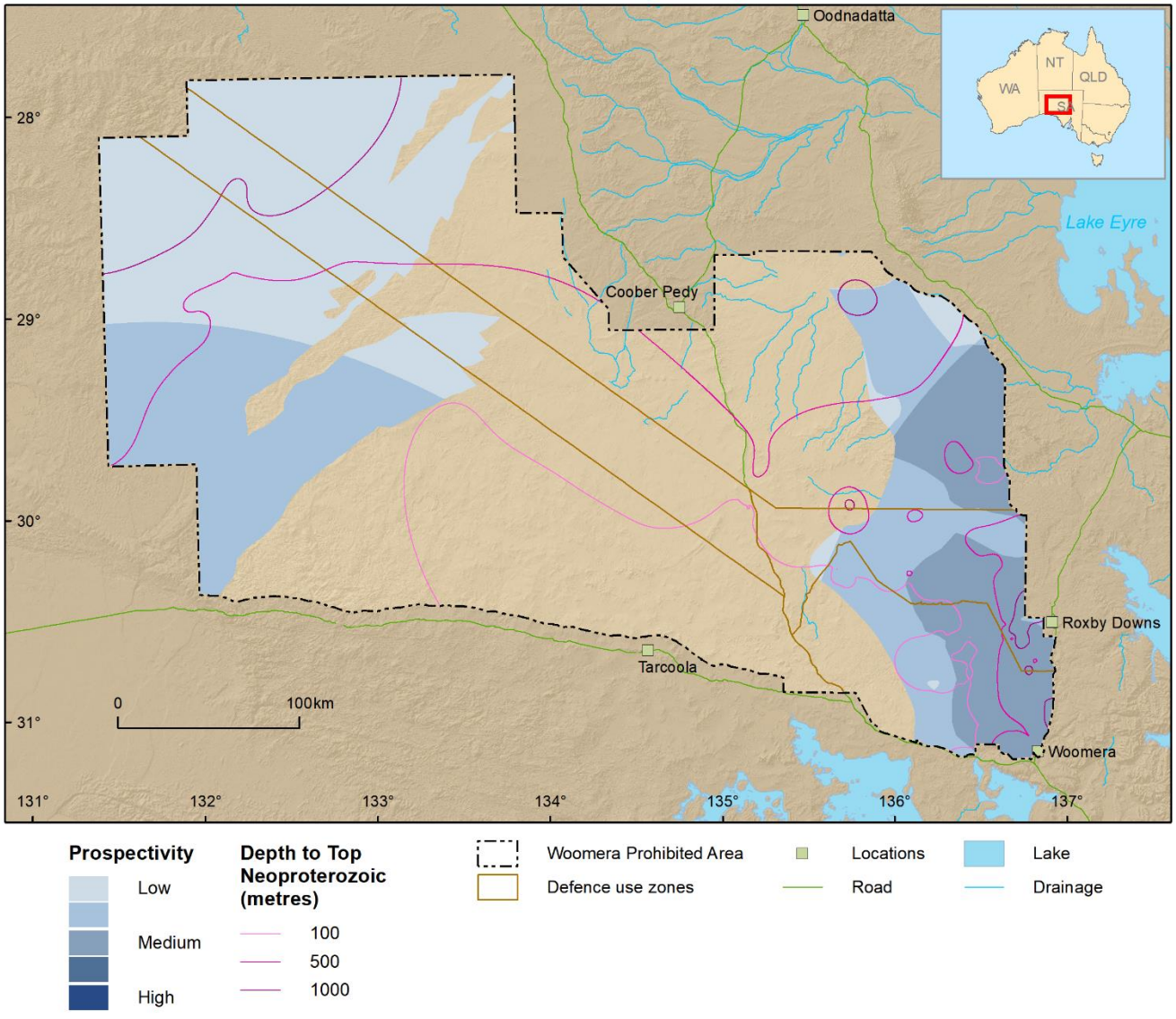


Table 15: Undiscovered copper tonnage potential within the WPA

Deposit style	Total Undiscovered Tonnage (t)		
	Prediction Interval Lower	Mean	Prediction Interval Upper
IOCG Copper	970,000	4,510,000	20,950,000
Sedimentary Copper	109,000	507,000	2,356,000
Total	**1,080,000**	**5,020,000**	**23,310,000**

Source: Scyne Advisory and DEM analysis, 2023

Economic value of copper in the WPA

Based on the derived undiscovered tonnages for IOCG and sedimentary-hosted copper deposits, the NPV of copper was determined based on the scenarios outlined in Table 16. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology*.

Table 16: NPV scenarios proposed to assess impact of possible future copper mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Copper (kt)	1,645	934	3,672	7,344
Potential Future Development(s)		1 Prominent Hill *(scaled to 110 Mt ore)*	1 Prominent Hill	2 Prominent Hill
		1 Emmie Bluff *(scaled to 7.7 Mt ore)*	1 Emmie Bluff	2 Emmie Bluff
			1 Carrapateena	2 Carrapateena
NPV ($AUD million)	**8,593**	**1,559**	**5,697**	**11,394**

Source: Scyne Advisory and DEM analysis, 2023

2.4.2 Gold

Gold resource prospectivity update from 2018

The assessment of potential for undiscovered gold-bearing mineral deposits has been updated from the 2018 Geoscience Australia report, with revisions to the map of IOCG deposits as described in the assessment of copper deposits, and updates to the inputs for the lode gold mineral deposit model.

The lode gold deposit model uses the same set of geological criteria as the 2018 model for Proterozoic and Archean lode gold systems, but also includes the additional host rocks described in the Sleafordian, Kimban and Kararan gold mineral systems[15] and drillhole geochemistry, outlined in Table 17. Figure 17 shows the updated areas of potential for lode gold deposits.

Table 17: Geological inputs used to evaluate gold potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Iron-oxide-copper-gold-uranium	*Gold IOCG prospectivity map is consistent with the Copper IOCG prospectivity map*		
Lode gold mineral systems	Key host units of the Sleafordian gold mineral system	• Mulgathing Complex • Christie Gneiss • Harris Greenstone belt (Lake Harris Komatiite)	The key host units of the 4 gold mineral systems have been merged into a single input for the mineral deposit model
	Key host units of the Kimban gold mineral system	• Mulgathing Complex (around the Bulgunnia Shear zone) • Mt Woods Complex	
	Key host units of the Kararan mineral system (Gawler Range Volcanics)	• Tarcoola Formation • Gawler Range Volcanics • Hutchison Group • Glenloth Granite • Lake Harris Komatiite	
	Key host units of the Kararan gold mineral systems (Hiltaba)	• Hiltaba Suite • Wallaroo Group • Gawler Range Volanics • Tunkillia Suite (felsics)	
	Calcrete Geochemistry	Geochemistry samples from Calcrete indicating Gold > 10 times crustal abundance	2 km buffer added around drillhole location
	Drillhole Geochemistry	Maximum drillhole geochemistry that indicate Gold > 10 times crustal abundance	2 km buffer added around drillhole location
	Faults	Archean to Early Mesoproterozoic faults	
	Geophysics	Linear features in the Total Magnetic Intensity response	
	Known occurrences	Known Gold deposits / occurrences in the WPA	

Source: DEM, Geoscience Australia

[15] Gum, J C. & Pawley, M J. (2022) *Gold mineral systems and exploration strategies for [finding them within] the Gawler Craton, South Australia.*

Figure 16: Gold potential in the iron-oxide-copper-gold-uranium mineral system

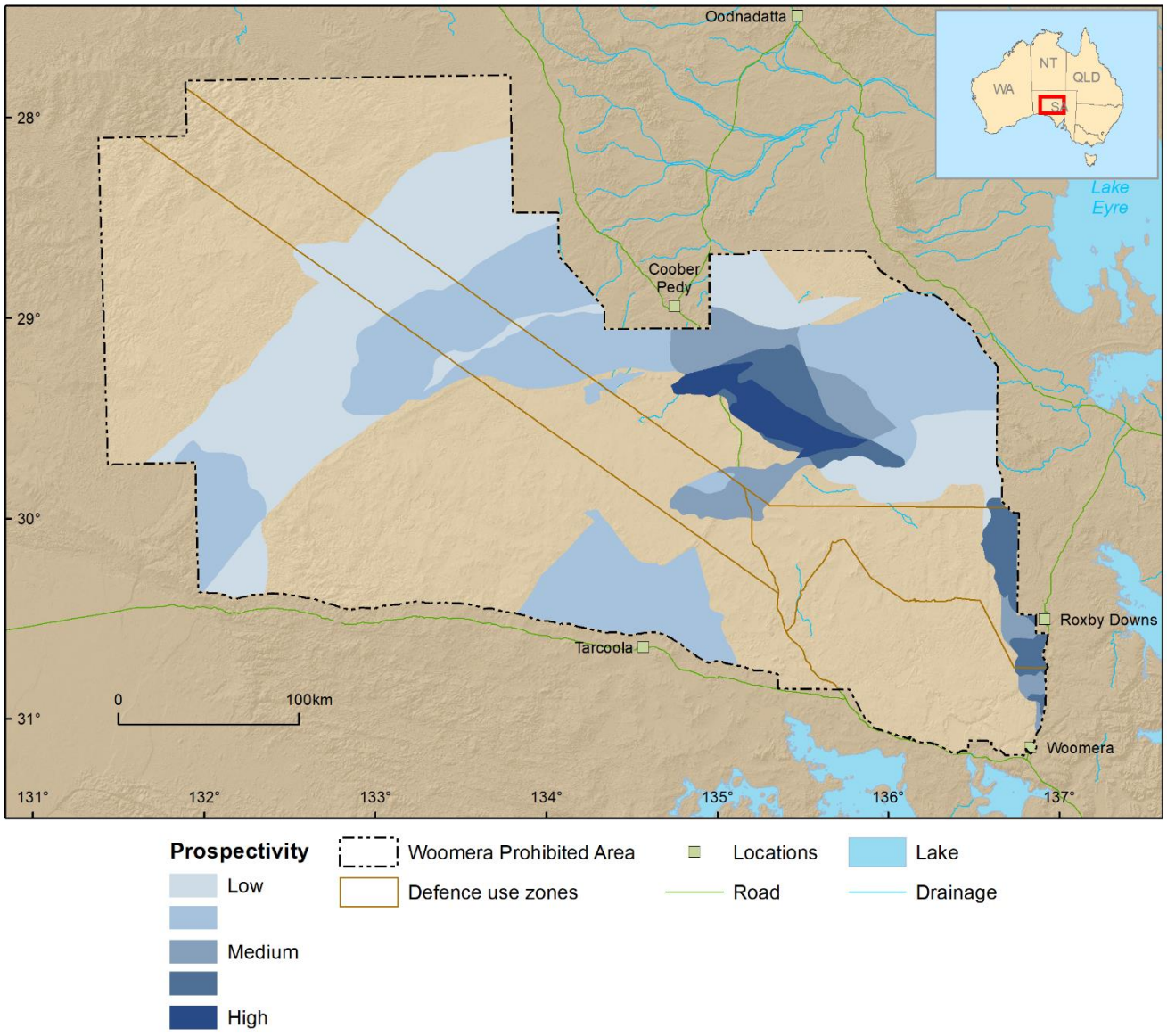


Figure 17: Gold potential in lode gold systems

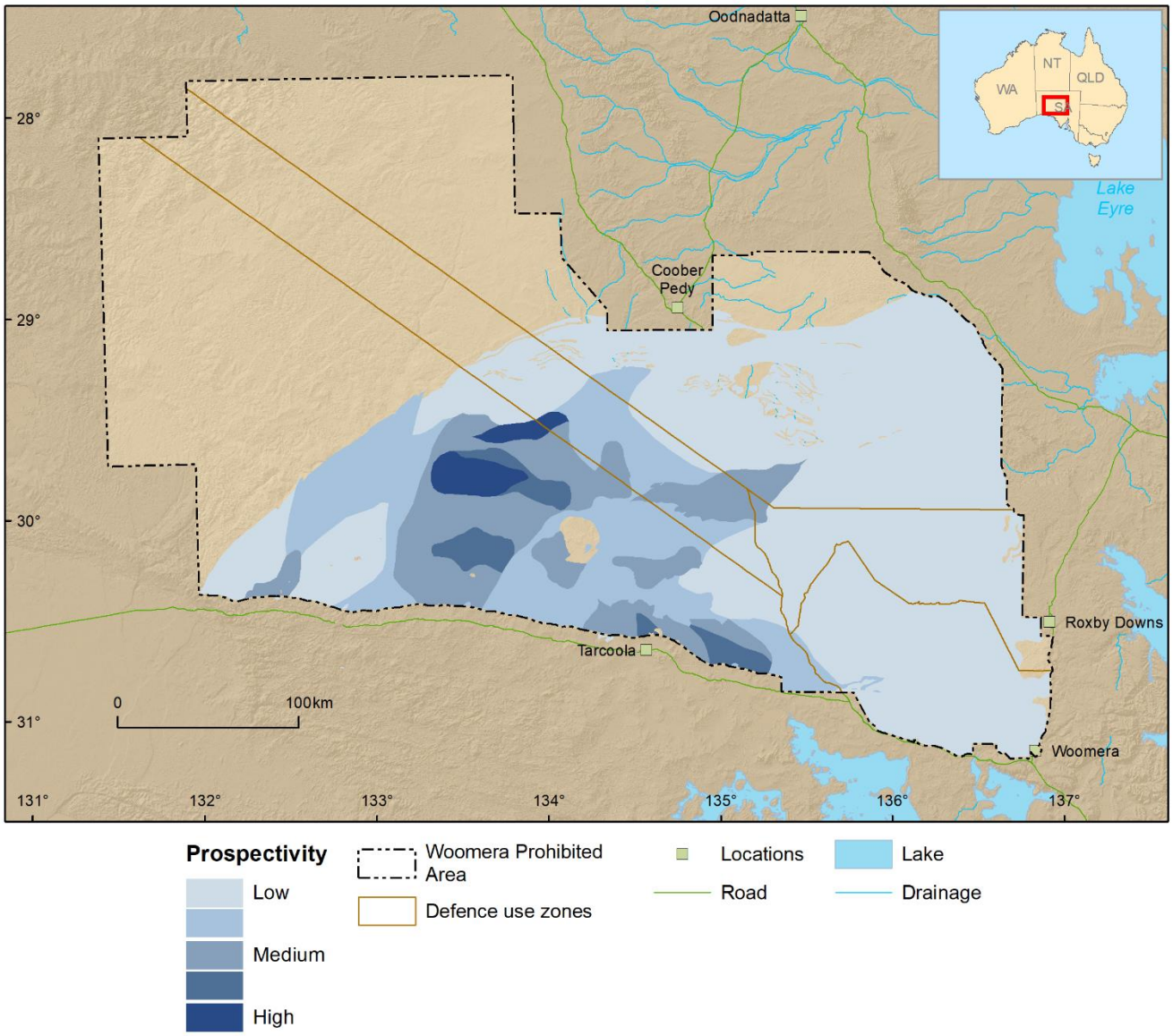
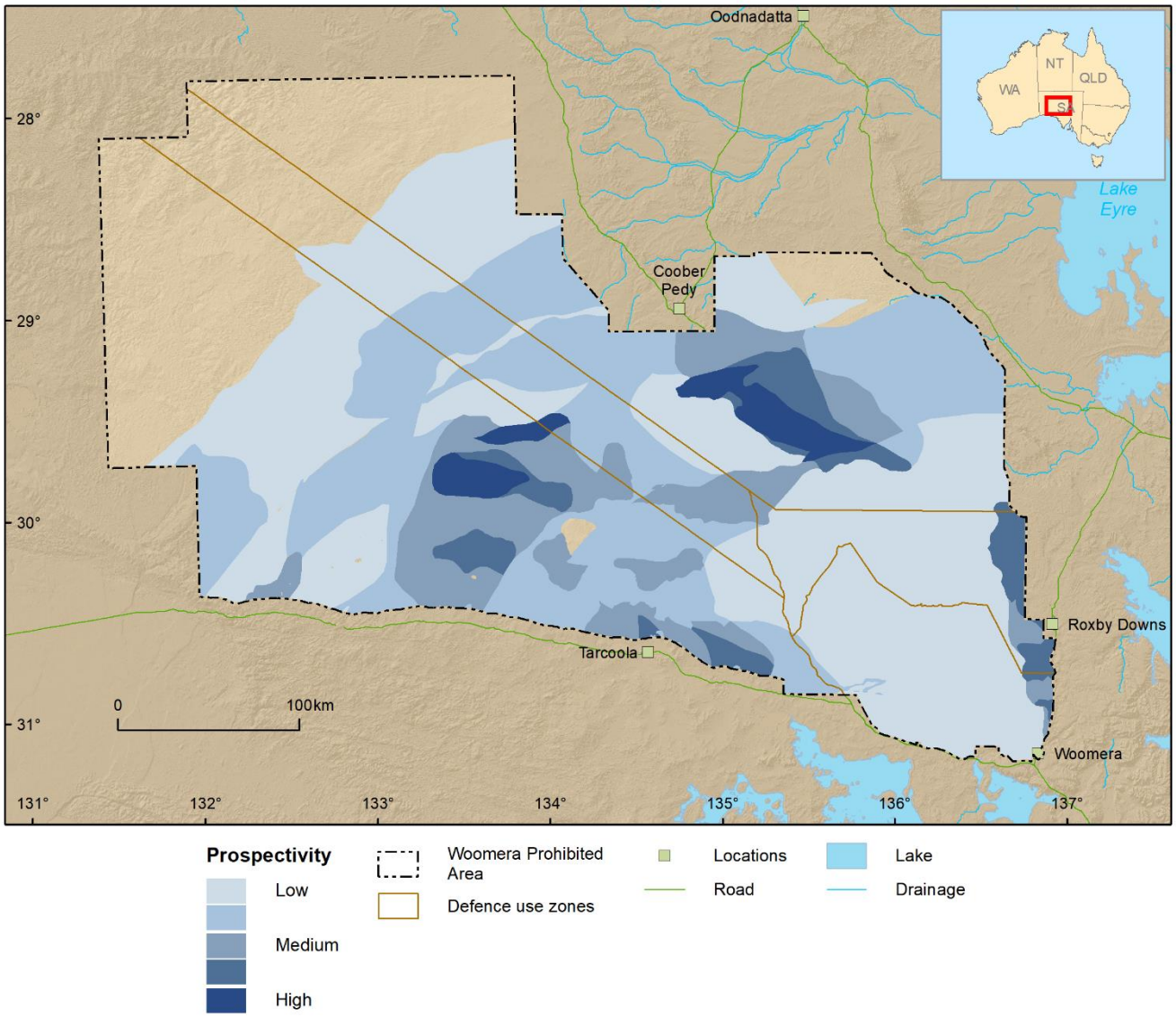


Figure 18: Gold potential in the WPA



Economic Demonstrated Resources

As of 30 June 2022, the EDR of gold within the WPA is 143.15 t (Table 18).

Table 18 : Gold deposits with EDR within the WPA

Deposit	Company	EDR (t)
Cairn Hill	Cu-River Mining Australia Pty Ltd	1.13
Challenger	Barton Gold Holdings Ltd	2.04
Prominent Hill	BHP Group Ltd	139.97
Total		**143.15**

Source: DEM, 2023
Note: EDR = Economic Demonstrated Resource; t = tonnes of contained resource

Future potential for Gold in the WPA

Figure 19 depicts the areas where the depth to basement is between 500-1000 m, and greater than 1000 m, areas where IOCG or lode gold ore bodies could be at depths that could significantly increase development complexity and cost. Cover thickness does not impact the area of highest prospectivity for IOCG gold or lode deposits.

Figure 19: Economic potential of Gold in the WPA

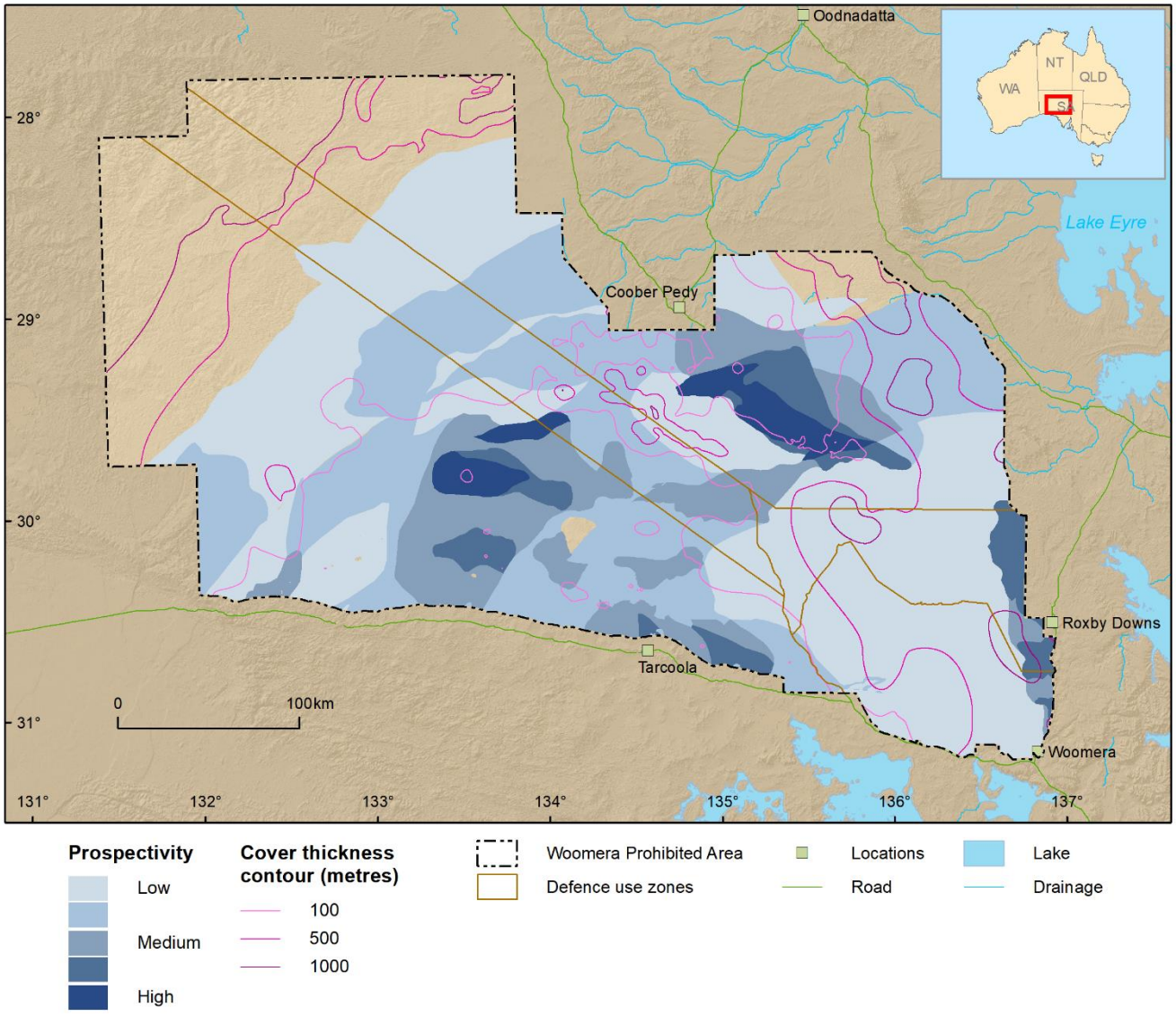


Table 19 summarises the outputs of the quantitative assessment of undiscovered contained gold tonnage in IOCG and lode gold deposit styles.

Table 19: Undiscovered gold tonnage potential within the WPA.

Deposit style	Total Undiscovered Tonnage (t)		
	Prediction Interval Lower	Mean	Prediction Interval Upper
IOCG Gold	34	156	722
Lode Gold	64	298	1,381
Total	**98**	**453**	**2,104**

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Gold in the WPA

Based on the derived undiscovered tonnages for IOCG and lode gold deposits, the NPV of gold was determined based on the scenarios outlined in Table 20. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology*.

Table 20: NPV scenarios proposed to assess impact of possible future gold mine developments in the WPA.

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Gold (t)	143.14	34	177.5	355
Potential Future Development(s)		1 Prominent Hill *(scaled to 110 Mt ore)*	1 Prominent Hill	2 Prominent Hill
			1 Challenger	2 Challenger
			1 Carrapateena	2 Carrapateena
NPV ($AUD million)	**4,870**	**360**	**1,851**	**3,702**

Source: Scyne Advisory and DEM analysis, 2023

2.4.3 Iron

Iron resource prospectivity update from 2018

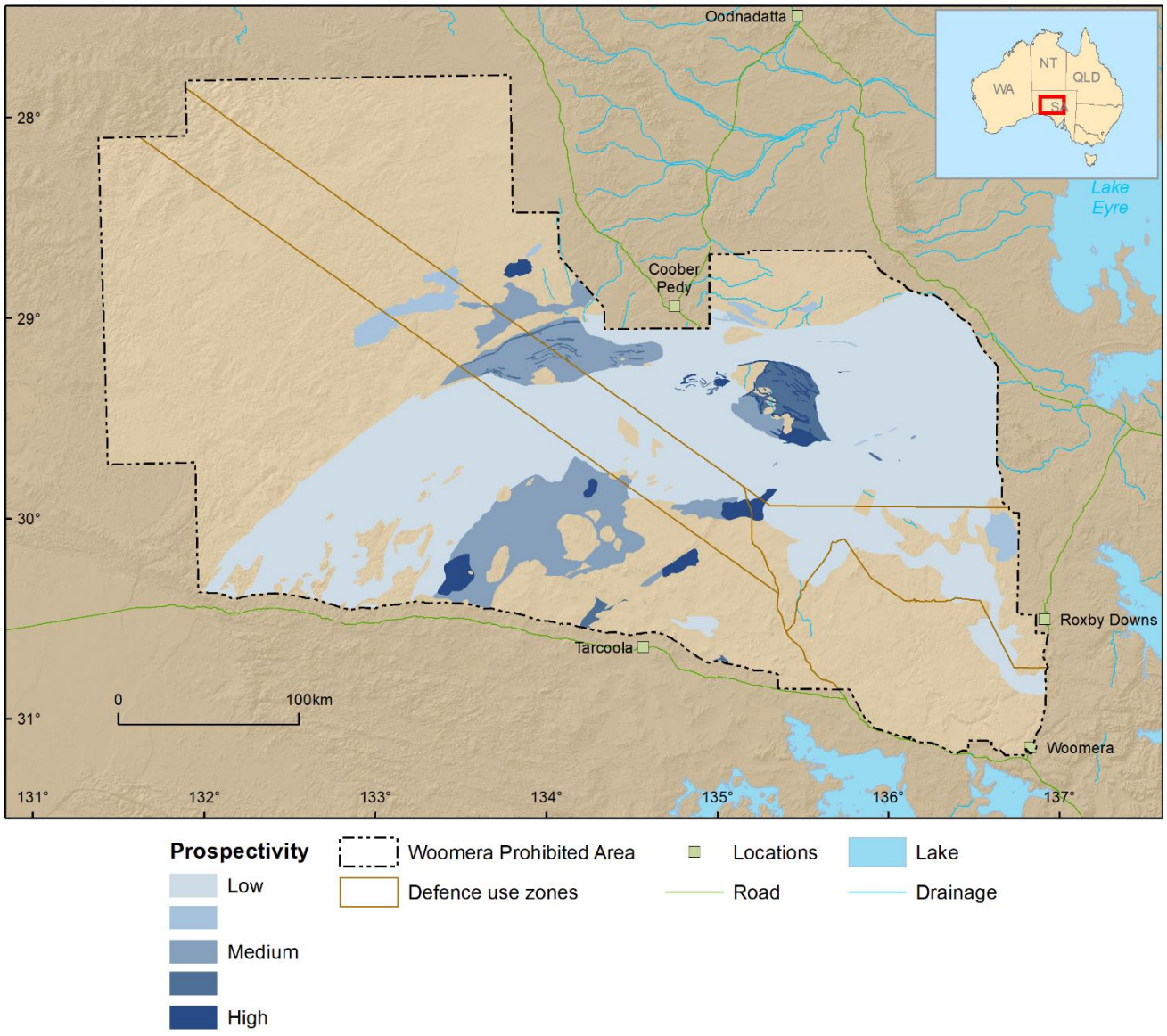
The assessment of potential for undiscovered gold-bearing mineral deposits has been updated from the 2018 Geoscience Australia report, combining the mineral deposit model for banded iron formations and hydrothermal iron deposits, expanding the suitable solid geology units to include the Mount Woods Complex and Mulgathing Complex, and including residual TMI anomalies Table 21. Figure 20 shows the updated areas of potential for iron deposits.

Table 21: Geological inputs used to evaluate iron potential in the WPA.

Deposit style	Geological Criteria	Inputs	Considerations
Banded Iron Formation and Hydrothermal	Solid Geology	• Mulgathing Complex • Mount Woods Complex • Iron Formations	Presence of Iron Formations uplifts prospectivity rating
	Geophysics	Residual TMI Anomalies	Filtered to only include anomalies > 136
	Known occurrences	Known Iron deposits / occurrences in the WPA	

Source: DEM, Geoscience Australia

Figure 20: Iron potential in Banded Iron Formation and Hydrothermal iron systems



Economic Demonstrated Resources

As of 30 June 2022, the EDR of iron within the WPA is 220.4 Mt (Table 22).

Table 22: Iron deposits with EDR within the WPA.

Deposit	Company	EDR (t)
Hawks Nest	Central Iron Pty Ltd	210,230,000
Cairn Hill	Cu-River Mining Australia Pty Ltd	5,643,000
Peculiar Knob	Southern Iron Pty Ltd	4,536,000
Total		**220,409,000**

Source: DEM, 2023
Note: EDR = Economic Demonstrated Resource; t = tonnes of contained resource

Future potential for Iron in the WPA

Figure 21 depicts the areas where the depth to basement is between 500-1000 m, and greater than 1000 m, where iron ore bodies could be at depths that could significantly increase development complexity and cost. Cover thickness does not impact the area of highest prospectivity for iron deposits.

Figure 21: Economic potential of Iron in the WPA

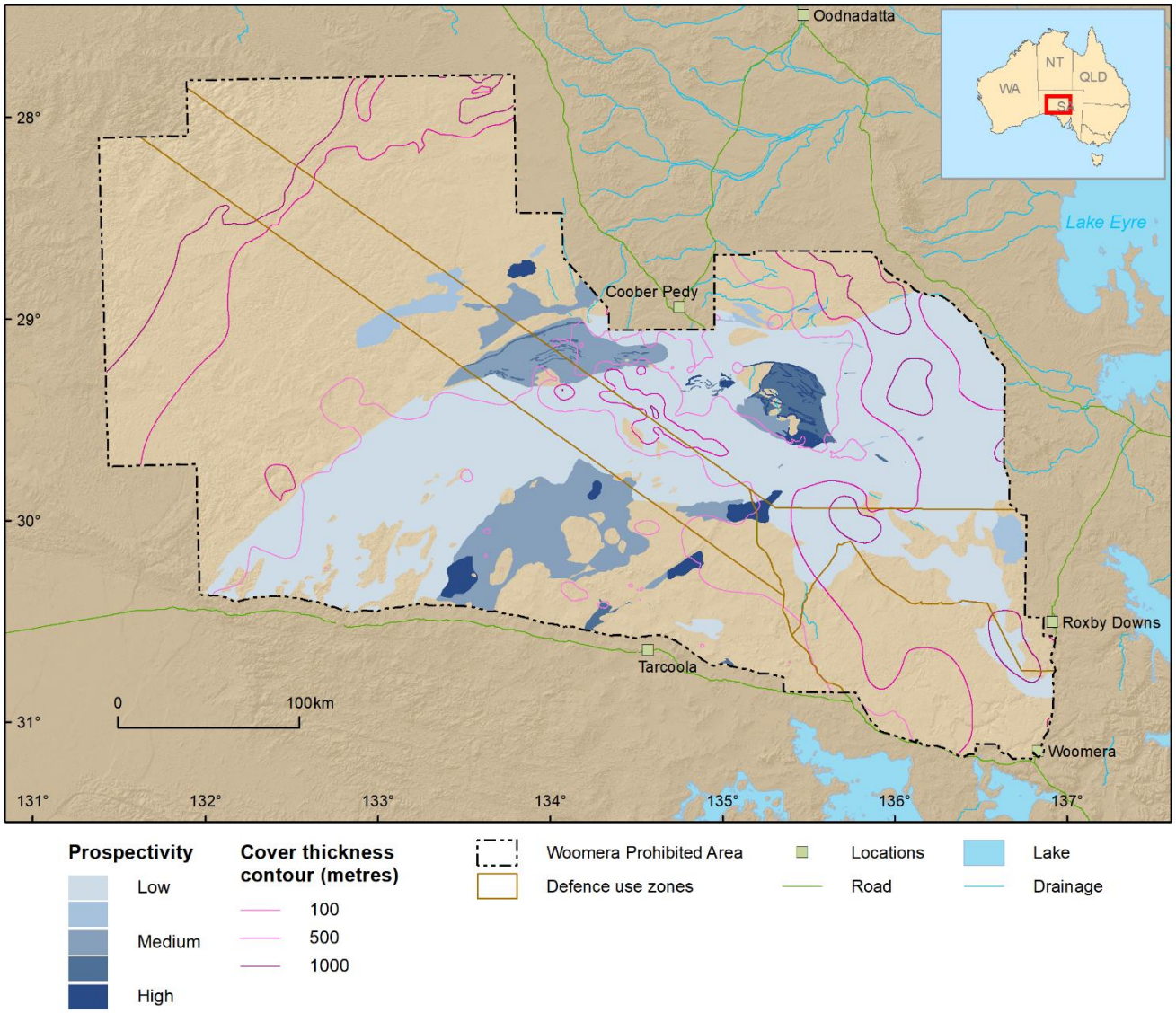


Table 23 summarises the outputs of the quantitative assessment of undiscovered contained iron tonnage in the WPA.

Table 23: Undiscovered iron ore tonnage potential within the WPA

Deposit style	Total Undiscovered Ore Tonnage (Mt)		
	Prediction Interval Lower	Mean	Prediction Interval Upper
Banded Iron Formation-hosted or Hydrothermal Iron	39	182	847

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Iron in the WPA

Based on the derived undiscovered tonnages for iron deposits, the NPV of iron was determined based on the scenarios outlined in Table 24. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology*.

Table 24: NPV scenarios proposed to assess impact of possible future iron mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Iron (Mt)	220.4	12.5	37.5	575
Potential Future Development(s)		1 Buzzard	3 Buzzard	3 Buzzard
				1 Central Eyre Iron Project
NPV ($AUD million)	**553**	**131**	**393**	**1,378**

Source: Scyne Advisory and DEM analysis, 2023

2.4.4 Uranium

Uranium resource prospectivity update from 2018

The assessment of potential for undiscovered uranium-bearing mineral deposits has been updated from the 2018 Geoscience Australia report, with revision to the unconformity associated (Figure 22), sandstone-hosted channel type (Figure 23) and sandstone-hosted rollfront type (Figure 24) uranium systems, and the addition of a calcrete-hosted uranium deposit model (Figure 25) Calcrete geochemistry data, where samples indicate uranium levels 10 times greater than crustal abundance, has been included to map areas of relatively higher prospectivity (Table 25). The IOCG associated uranium mineral system has also been revised as described in the copper assessment (Figure 26).

The relative prospectivity of the sandstone-hosted rollfront type and sandstone-hosted channel type areas were also adjusted from 2018, with all prospectivity levels being lowered by one (e.g., areas mapped as Moderate have been changed to Low/Moderate, and areas mapped as Low/Moderate in 2018 have been revised to Low). This has been done based on the number of inputs described in the 2018 mineral deposit model and the constraints required by other mineral deposit models to constrain high prospectivity areas for input into the quantitative assessment method.

Figure 27 shows the updated Uranium potential for the WPA.

Table 25: Geological inputs used to evaluate uranium potential within the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Iron-oxide-copper-gold-uranium	*Uranium IOCG prospectivity map is consistent with the Copper IOCG prospectivity map*		
Calcrete Hosted	*Mapped areas per 2018 sandstone-hosted channel type uranium map, with the additional input below*		
	Calcrete Geochemistry	Geochemistry samples from Calcrete indicating Uranium > 10 times crustal abundance	2 km buffer added around drillhole location
	Presence of calcrete	Induration Mixed Calcareous and Gypsiferous layer	
Sandstone-hosted Channel type	*Mapped areas per 2018 sandstone-hosted channel type uranium map, with the additional input below*		
	Calcrete Geochemistry	Geochemistry samples from Calcrete indicating Uranium > 10 times crustal abundance	2 km buffer added around drillhole location
Sandstone-hosted Rollfront type	*Mapped areas per 2018 sandstone-hosted rollfront uranium map, with the additional input below*		
	Calcrete Geochemistry	Geochemistry samples from Calcrete indicating Uranium > 10 times crustal abundance	2 km buffer added around drillhole location
Unconformity associated	*Mapped areas per 2018 unconformity associated uranium map, with the additional input below*		
	Calcrete Geochemistry	Geochemistry samples from Calcrete indicating Uranium > 10 times crustal abundance	2 km buffer added around drillhole location

Source: DEM, Geoscience Australia

Figure 22: Unconformity associated uranium potential within the WPA (modified from Geoscience Australia, 2018)

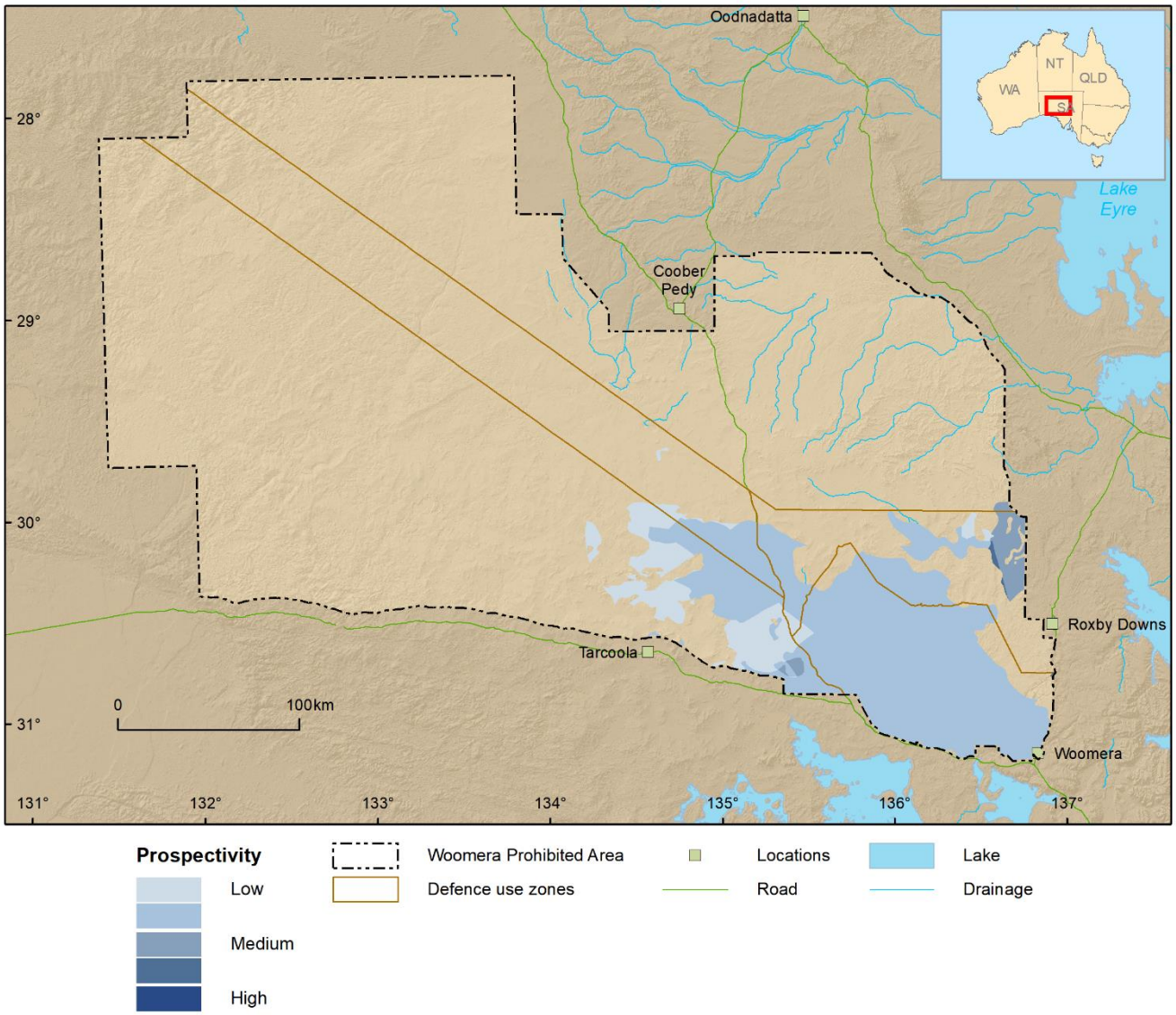


Figure 23: Sandstone-hosted channel type uranium potential within the WPA (modified from Geoscience Australia, 2018)

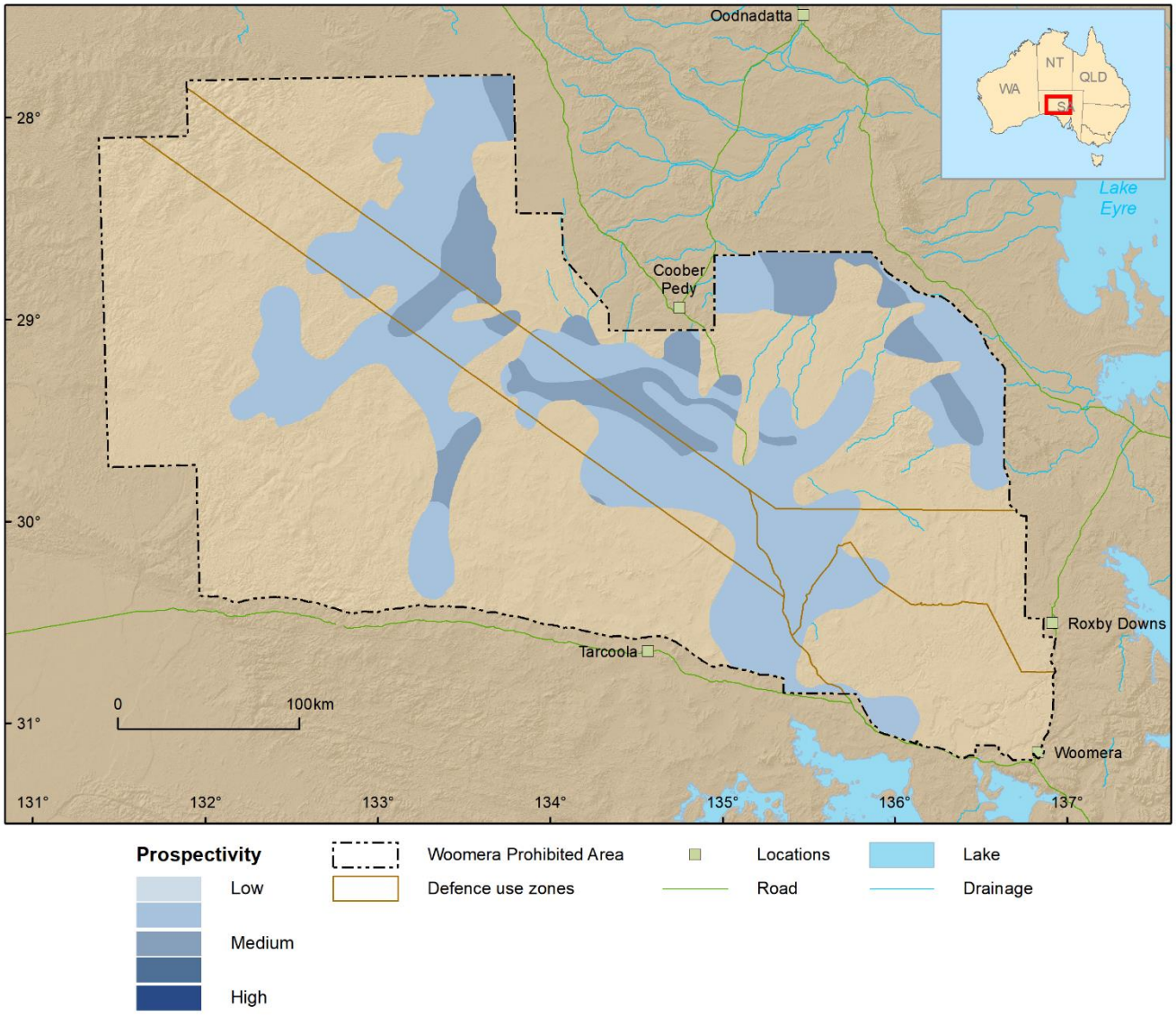


Figure 24: Sandstone-hosted rollfront type uranium potential within the WPA (modified from Geoscience Australia, 2018)

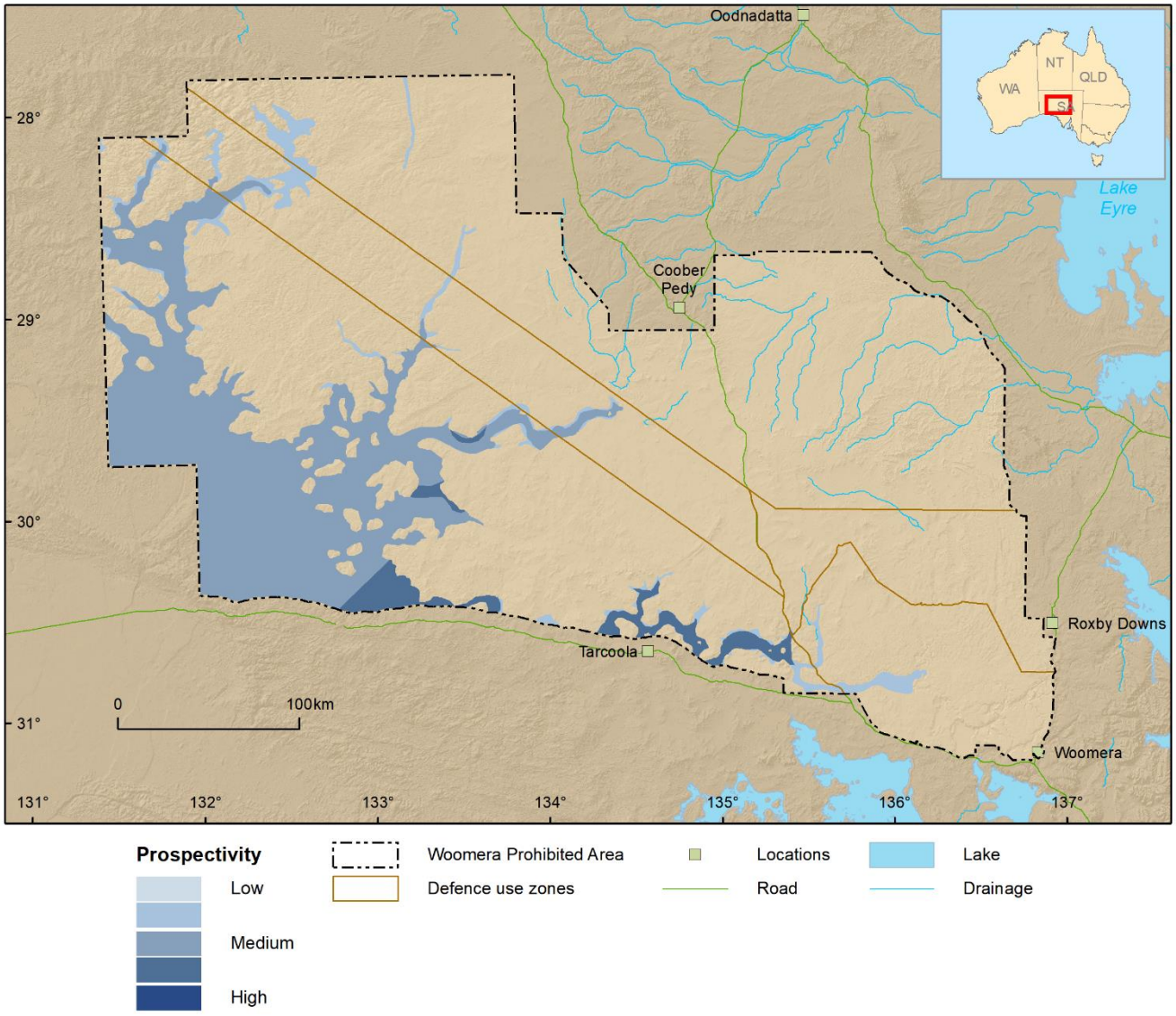


Figure 25: Calcrete-hosted uranium potential within the WPA

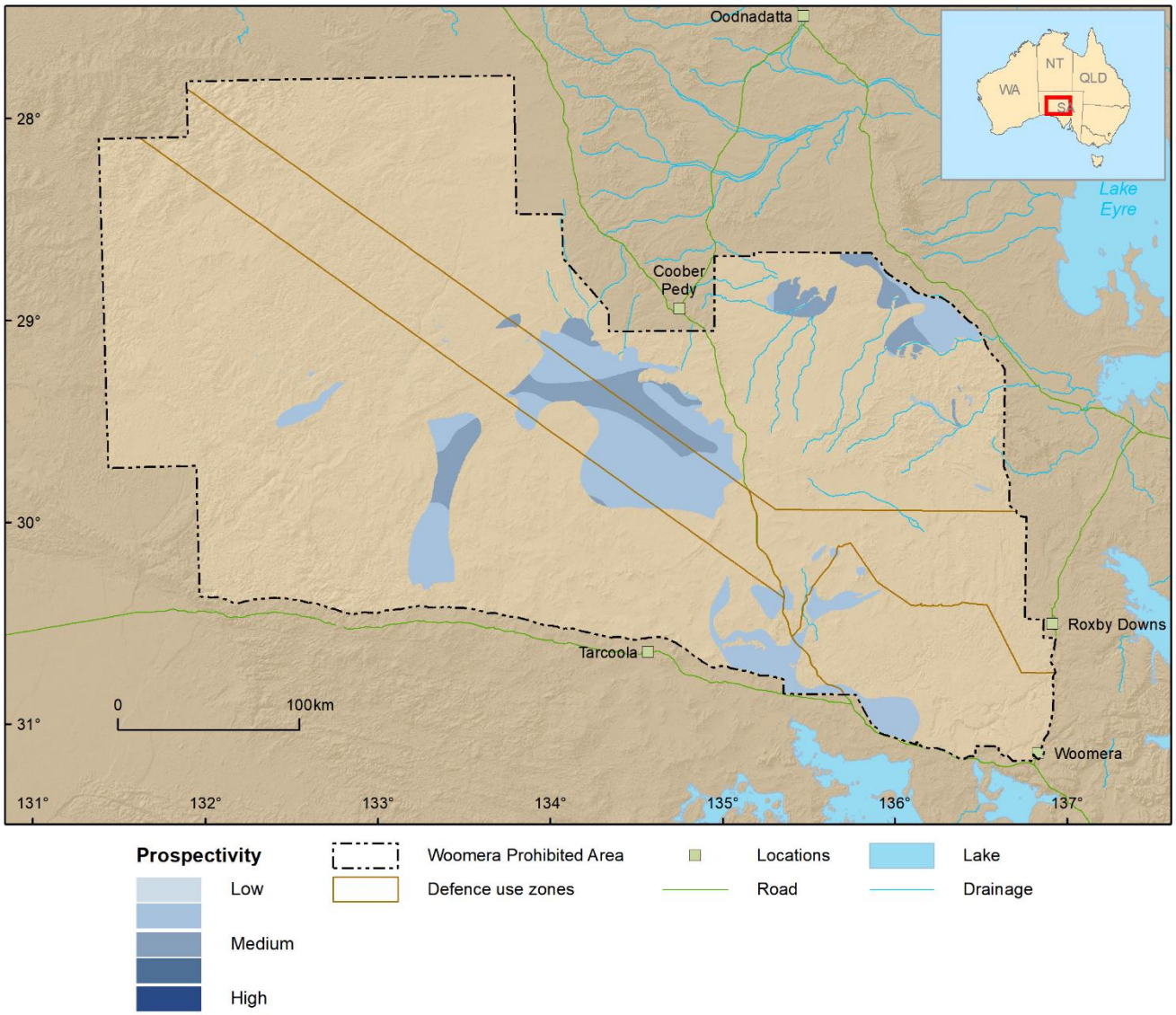


Figure 26: Uranium potential associated with iron-oxide-copper-gold-uranium mineral system

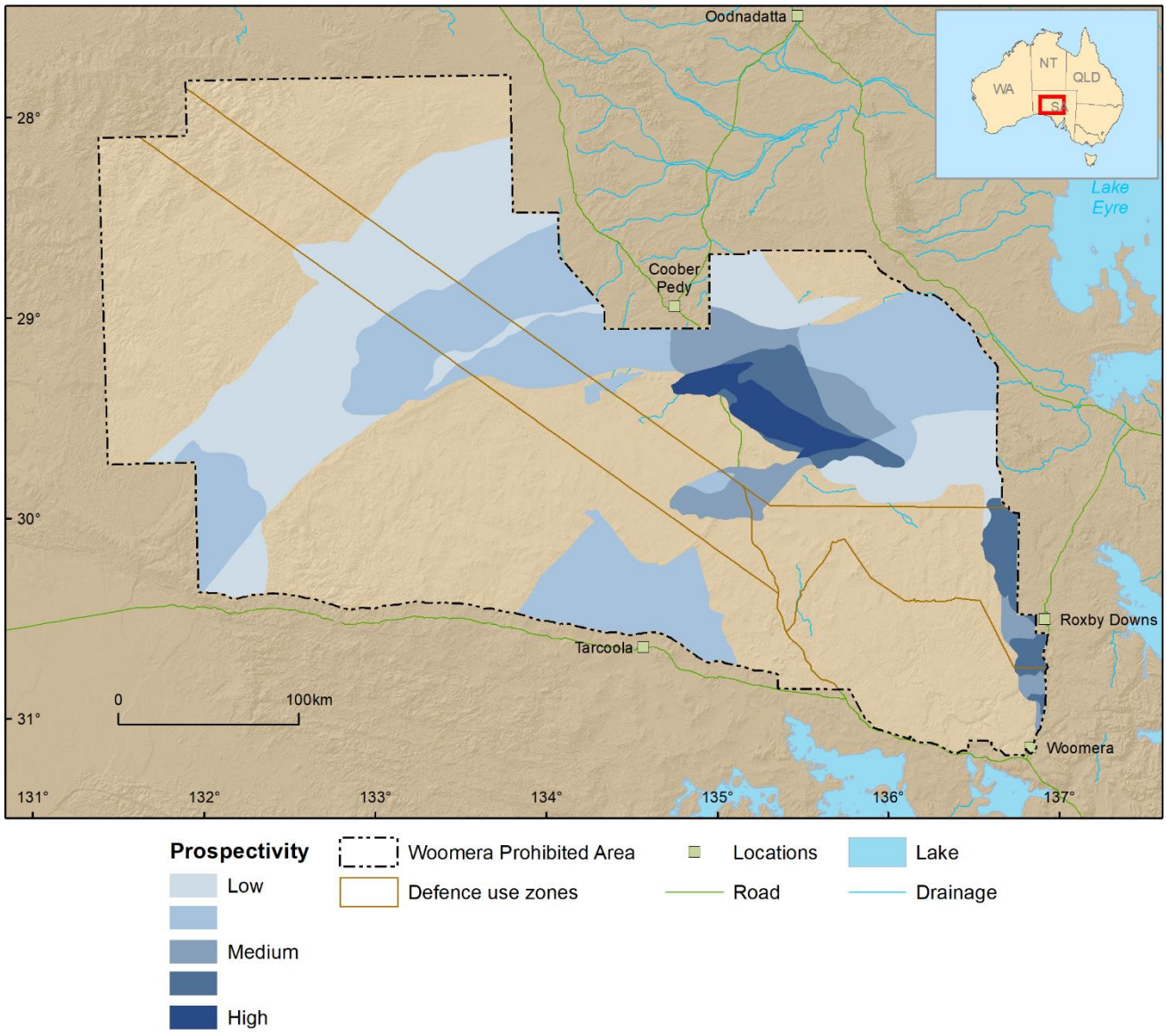
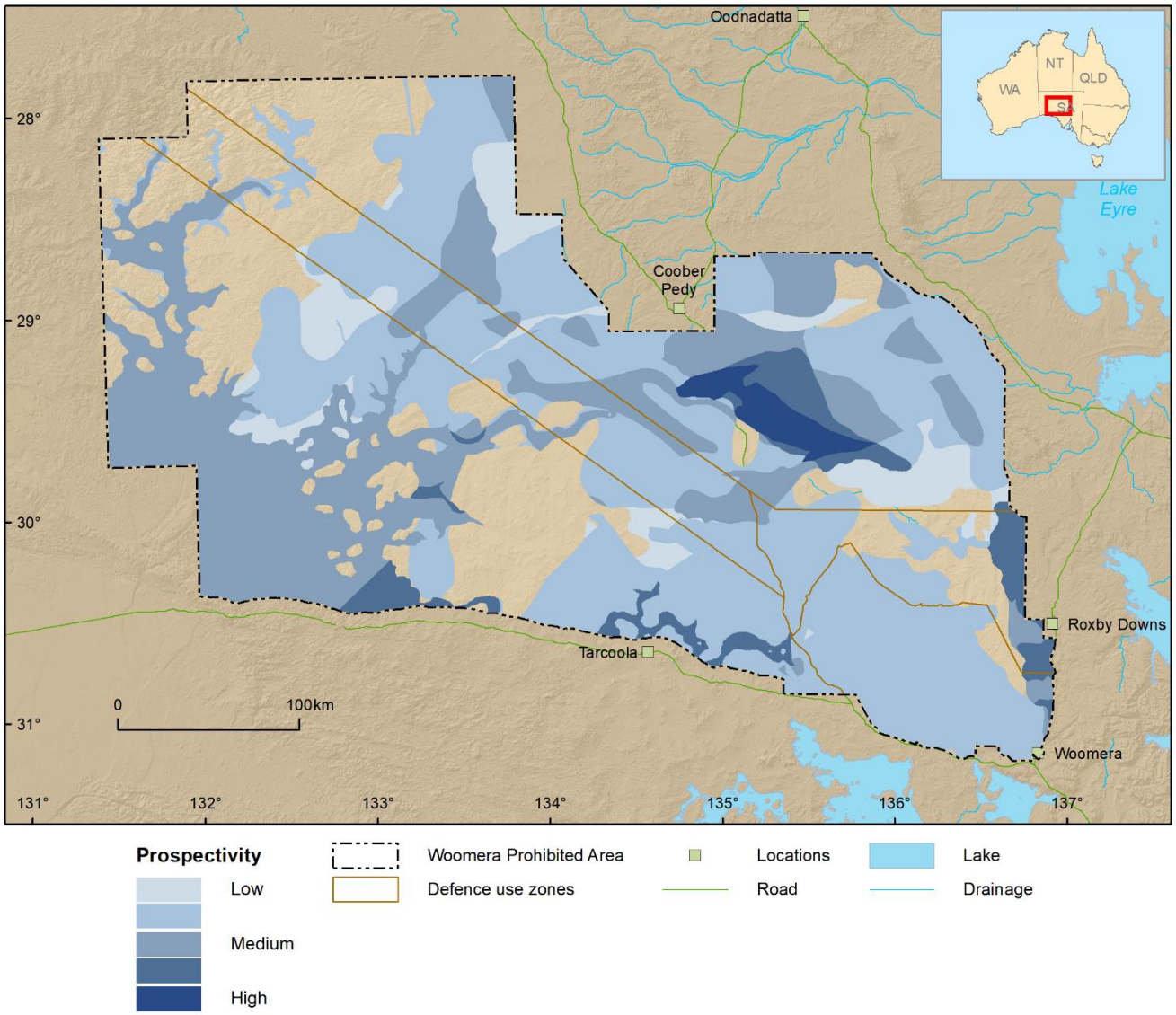


Figure 27: Uranium potential within the WPA



Future potential for Uranium in the WPA

Figure 28 depicts the areas where the depth to basement is between 500-1000 m, and greater than 1000 m, where uranium ore bodies could be at depths that could significantly increase development complexity and cost. Cover thickness may impact the economic viability of sandstone-hosted rollfront type deposits in the north-eastern most extent of the WPA and IOCG deposits on the eastern side of the WPA.

Figure 28: Economic potential of IOCG associated uranium within the WPA

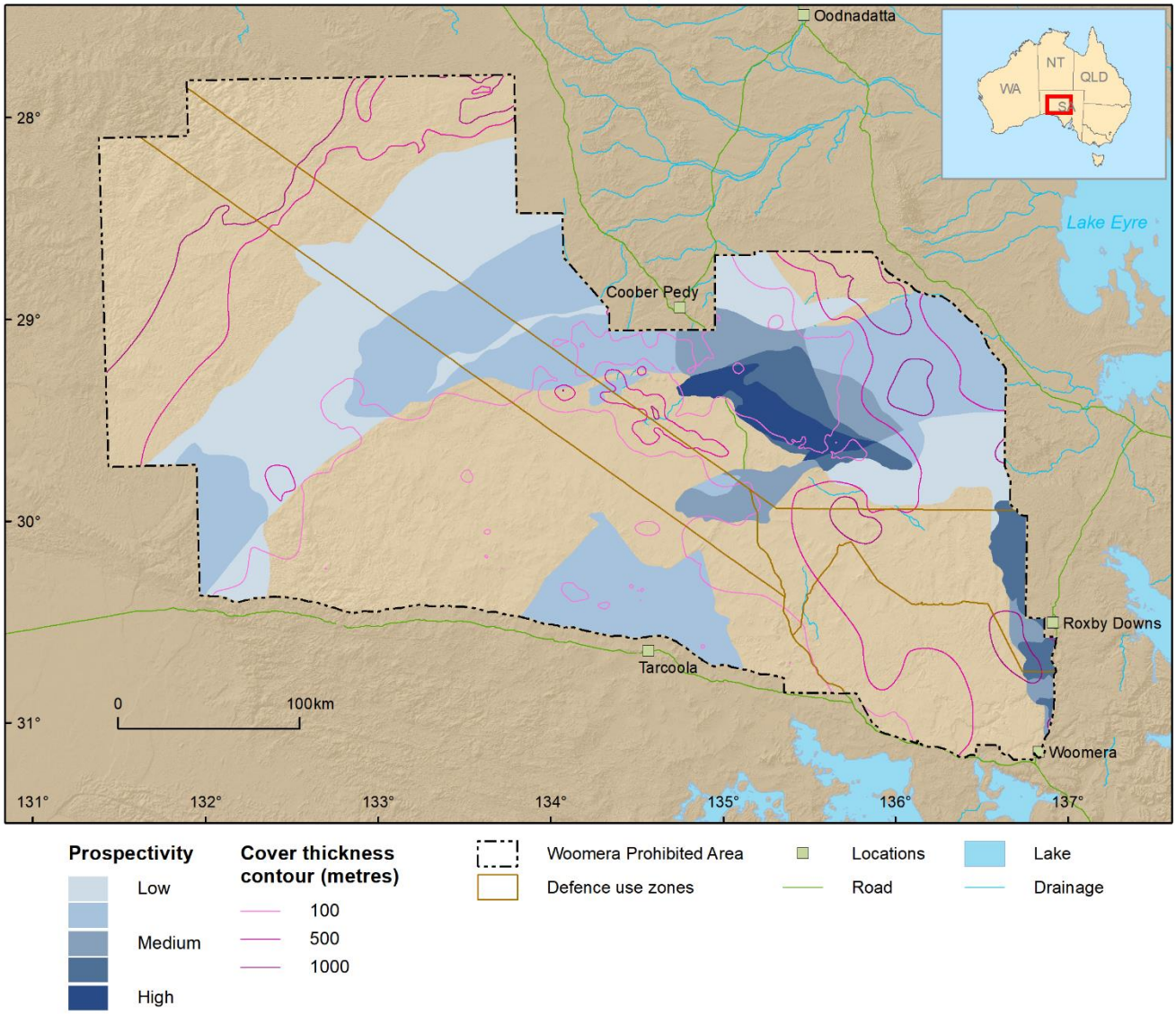


Table 26 summarises the outputs of the quantitative assessment of undiscovered contained uranium tonnage in the WPA.

Table 26: Undiscovered uranium tonnage potential within the WPA.

Uranium Deposit style	Total Undiscovered Tonnage (t)		
	Prediction Interval Lower	Mean	Prediction Interval Upper
Unconformity-associated	3,400	15,800	73,200
Sandstone-hosted Channel type	12,500	58,000	269,100
Sandstone-hosted Rollfront type	11,400	53,000	246,100
Calcrete-hosted	1,500	6,900	32,000
IOCG associated	47,000	218,000	1,012,100
Total	**75,800**	**351,700**	**1,632,500**

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Uranium in the WPA

Based on the derived undiscovered tonnages for uranium deposits, the NPV of uranium was determined based on the scenarios outlined in Table 27. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology*.

Table 27: NPV scenarios proposed to assess impact of possible future uranium mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Uranium (kt)	N/A	17.1	74.1	148.1
Potential Future Development(s)		1 Prominent Hill *(scaled to 110 Mt ore)*	1 Prominent Hill	2 Prominent Hill
			1 Beverley	2 Beverley
NPV ($AUD million)		**440**	**1,605**	**3,210**

Source: Scyne Advisory and DEM analysis, 2023

2.4.5 Heavy Mineral Sands

Heavy Mineral Sands resource prospectivity update from 2018

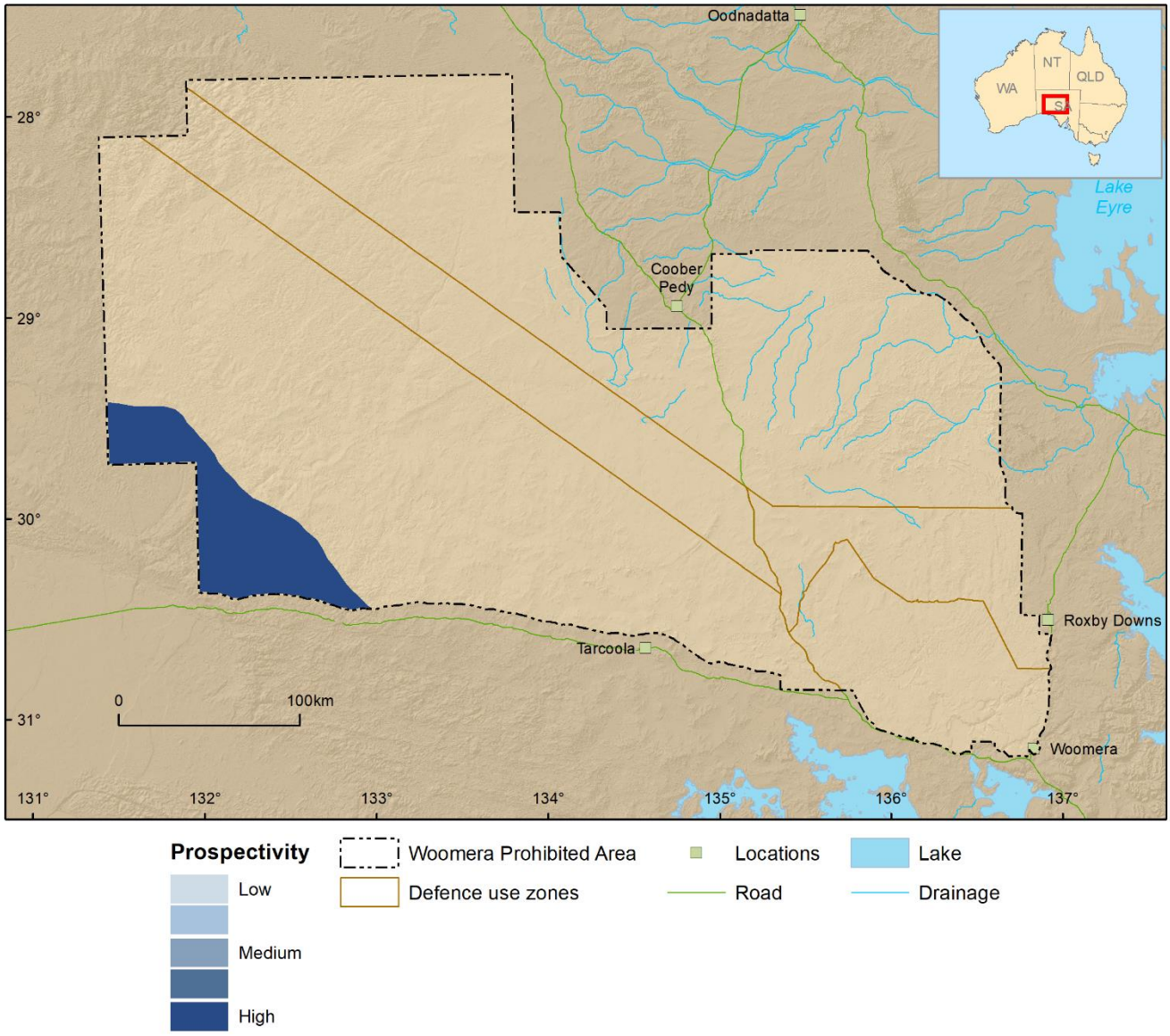
The assessment of potential for undiscovered heavy mineral sand deposits has not been updated from the 2018 Geoscience Australia report. The datasets used to evalute the resource potential for heavy mineral sands in the WPA are given in Table 28.

Table 28: Geological inputs used to evaluate heavy mineral sands potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Heavy mineral sands	*Mapped areas per 2018 Geoscience Australia Heavy Mineral Sands map*		

Source: DEM, Geoscience Australia

Figure 29: Heavy Mineral Sands potential within the WPA



Future potential for Heavy Minerals in the WPA

Table 29 summarises the outputs of the quantitative assessment of undiscovered heavy mineral sands tonnage in the WPA.

Table 29: Undiscovered tonnage potential of heavy mineral sands within the WPA

Deposit style	Total Undiscovered Tonnage (t)		
	Prediction Interval Lower	Median	Prediction Interval Upper
Heavy Mineral Sands	836,000	3,880,000	18,010,000

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Heavy Minerals in the WPA

Based on the derived undiscovered tonnages for HMS deposits, the NPV of HMS was determined based on the scenarios outlined in Table 30. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology*.

Table 30: NPV scenarios proposed to assess impact of possible future heavy mineral sands (HMS) mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Heavy Mineral Sands	N/A	1,371 kt Zircon 142.4 kt Rutile 605.4 kt Ilmenite	5,082 kt Zircon 528 kt Rutile 2,244 kt Ilmenite	10,164 kt Zircon 1,056 kt Rutile 4,488 kt Ilmenite
Potential Future Development(s)		1 Jacinth-Ambrosia *(scaled to 39 Mt ore)*	1 Jacinth-Ambrosia	2 Jacinth-Ambrosia
NPV ($AUD million)		**241**	**894**	**1,788**

Source: Scyne Advisory and DEM analysis, 2023

2.4.6 Cobalt

Cobalt resource prospectivity update from 2018

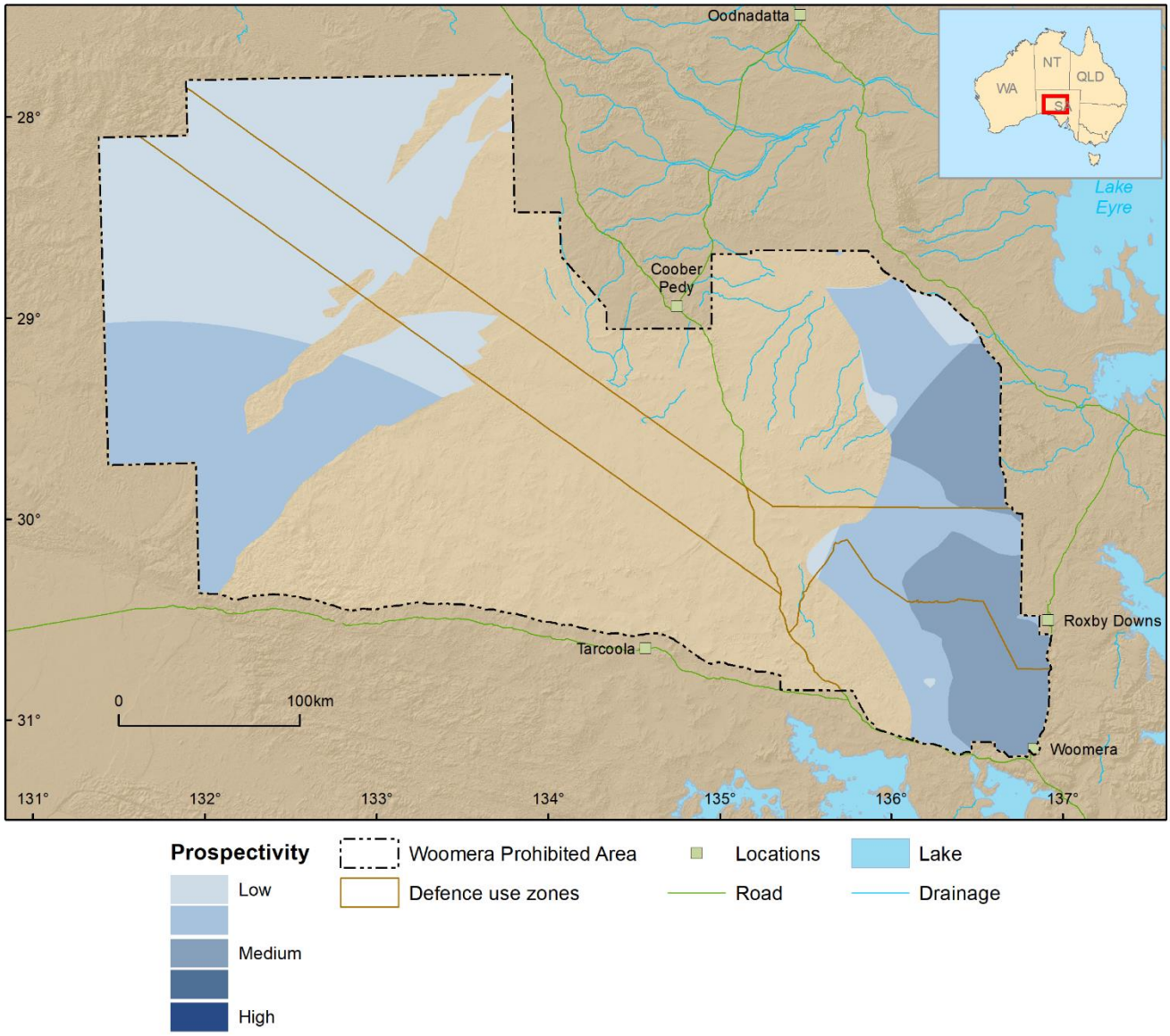
The potential for undiscovered cobalt-bearing mineral deposits was not assessed in the 2018 Geoscience Australia report. For this assessment, cobalt associated with sedimentary-hosted copper deposits has been included.

Table 31: Geological inputs used to evaluate cobalt potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Cobalt associated with Sedimentary-hosted Copper	*Mapped areas per Sedimentary-hosted copper map*		

Source: DEM

Figure 30: Cobalt associated with sedimentary copper potential within the WPA



Economic Demonstrated Resources

There are currently no quantified EDRs of cobalt within the WPA at this time.

Future potential for cobalt in the WPA

The assessment of the future potential for cobalt in the WPA has been determined on the basis the commodity is associated with Sedimentary Copper and IOCG mineral deposit models. Table 32 summarises the outputs of the quantitative assessment of undiscovered contained cobalt tonnage in the WPA.

Figure 31 depicts the areas of greater cover thickness in the WPA overlain on the prospectivity map for cobalt. As with sedimentary-hosted copper, cover is thick in the south-eastern corner of the WPA, near Roxby Downs and Woomera, which could impact the economic viability of a deposit in the Moderate prospectivity rated Stuart Shelf sediments in this area. Cover does thin as you move westwards and northwards from Roxby Downs and Woomera. The Neoproterozoic sediments in the north-west corner of the WPA are beneath a thick layer of cover > 1000m.

Figure 31: Economic potential of cobalt associated with sedimentary copper within the WPA

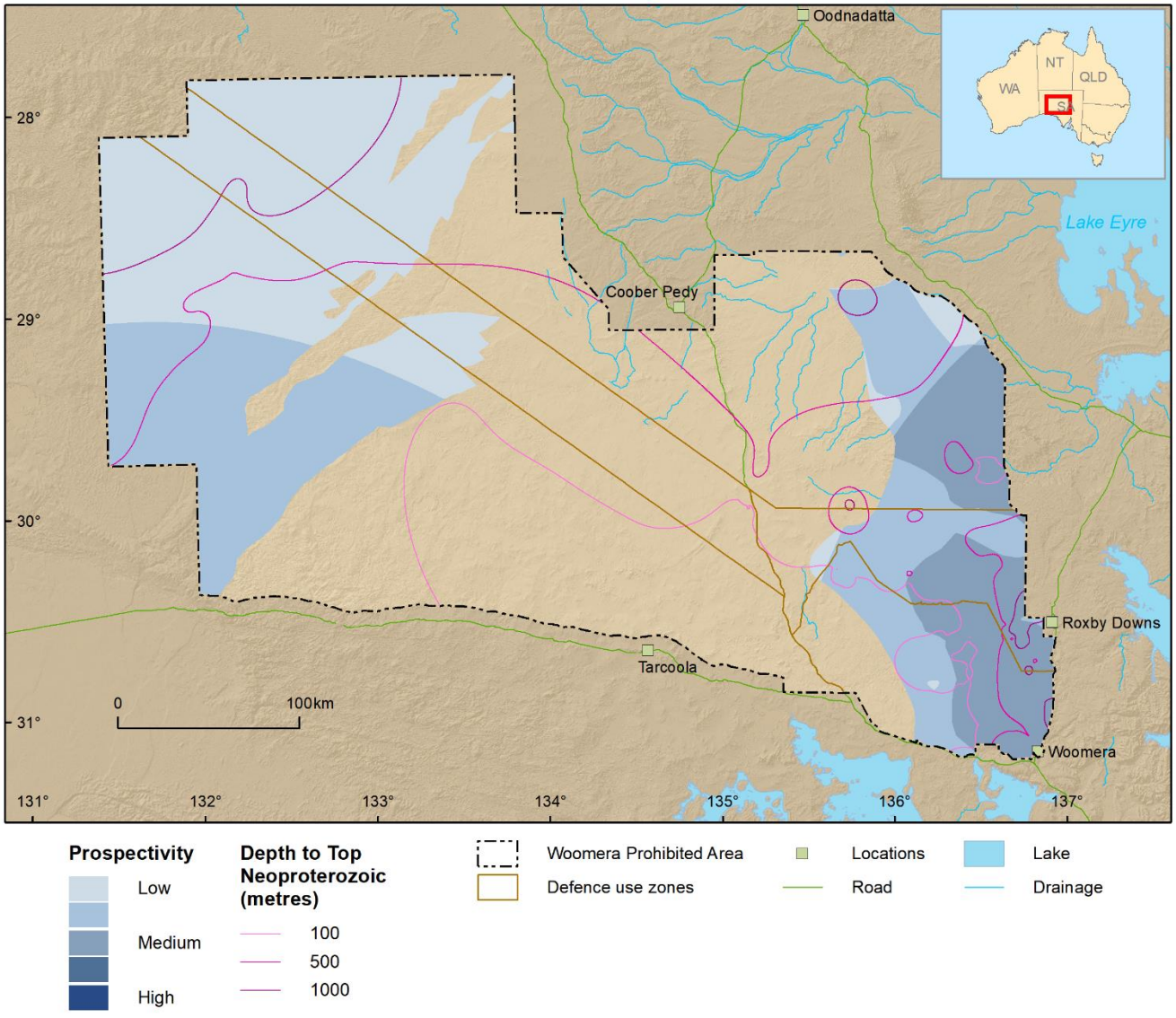


Table 32: Undiscovered tonnage potential of cobalt associated with sedimentary copper deposits within the WPA

Deposit style	Total Undiscovered Tonnage (t)		
	Low	Medium	High
Cobalt (associated with Sedimentary Copper)	3,400	15,600	72,500

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Cobalt in the WPA

Based on the derived undiscovered tonnages for sedimentary-hosted copper deposits, the NPV of cobalt was determined based on the scenarios outlined in Table 33. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology* and aligns with the choice of sediment-hosted copper mines.

Table 33: NPV scenarios proposed to assess impact of possible future sediment hosted copper-cobalt mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Cobalt (t)	N/A	2,800	14,000	28,000
Potential Future Development(s)		1 Emmie Bluff *(scaled to 7.7 Mt ore)*	1 Emmie Bluff	2 Emmie Bluff
NPV ($AUD million)	N/A	8	49	97

Source: Scyne Advisory and DEM analysis, 2023

2.4.7 Silver

Silver resource prospectivity update from 2018

Silver was assessed in the 2018 Geoscience Australia report as an associated mineral with IOCG deposits. For this assessment, the potential for undiscovered IOCG associated silver resources has been revised to the map of IOCG deposits as described in the assessment of copper deposits (Table 34), and silver associated with sedimentary-hosted copper deposits has also been included (Figure 32).

A map of silver associated with sedimentary copper potential within the WPA is shown in Figure 33 and total silver potential in Figure 34.

Table 34: Geological inputs used to evaluate silver potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Silver associated with IOCG	*Silver IOCG prospectivity map is consistent with the Copper IOCG prospectivity map*		
Silver associated with Sedimentary-hosted Copper	*Mapped areas per Sedimentary-hosted copper map*		

Source: DEM

Figure 32: Silver potential associated with iron oxide copper gold mineral systems

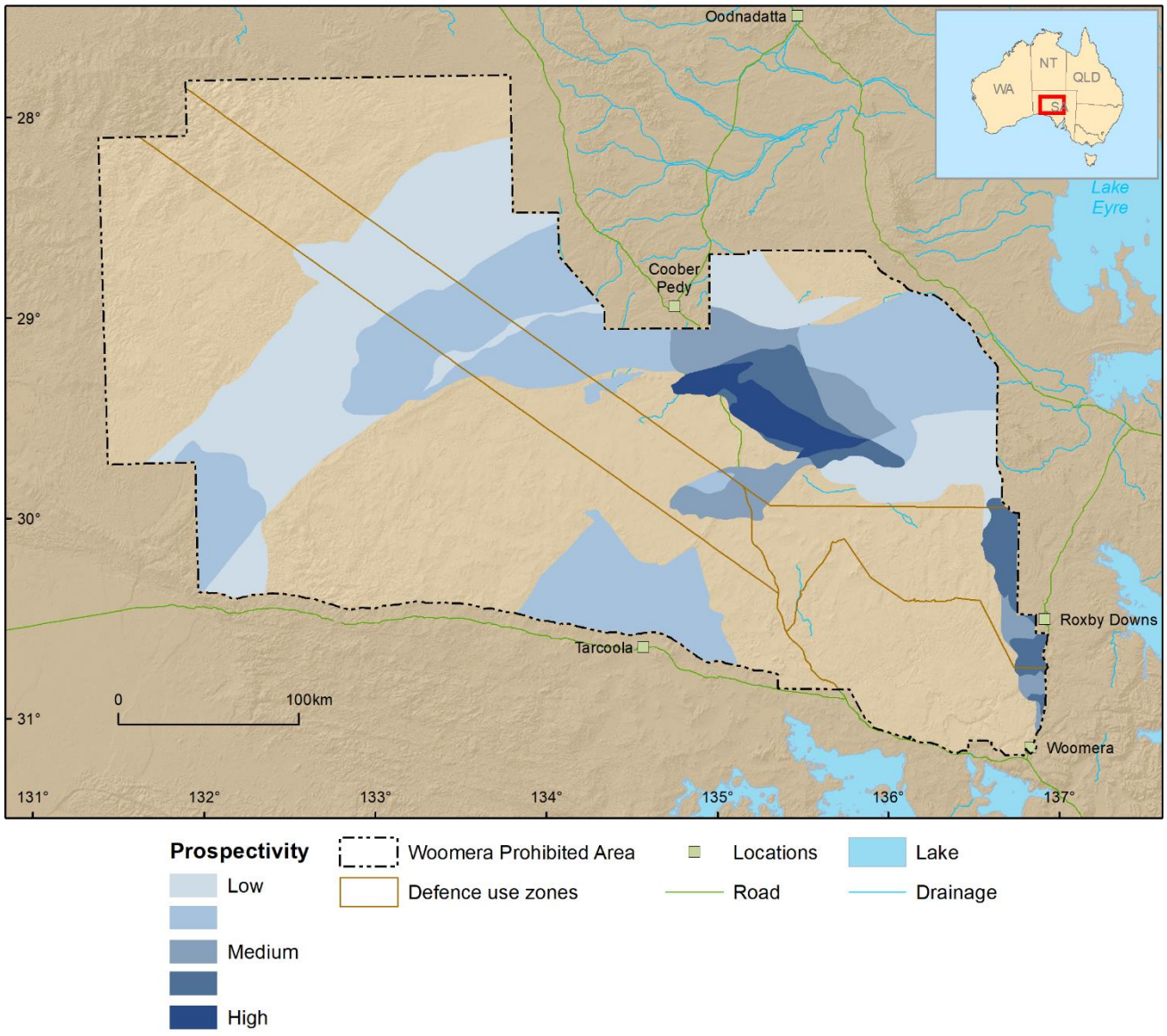


Figure 33: Silver associated with sedimentary copper potential within the WPA

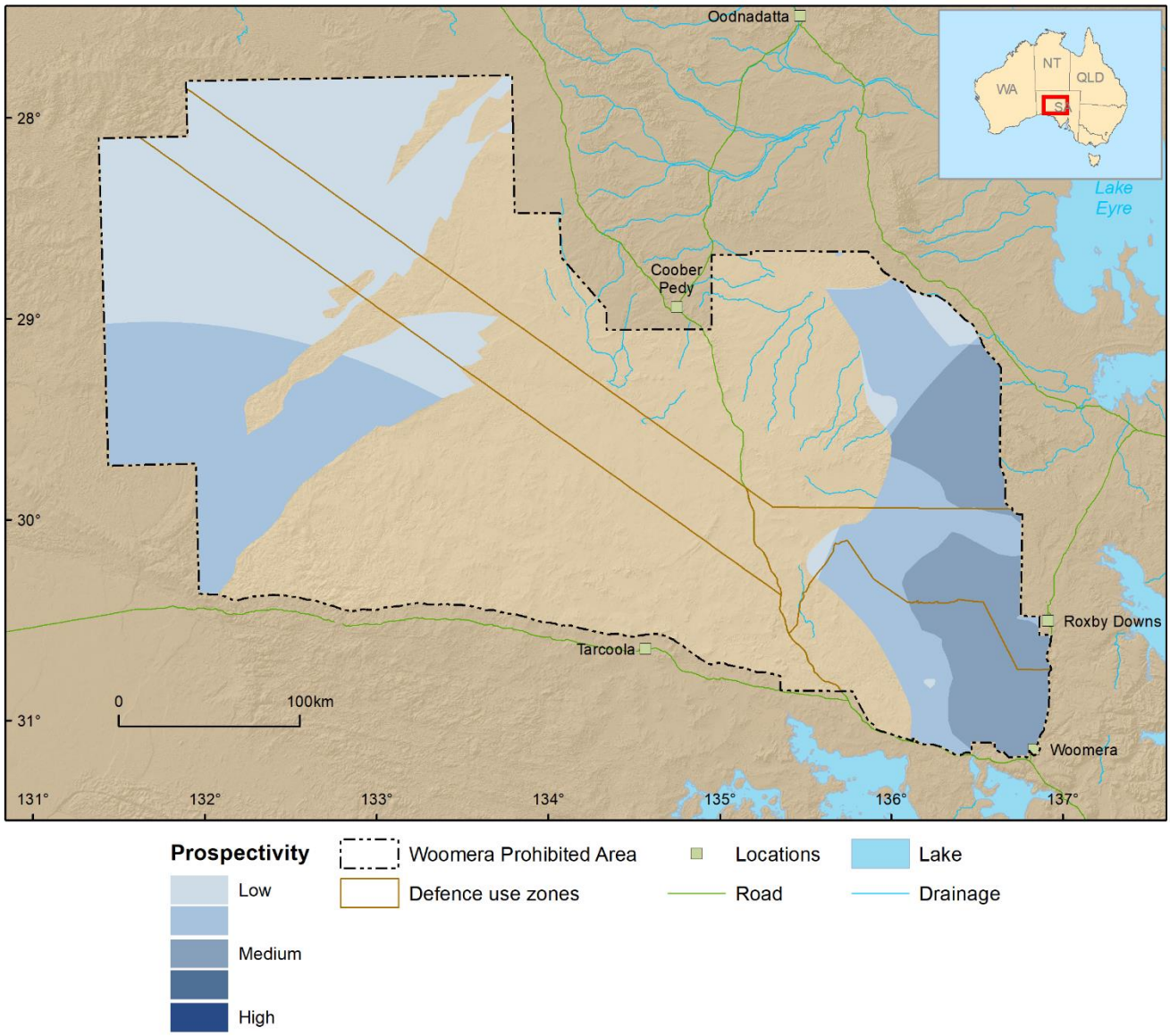
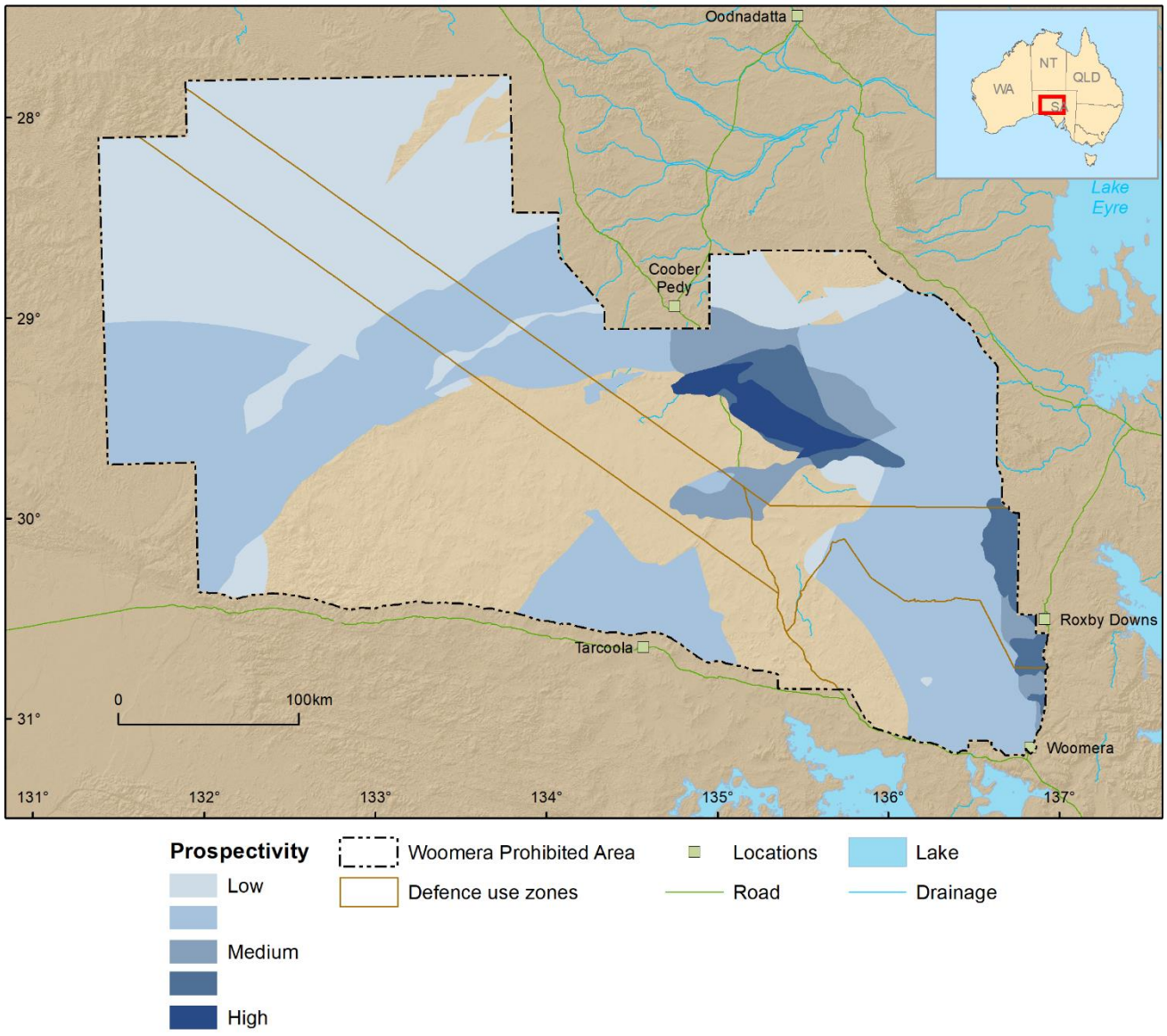


Figure 34: Silver potential within the WPA



Economic Demonstrated Resources

As of 30 June 2022, the EDR of silver within the WPA is 435.46 t (Table 35).

Table 35: Silver deposits with EDR within the WPA

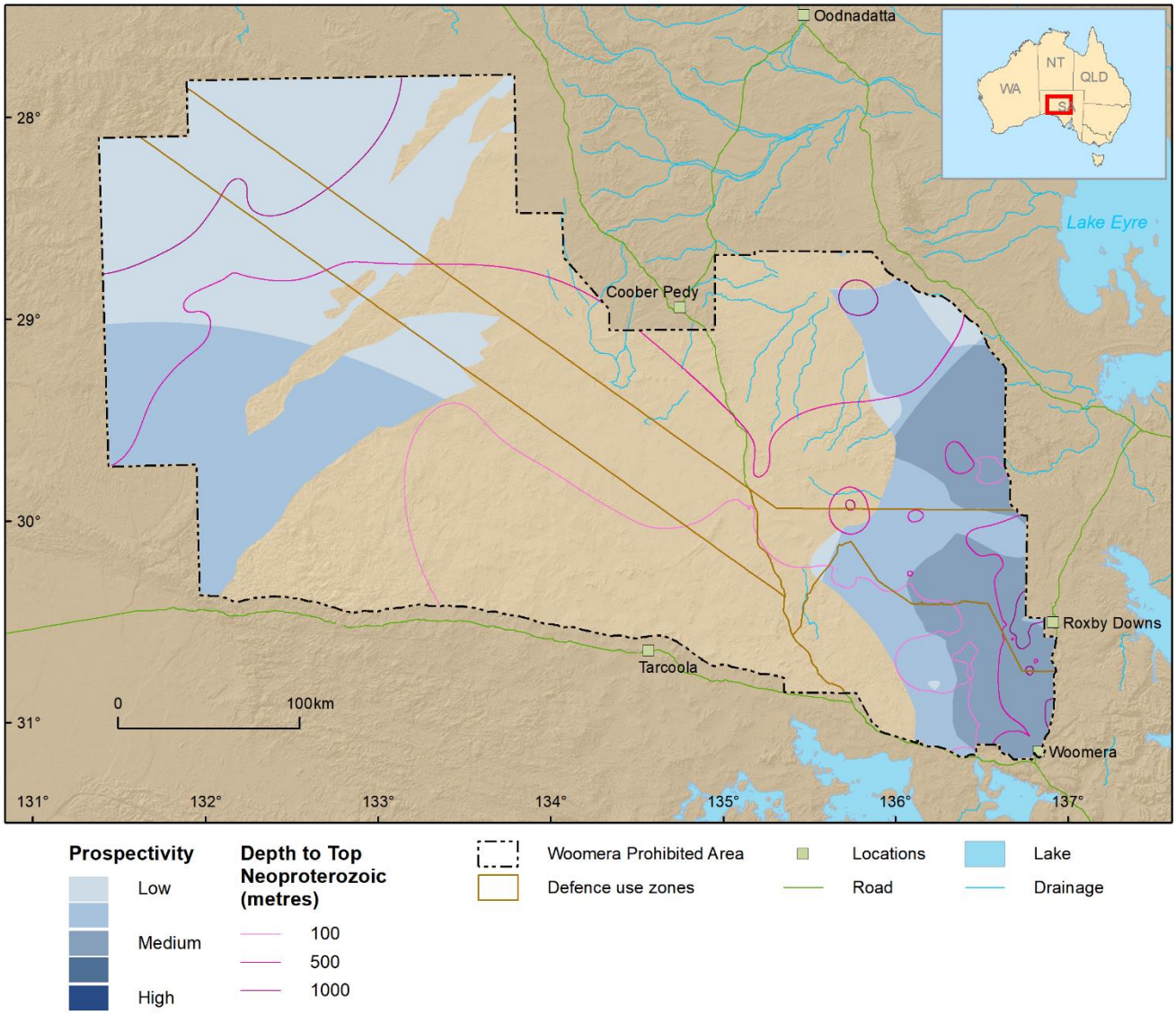
Deposit	Company	EDR (t)
Prominent Hill	BHP Group Ltd	435.46
Total		**435.46**

Source: DEM, 2023
Note: EDR = Economic Demonstrated Resource; t = tonnes of contained resource

Future potential for Silver in the WPA

The assessment of the future potential for Silver in the WPA has been determined on the basis the commodity is associated with Sedimentary Copper and IOCG mineral deposit models. Table 36 summarises the outputs of the quantitative assessment of undiscovered contained silver tonnage in the WPA. Figure 35 depicts the areas of greater cover thickness in the WPA overlain on the prospectivity map for silver.

Figure 35: Economic potential of silver associated with sedimentary copper within the WPA



As with sedimentary-hosted copper, cover is thick in the south-eastern corner of the WPA, near Roxby Downs and Woomera, which could impact the economic viability of a deposit in the Moderate prospectivity rated Stuart Shelf sediments in this area. Cover thins westwards and northwards from Roxby Downs and Woomera. The Neoproterozoic sediments in the north-west corner of the WPA are beneath a thick layer of younger post-Neoproterozic cover > 1000m.

The total undiscovered tonnage for silver associated with sedimentary copper deposits and IOCGS is shown in Table 36.

Table 36: Undiscovered tonnage potential of silver associated with sedimentary copper deposits and IOCGs within the WPA

Deposit style	Total Undiscovered Tonnage (t)		
	Low	Medium	High
Silver (associated with Sedimentary Copper)	73	340	1,579
Silver (associated with IOCGs)	275	1,275	5,900
	348	**1,600**	**7,500**

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Silver in the WPA

Based on the derived undiscovered tonnages for IOCG and sedimentary-hosted copper deposits, the NPV of silver was determined based on the scenarios outlined in Table 37. The choice of the 'Potential Future Development' mines is described in *Resource prospectivity technical appendix* section *Net Present Value methodology* and aligns with the choices of mines representative of IOCG and sediment-hosted copper deposit styles.

Table 37: NPV proposed to assess impact of the contained silver within possible future sediment hosted copper and IOCG mine developments in the WPA

	EDR	Economic Impact Scenarios		
		Low	Medium	High
Silver (t)	435.46	205	1,132	2,260
Potential Future Development(s)		1 Prominent Hill *(scaled to 110 Mt ore)*	1 Prominent Hill	2 Prominent Hill
		1 Emmie Bluff *(scaled to 7.7 Mt ore)*	1 Emmie Bluff	2 Emmie Bluff
			1 Carrapateena	2 Carrapateena
			1 Challenger	2 Challenger
NPV ($AUD million)	**194**	**27**	**138**	**277**

Source: Scyne Advisory and DEM analysis, 2023

2.4.8 Nickel & Platinum Group Elements

Nickel-PGE resource prospectivity update from 2018

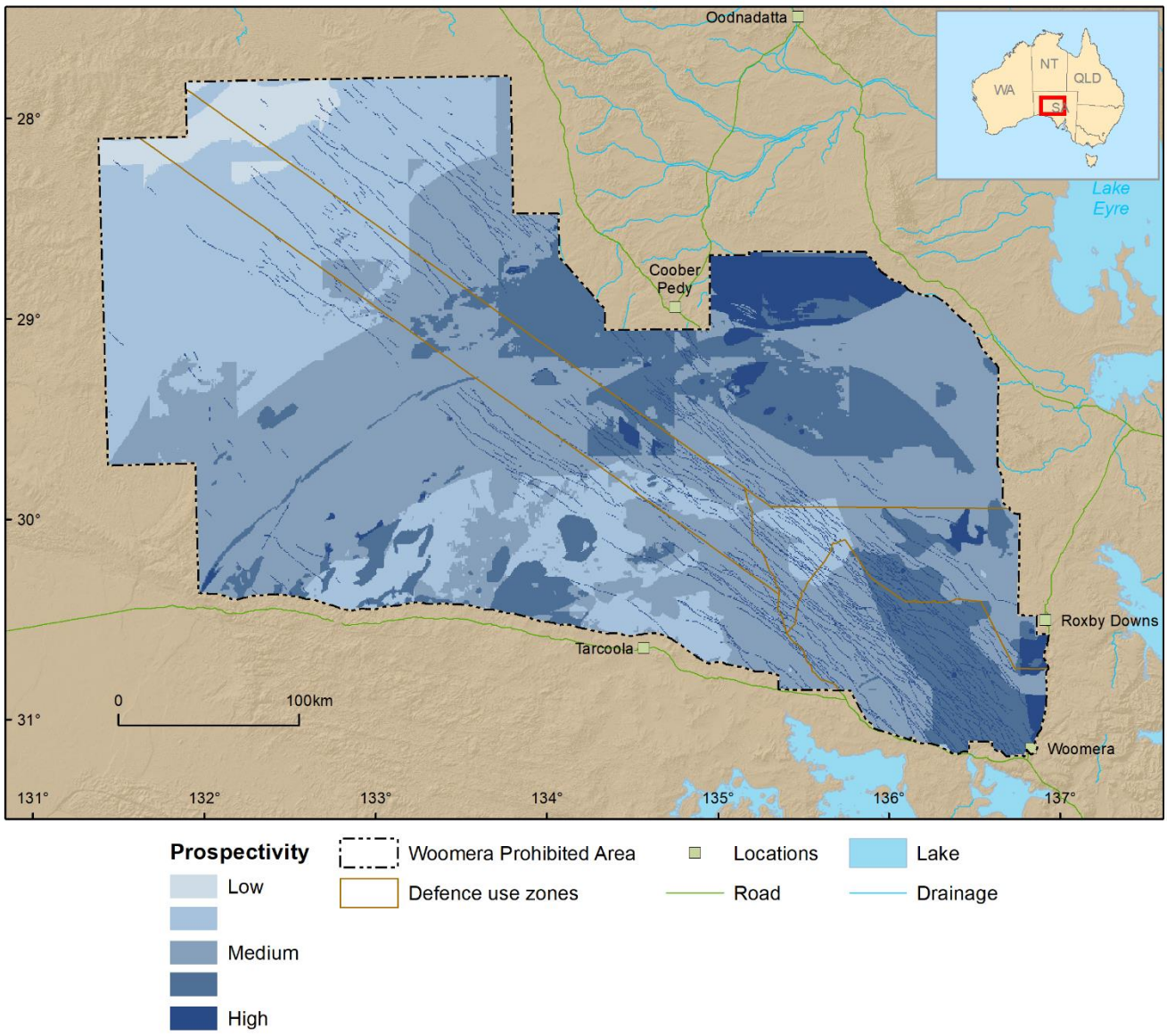
The assessment of potential for undiscovered nickel-PGE deposits has not been updated from the 2018 Geoscience Australia report (Figure 36), using the continental-scale assessment of Dulfer et al. (2016) as shown in Table 38.

Table 38: Geological inputs used to evaluate nickel-PGE potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Nickel-PGE	*Mapped areas per 2018 Geoscience Australia Nickel-PGE map (adopted from Dulfer et al., 2016)*		

Source: Geoscience Australia

Figure 36: Nickel-PGE potential within the WPA (modified from Dulfer et al. (2016))



Economic Demonstrated Resources

There are currently no EDRs of Nickel within the WPA at the time of this report.

Future potential for Nickel & PGE in the WPA

The assessment of the future potential for Nickel has been assessed using analogue deposits suggested by the Department for Energy and Mining. Table 39 summarises the analogue deposits chosen for a deterministic low, best and high estimate of undiscovered contained Nickel tonnage in the WPA. Figure 37 shows that areas of high prospectivity are generally under more than 500m of cover across the WPA area, except immediately to the East and South-East of Cooper Pedy. Where the Peake Metamorphics are present, cover thicknesses are less than 100 m and deepen further towards the eastern boundary of the WPA.

Because the areas and prospectivity rating were defined by Geoscience Australia in 2018 using the Dulfer et al. (2016) model, the prospective areas and their associated rating were not defined using the same quantitative approach as the Group A commodities (Table 7). However, because of the high potential for a nickel deposit in the WPA, an assessment of nickel's future potential was still undertaken using a deterministic approach. Similar to 2018, analogue nickel deposits were nominated by the Department for Energy and Mining for a low, medium and high resource potential. Cassini (Southern Goldfields region, Western Australia), Claude Hills (Central Musgrave, Western Australia) and Nebo-Babel (West Musgrave, Western Australia) were chosen for low, medium and high resource potential respectively.

Figure 37: Economic potential of nickel-PGE deposits within the WPA

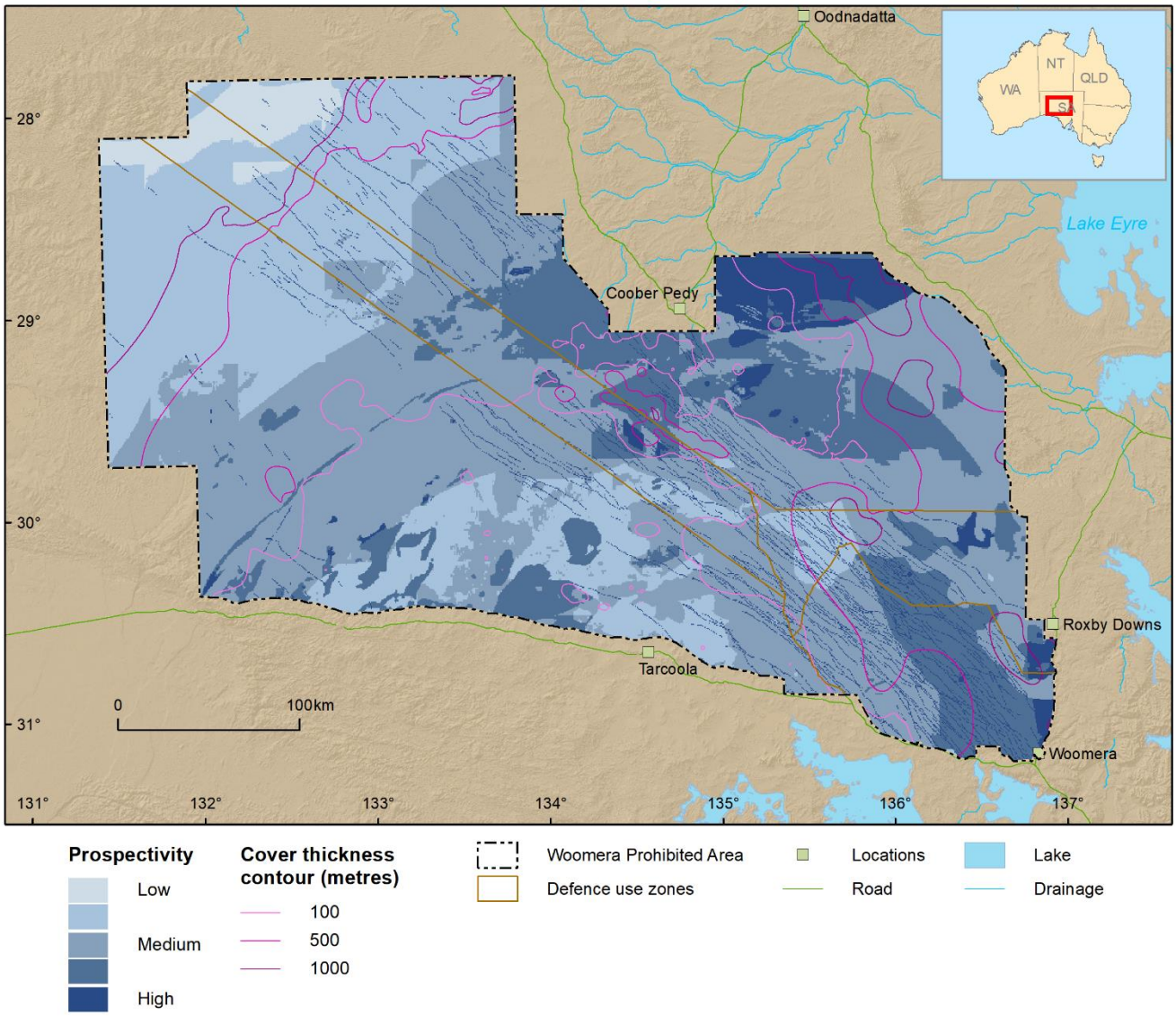


Table 39: Undiscovered nickel tonnage potential within the WPA

	Total Undiscovered Tonnage (t)		
	Low	Medium	High
Analogue deposits	**Cassini**	**Claude Hills**	**Nebo-Babel**
Contained Nickel	58,800	269,700	1,122,000

Source: Scyne Advisory and DEM analysis, 2023

Economic value of Nickel in the WPA

Based on the deterministic deposits chosen as low, medium and high estimate undiscovered tonnages, the NPV of Nickel was determined based on the scenarios outlined in Table 40. Because the Claude Hills deposit is currently undeveloped, an analogue operating mine of a similar deposit size in Western Australian, Nova-Bollinger, was used for cost and production rate inputs instead.

Table 40: NPV scenarios proposed to assess impact of possible future nickel-PGE mine developments in the WPA

		Economic Impact Scenarios		
	EDR	Low	Medium	High
Nickel (kt)	N/A	35.3	266.8	686.4
Potential Future Development(s)		1 Cassini (WA)	1 Nova-Bollinger (WA)	1 Nebo-Babel (WA)
NPV ($AUD million)		**267**	**1,409**	**872**

Source: Scyne Advisory and DEM analysis, 2023

2.4.9 Rare Earth Elements

REEs resource prospectivity update from 2018

The assessment of potential for undiscovered rare earth element (REE) mineral deposits has been updated from the 2018 Geoscience Australia report and includes REE potential associated with iron oxide copper gold mineral systems (Figure 38), with revisions to the map of IOCG associated REE deposits and the inclusion of clay-hosted REE deposits (Figure 39) as a prospective deposit style using the mineral deposit model described in Table 41.

Figure 40 shows the combined REE potential within the WPA.

Table 41: Geological inputs used to evaluate REE potential in the WPA.

Deposit style	Geological Criteria	Inputs	Considerations
Clay-hosted REEs	Solid geology	Igneous and Mount Woods Complex units: • Engenina Adamellite, Symons Granite, equivalents of Tunkillia Suite • Gawler Range Volcanics (upper and lower) • Hiltaba Suite • Curramulka Gabbronorite • Mount Woods Complex • Muckanippie Suite • Undifferentiated granitoid intrusive rocks of Kimban Orogeny	
	Weathered bedrock	Regolith material, weathering intensity	Included only moderately to highly weathered bedrock
	Limited sedimentary overburden	Neoproterozoic and Middle Mesoproterozoic maps	Regions with Neoproterozoic to Mesoproterozoic sedimentary cover were excluded
Iron-oxide Copper Gold associated REEs	*IOCG-associated REE prospectivity map is consistent with the IOCG Copper prospectivity map*		
Heavy mineral sands associated REEs	*HMS-associated REE prospectivity map is consistent with the HMS prospectivity map*		

Source: DEM, Geoscience Australia

Figure 38: REE potential associated with iron oxide copper gold mineral systems

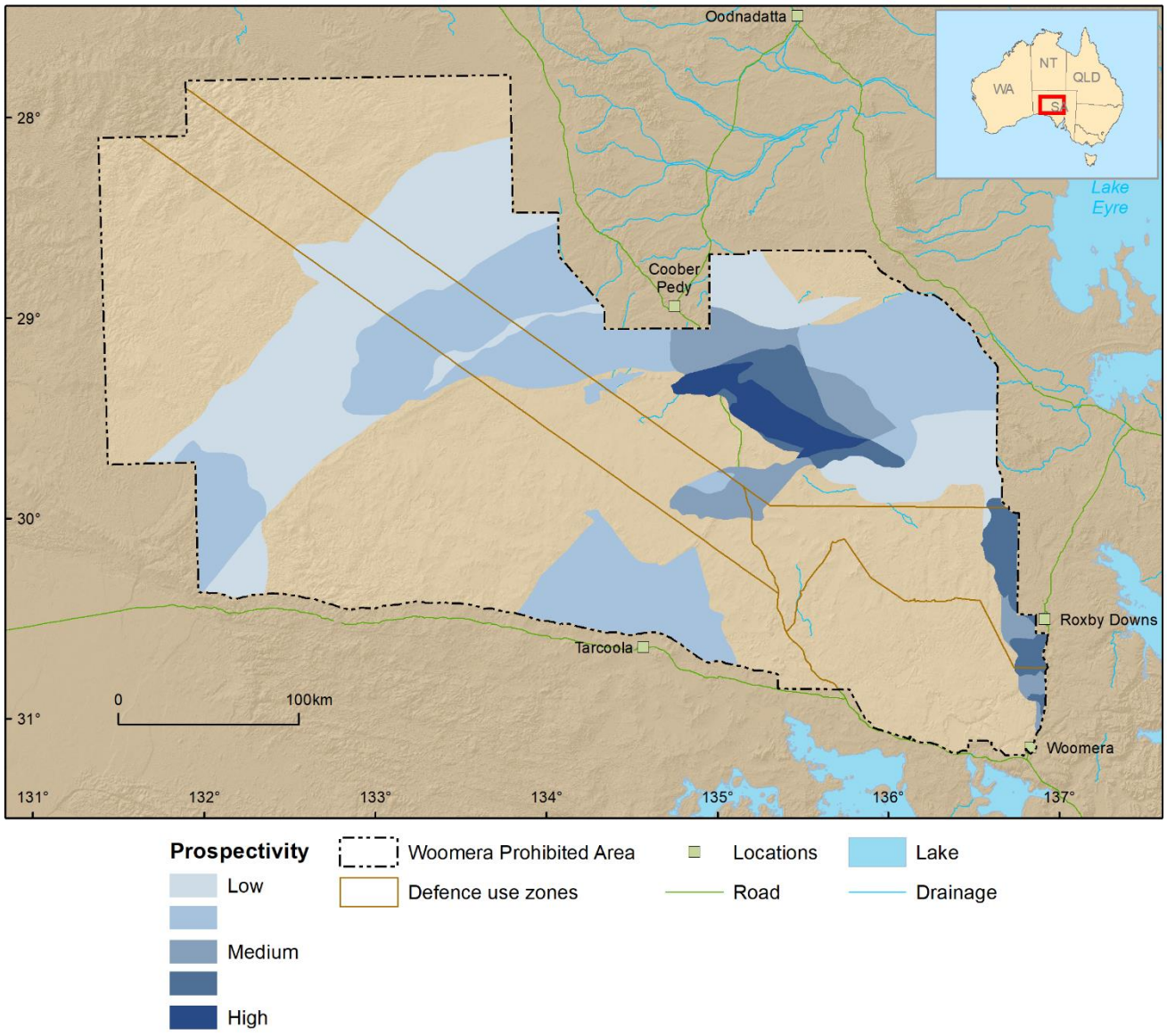


Figure 39: REE potential in clay-hosted REE systems

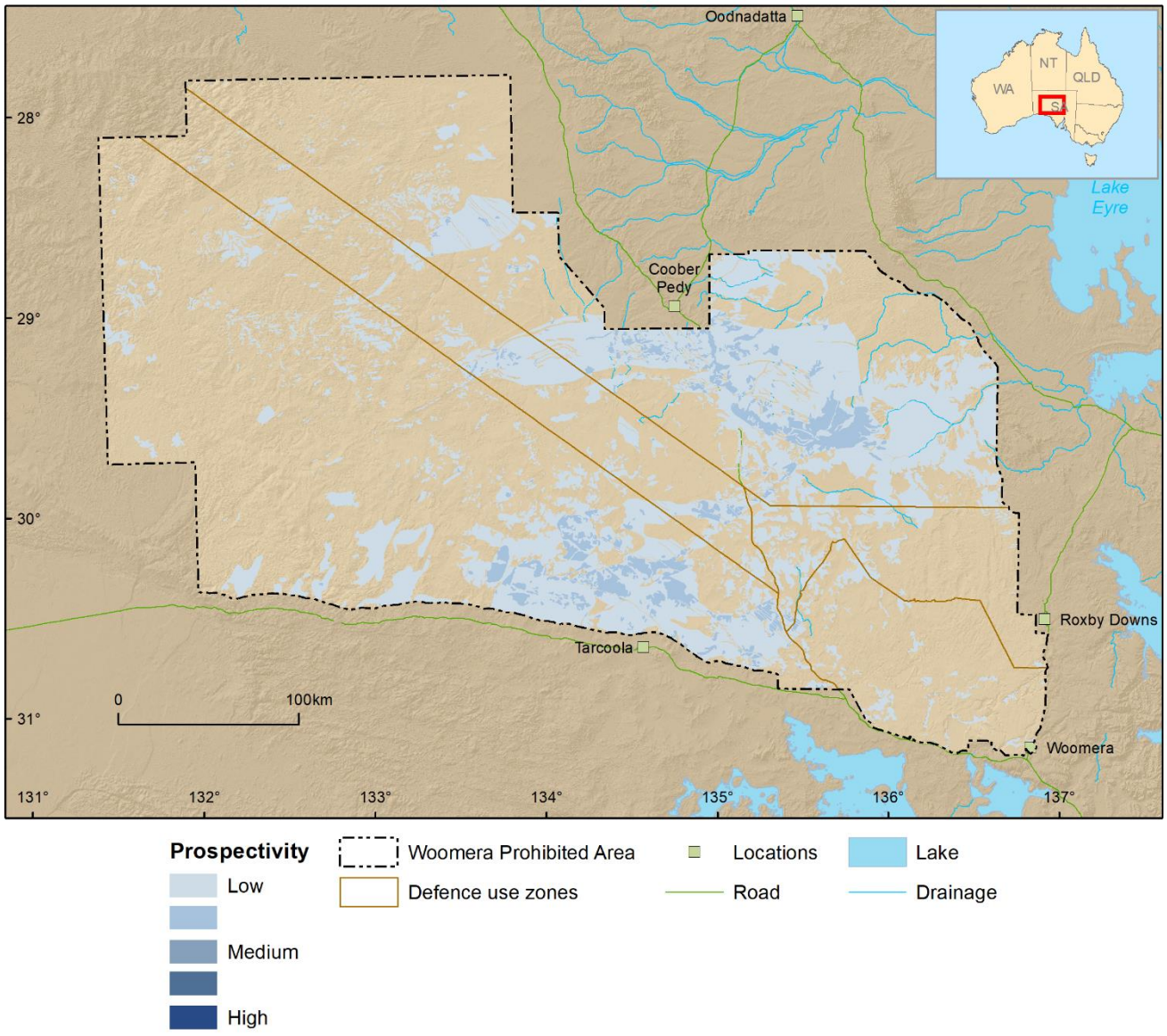
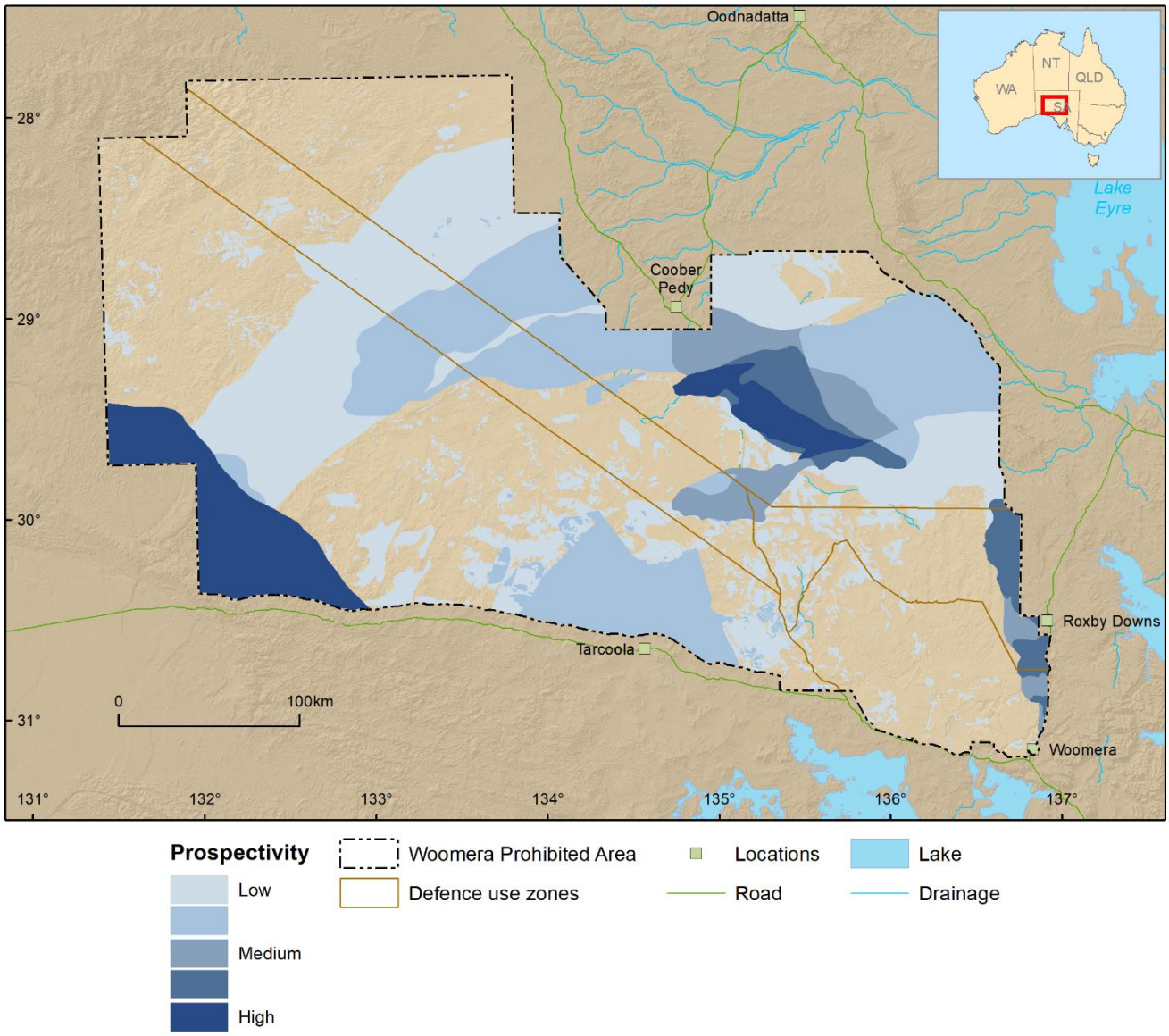


Figure 40: REE potential within the WPA



Economic Demonstrated Resources

There are currently no EDRs of rare earth elements within the WPA at the time of this report.

Future potential for REEs in the WPA

The assessment of the future potential for REE has been assessed using analogue deposits suggested by the Department for Energy and Mining. Table 42 summarises the analogue deposits chosen for a deterministic low, best and high estimate of undiscovered contained REE tonnage in the WPA. Although the areas and prospectivity rating for the IOCG and clay-hosted REEs deposit styles have been updated for this assessment, a suitable REE grade and tonnage model for the WPA could not be determined to use the quantitative method used for Group A commodities.

Figure 41 depicts the areas of 10-30m, 30-50m and > 50m of cover thickness in the WPA, overlain on the prospectivity map for clay-hosted rare earth elements. Cover thicknesses greater than 10m could impact the economic viability of a discovery in that area, and the map suggests that there is greater potential for an economic, shallow clay-hosted REE deposit in the central area of the WPA, towards the southern boundary.

Figure 41: Economic potential of clay-hosted REE deposits within the WPA

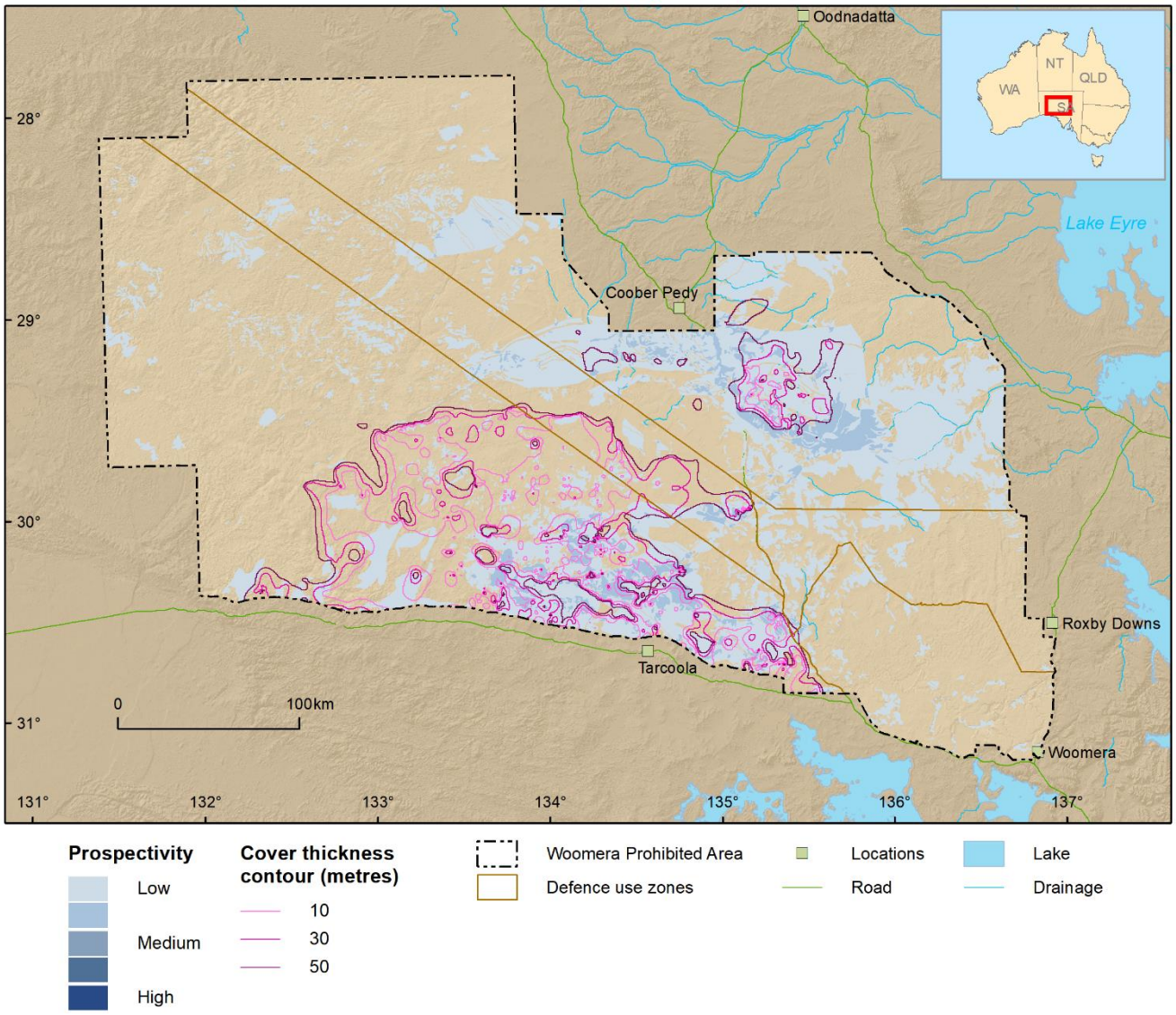


Table 42: Undiscovered REE tonnage potential within the WPA

	Total Undiscovered Tonnage (t)		
	Low	Medium	High
Analogue deposits	**Clarke**	**Koppamurra**	**Olympic Dam**
Contained REE	9,700	63,900	> 100,000

Source: Scyne Advisory and DEM analysis, 2023

Economic value of REEs in the WPA

Although there is potential for clay-hosted REE and IOCG associated REE discoveries in the WPA, and the presence of rare earth phases in the Olympic Dam deposit, at the time of writing there are no matured clay-hosted REE projects in Australia, and BHP do not currently produce rare earths from the Olympic Dam deposit. As the NPV approach requires a suitable analogue to be identified, the NPV of REEs was not calculated for this report.

2.4.10 Zinc and Lead

Zinc and Lead resource prospectivity update from 2018

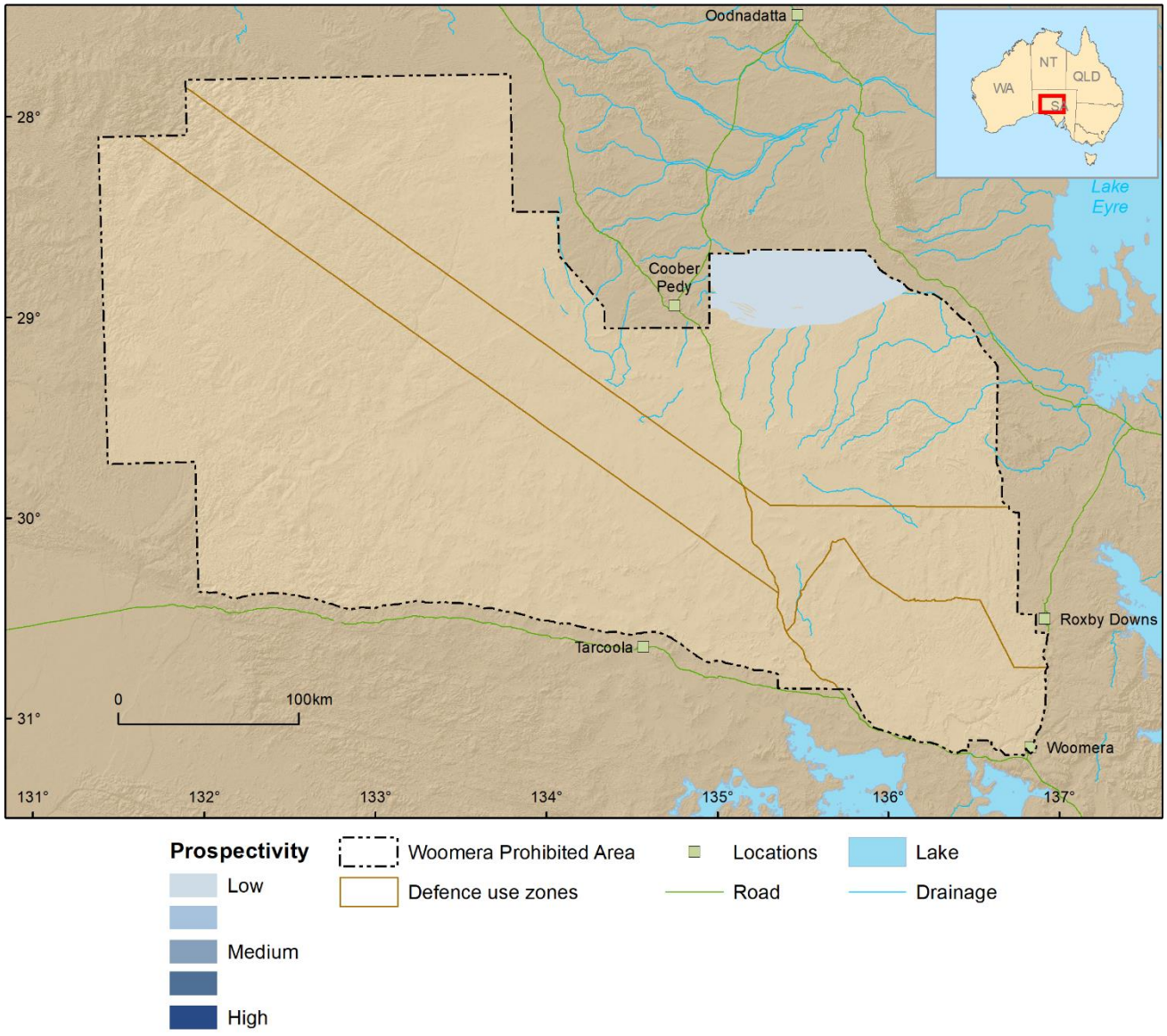
The potential for undiscovered lead and zinc-bearing mineral deposits was described qualitatively in the 2018 Geoscience Australia report. For this assessment, a simple mineral deposit model has been included (Table 43, Figure 42).

Table 43: Geological inputs used to evaluate zinc and lead potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
Zinc and Lead	Solid geology	Peake Metamorphics	

Source: DEM

Figure 42: Zinc and lead potential within the WPA



Future potential for Zinc and Lead in the WPA

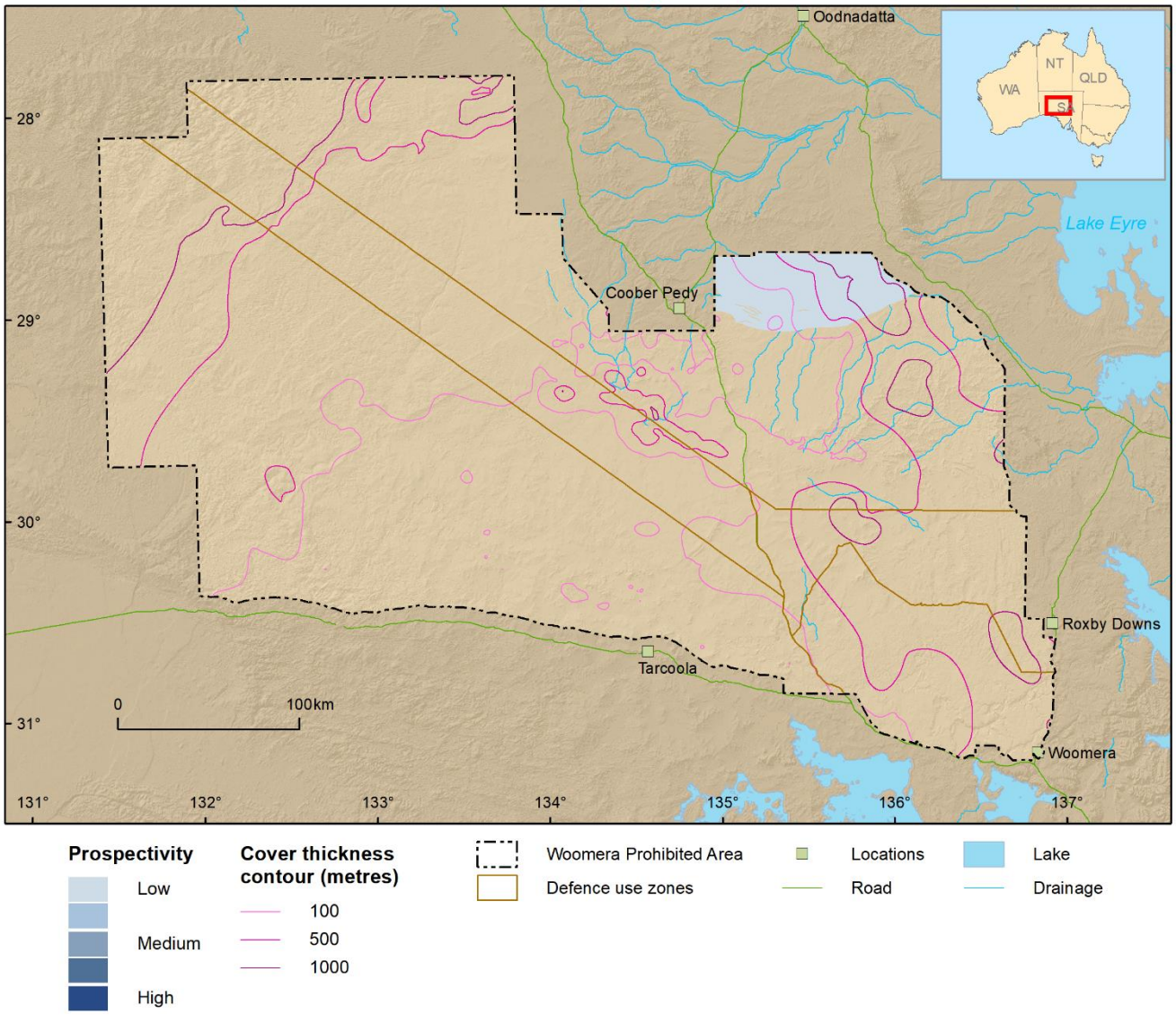
Figure 43 depict the areas where the depth to basement is between 500-1000 m, and greater than 1000 m, where zinc and lead bearing ore bodies could be at depths that could significantly increase development complexity and cost. Cover thickness greater than 500m cover half of the prospective area in the north-eastern corner of the WPA and could impact the economic viability of developing a zinc and lead deposit found in the area.

No assessment of the future potential of Zinc and Lead in the WPA was performed in this report.

Economic value of Zinc and Lead in the WPA

The NPV of Zinc and Lead in the WPA was not calculated for this report.

Figure 43: Economic potential of zinc and lead deposits within the WPA



2.4.11 Potash and Lithium

Potash and Lithium resource prospectivity update from 2018

The assessment of potential for undiscovered potash (Figure 44, Table 44) has not been updated from the 2018 Geoscience Australia report, which was assessed using the Jaireth et al. (2012) and Mernagh et al. (2013) national maps.[16] [17]

The assessment of undiscovered Lithium potential, Figure 45, is based on predicted lithium concentrations using available geochemical data within the salt lake systems and in groundwater within the lake catchments. The national map of Mernagh et al. (2013) shows limited information on the salt lake systems within the WPA area. Therefore, the future potential for Lithium resources in the WPA area, based on existing information, is considered low.

Table 44: Geological inputs used to evaluate Potash and Lithium potential in the WPA.

Deposit style	Geological Criteria	Inputs	Considerations
Potash	*Mapped areas per Mernagh et al. (2013) national map*		
Lithium	*Mapped areas per Mernagh et al. (2013) national map*		

Source: DEM, Geoscience Australia

[16] Jaireth S, Bastrakov E, Wilford J, English P, Magee J, Clarke J, de Caritat P, Mernagh T, McPherson A, Thomas M (2012). Salt lakes prospective for Potash Deposits (first edition), 1:5 000 000 scale. Geoscience Australia, Canberra.

[17] Mernagh, TP (ed) (2013). A review of Australian salt lakes and assessment of their potential for strategic resources. Geoscience Australia Record, 2013/39. Geoscience Australia, Canberra.

Figure 44: Potash potential within the WPA

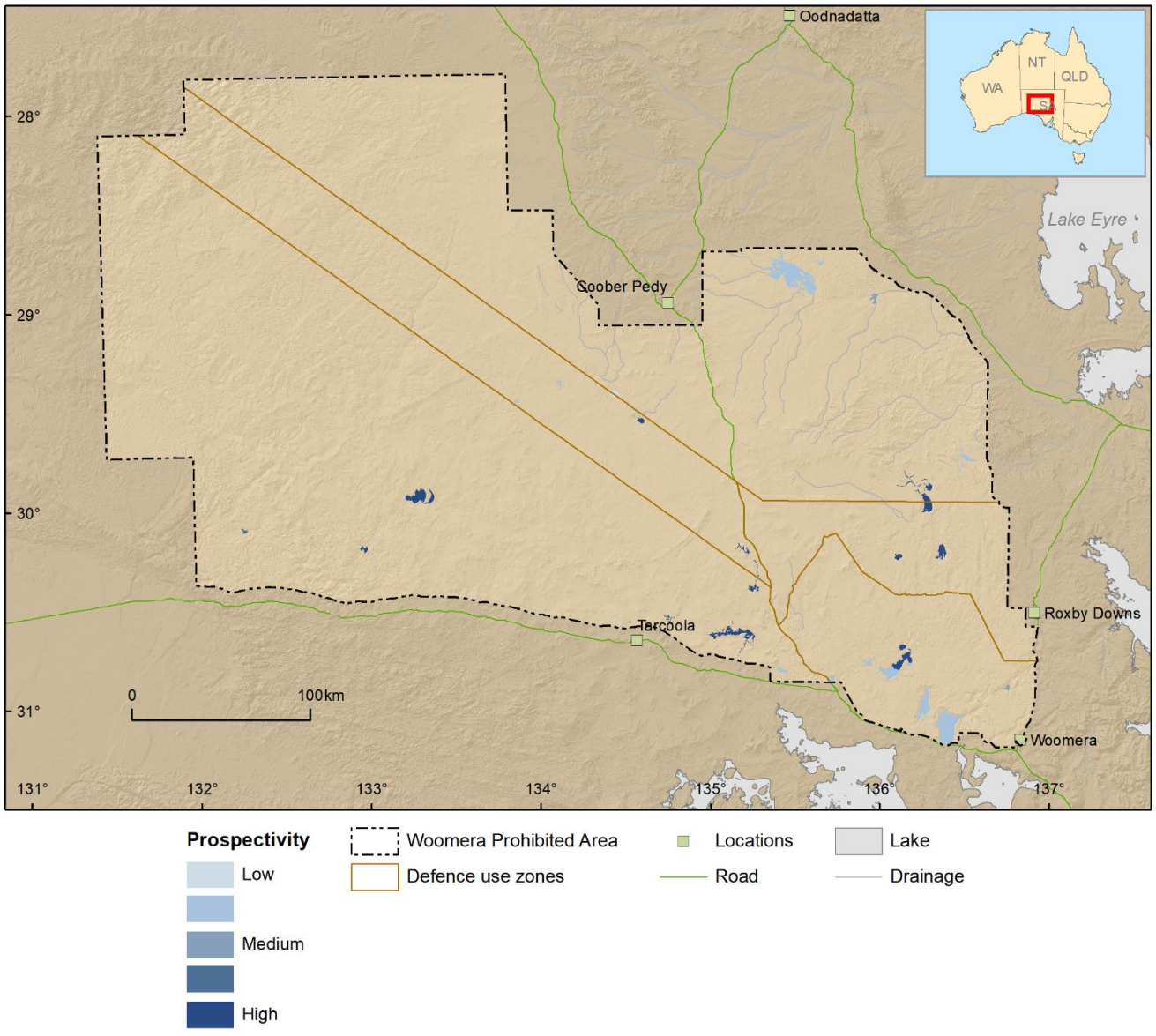
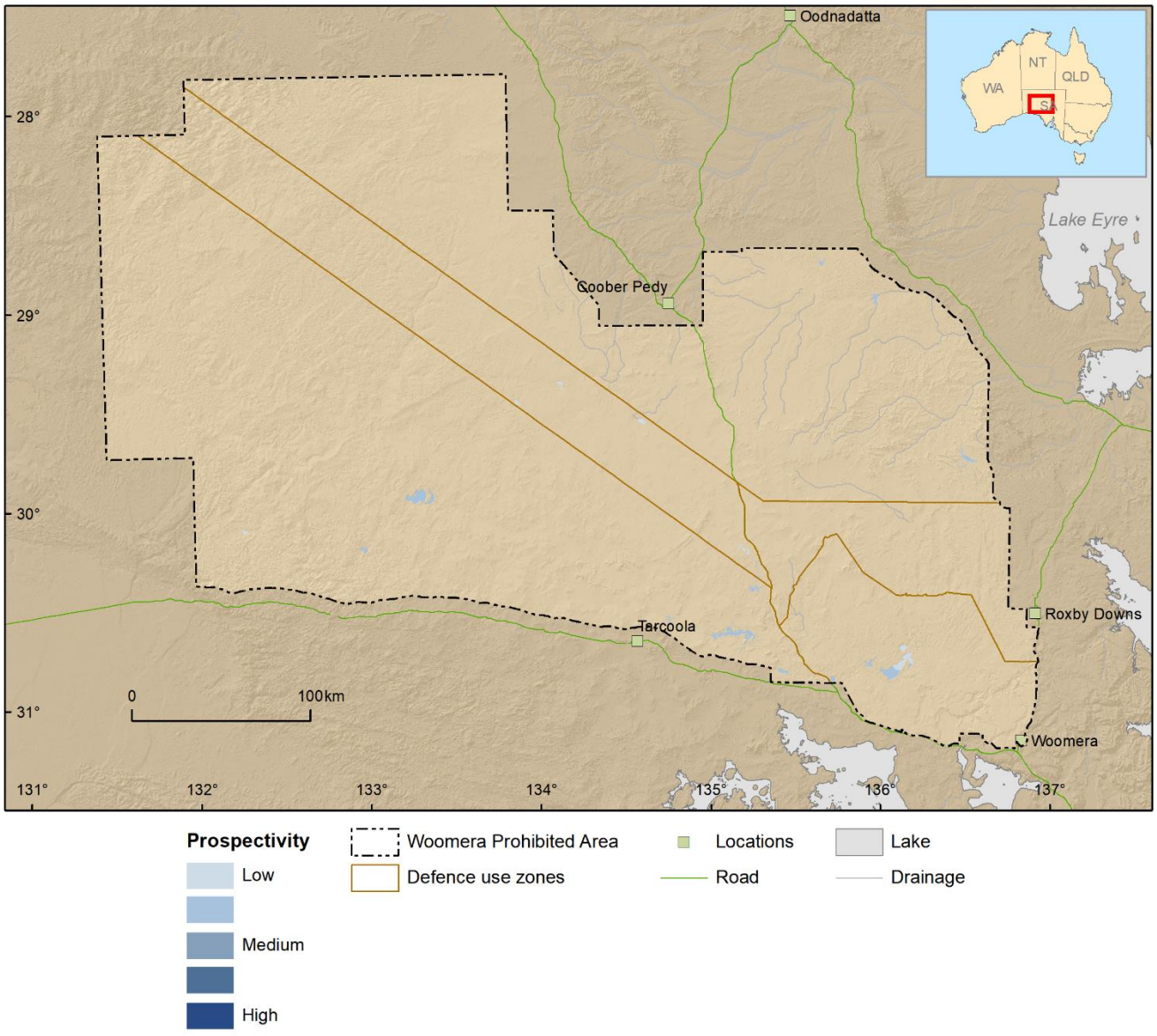


Figure 45: Lithium potential within the WPA



Future potential for Potash and Lithium in the WPA

No assessment of the future tonnage potential for Potash and Lithium in the WPA was performed in this report.

Economic value of Potash and Lithium in the WPA

The NPV of Potash and Lithium in the WPA was not calculated for this report.

2.4.12 High Purity Alumina

High purity alumina resource prospectivity update from 2018

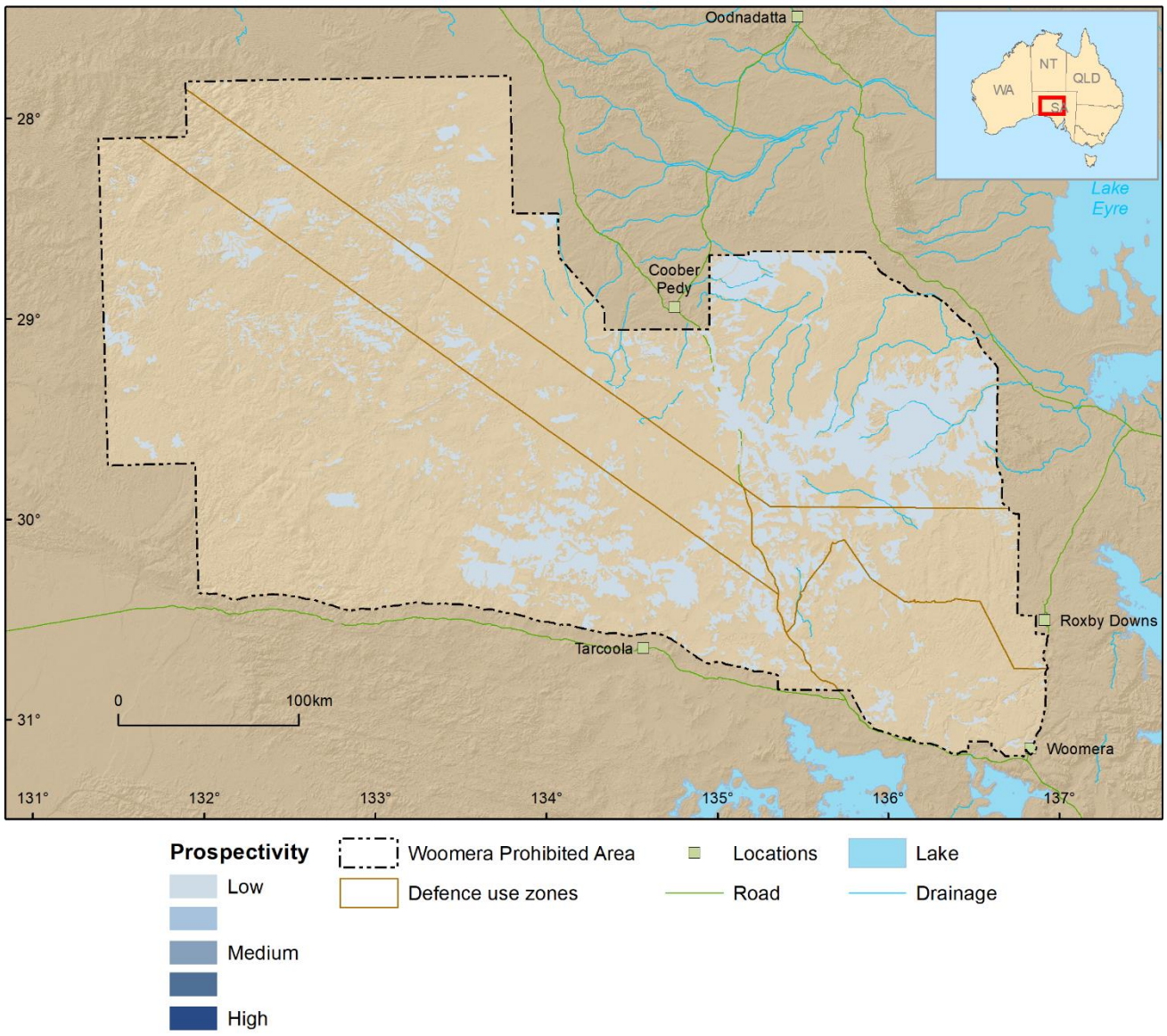
The potential for undiscovered high purity alumina mineral deposits was not assessed in the 2018 Geoscience Australia report. For this assessment, a simple mineral deposit model has been included (Table 45, Figure 46).

Table 45: Geological inputs used to evaluate high purity alumina potential in the WPA

Deposit style	Geological Criteria	Inputs	Considerations
High Purity Alumina	Weathered bedrock	Regolith material weathering intensity	Included only moderately to highly weathered bedrock

Source: DEM

Figure 46: High purity alumina potential within the WPA

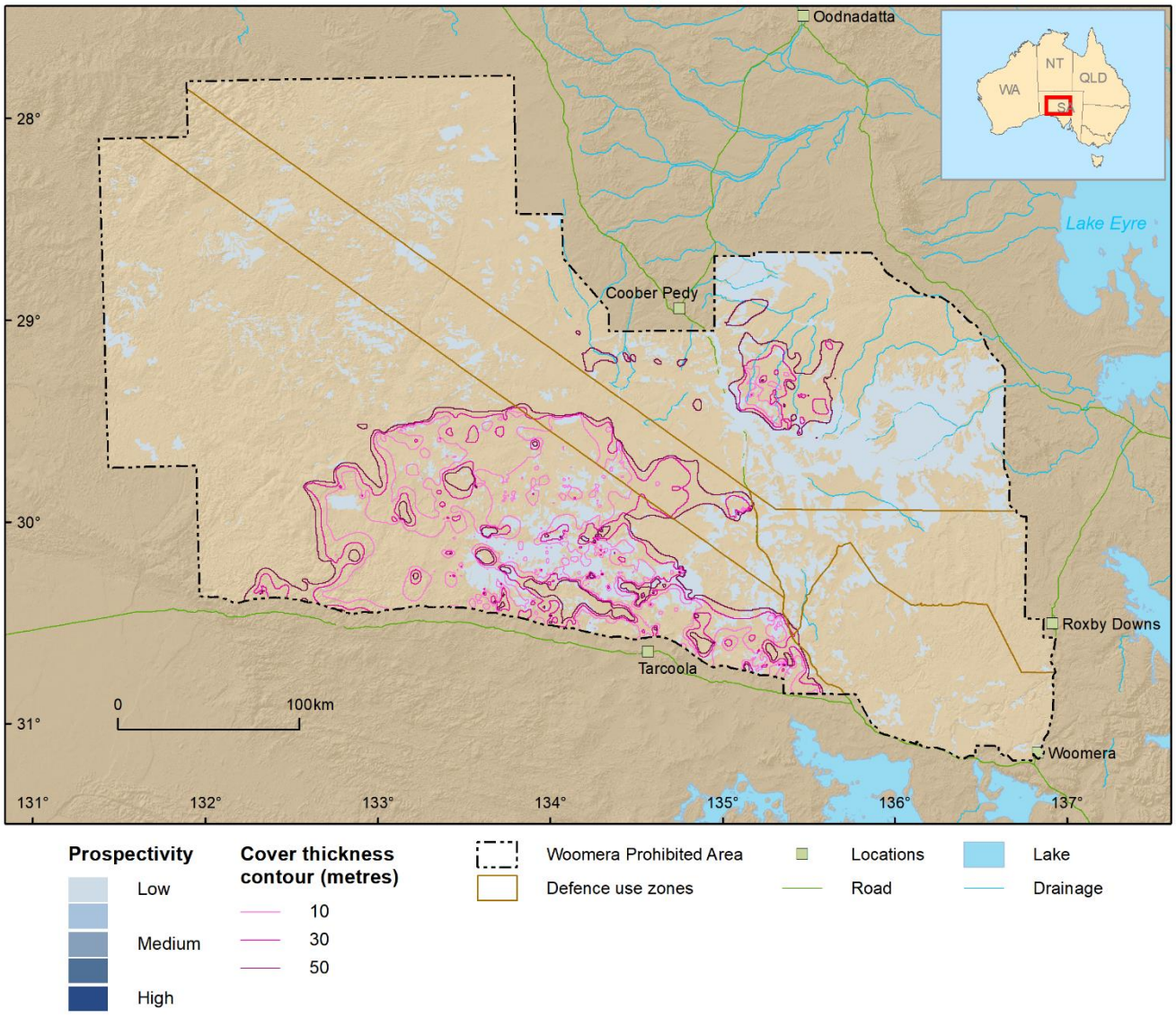


Future potential for high purity alumina in the WPA

Figure 47 depicts the areas of 10-30m, 30-50m and > 50m of cover thickness in the WPA, overlain on the prospectivity map for high purity alumina deposits. Cover thicknesses greater than 10m could impact the economic viability of a discovery in that area, and the map suggests that there is greater potential for an economic, shallow high purity alumina deposits in the central area of the WPA, north of Tarcoola.

No assessment of the future tonnage potential for high purity alumina in the WPA was performed in this report.

Figure 47: Economic potential of high purity alumina within the WPA



Economic value of high purity alumina in the WPA

The NPV of high purity alumina in the WPA was not calculated for this report due to insufficient data.

2.4.13 Solar and Wind

Solar and Wind resource prospectivity update from 2018

The potential for solar and wind energy resources was not assessed in the 2018 Geoscience Australia report. The transition from 'fossil fuel' derived energy resources, such as gas and coal, has seen a shift in South Australia's energy mix from 1% renewables to more than 70% generated by wind and solar in just over 20 years[18], and 35.9% of Australia's electricity generation in 2022 came from renewable energy sources[19]. In May 2022, the Government of South Australia declared a climate emergency and committed to transforming the economy to net zero emissions by 2050[20]. These commitments will see continued growth in the contribution of renewable energy sources in South Australia's energy mix and the potential for solar and wind energy power generation to support public, private and defence infrastructure in the WPA pertinent to this report.

Solar resource availability in the WPA has been assessed using annual average daily Direct Normal Irradiation (DNI). Average daily DNI data has been sourced from the Global Solar Atlas. Figure 48 indicates the areas of the WPA where DNI levels are good (greater than 20.5 MJ/m^2) and world class (greater than 23.5 MJ/m^2).

Wind energy resource availability has been assessed using average wind speed at 100 metres above ground level. Wind speed data has been sourced from the Global Wind Atlas. The Renewable Energy Solar Atlas (Department for Energy and Mining) identifies areas with mesoscale wind speeds at or greater than 7.31 m/s at 80 metres above ground as the best areas for wind development. To convert this to a wind speed at 100 metres above ground, a logarithmic wind profile and a roughness length of 0.03m (equivalent to open agricultural land without fences and hedges) was used to define the threshold of 7.5 m/s for wind speed at 100 metres above ground level to identify areas of wind development in the WPA (Figure 49).

[18] Department for Energy and Mining, *Leading the Green Economy*, Government of South Australia, accessed 26 September 2023, https://www.energymining.sa.gov.au/industry/modern-energy/leading-the-green-economy

[19] Clean Energy Australia Report 2023, Clean Energy Council, April 2023

[20] Climate emergency declaration passes in Parliament, Government of South Australia Media Release 31 May 2022

Figure 48: Annual average daily Direct Normal Irradiation levels within the WPA (Global Solar Atlas)

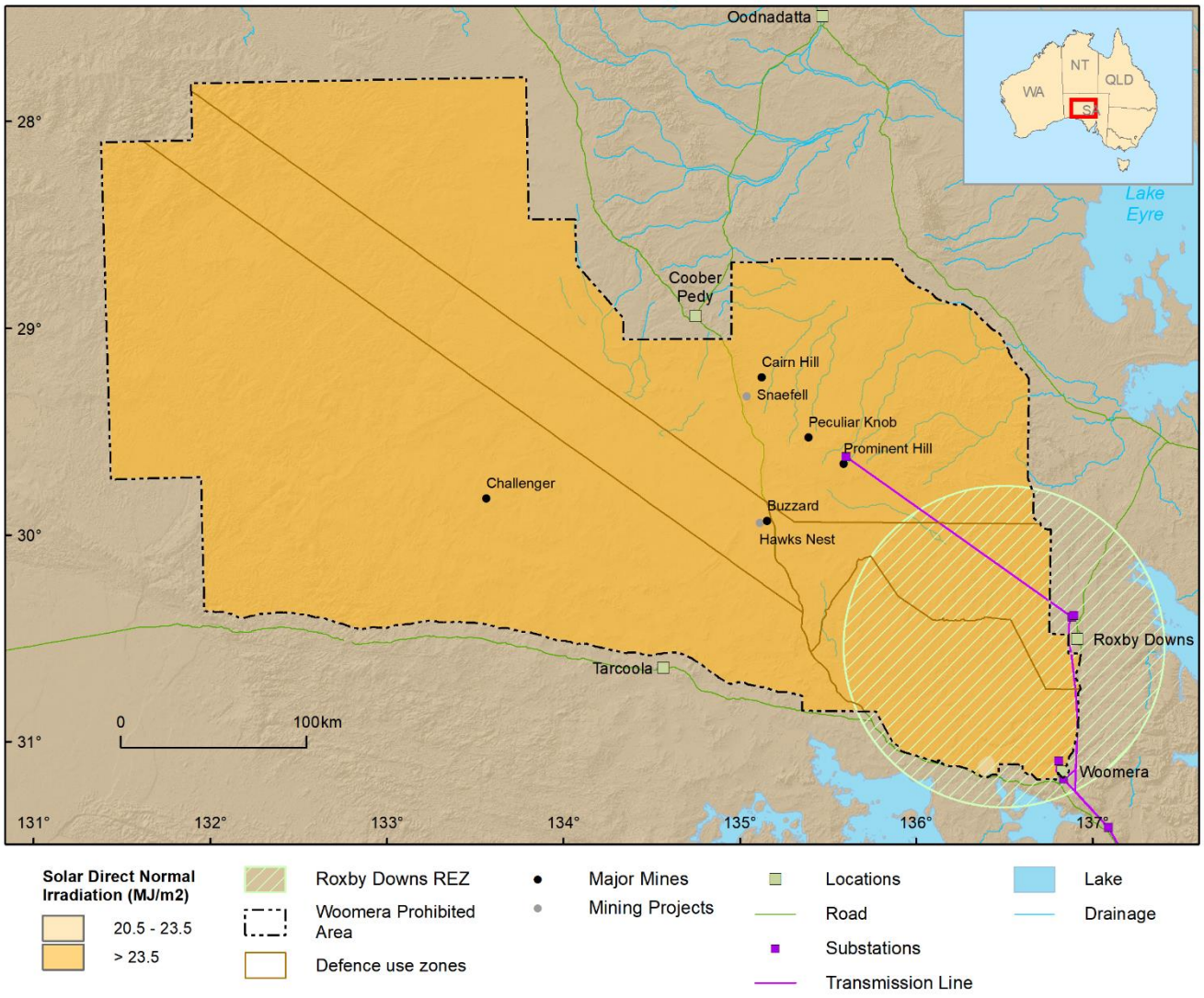
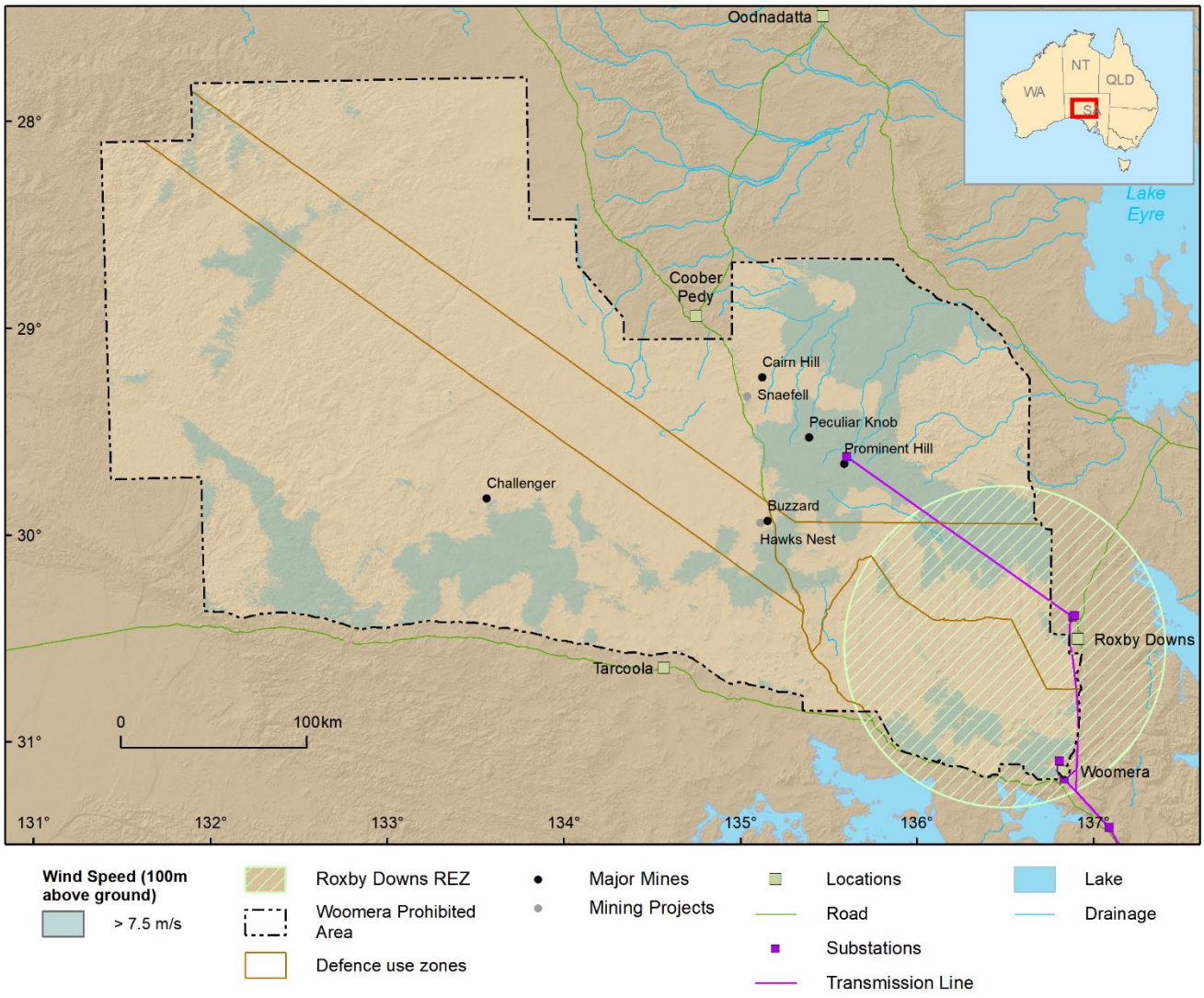


Figure 49: Average wind speed at 100m above ground level within the WPA (Global Wind Atlas)



Future potential for solar and wind in the WPA

Given the widespread availability of solar resources in the WPA, the future potential for solar and wind in the WPA has been assessed using deterministic scenarios to constrain the drivers of renewable energy development in the WPA. These scenarios have been aligned to three of the four AEMO 2022 ISP scenarios[21] for the development of the Roxby Downs Renewable Energy Zone (REZ).

The ISP scenarios capture the range of rates of emission reduction, electricity demand and decentralisation. The high-level ISP descriptions of the scenarios are as follows:

- **Slow Change –** is the challenging economic environment following the COVID-19 pandemic, with greater risk of industrial load closures, and slower net zero emissions action.
- **Progressive Change –** is pursuing an economy-wide net zero emissions 2050 target progressively, ratcheting up emissions reduction goals over time.

[21] Australian Energy Market Operator, *2022 Integrated Systems Plan (ISP) for the National Electricity Market, June 2022*

- **Step Change –** is rapid consumer-led transformation of the energy sector and co-ordinated economy-wide action.
- **Hydrogen Superpower –** is strong global action and significant technological breakthroughs.

Of these scenarios, the *Step Change* scenario has been considered by energy industry stakeholders to be the most likely scenario, ahead of the *Progressive Change* scenario. Therefore, for the purposes of this assessment, the *Progressive Change* scenario has been used as a 'Low' estimate, the *Step Change* scenario as the 'Best' estimate and the *Hydrogen Superpower* scenario as the 'High' estimate of future solar and wind generation potential in the WPA. Under these scenarios, the projected generation capacity by 2050 in the Roxby Downs REZ are shown in Table 46. The capacity is driven entirely by solar photovoltaics (PV) – the modelling outcomes under all scenarios did not project any wind generation in the Roxby Downs REZ.

As the majority of the REZ is within the WPA, it is assumed all the generation capacity occurs within the WPA and no adjustments have been made.

Table 46: Projected generation capacity of the Roxby Downs Renewable Energy Zone, by AEMO Integrated System Plan Scenario, by 2050.

	Project Generation Capacity (MW)		
	Progressive Change	**Step Change**	**Hydrogen Superpower**
Solar	650	700	3,400
Wind	-	-	-

Source: AEMO Integrated Systems Plan, June 2022, Appendix 3. Renewable energy zones, pg. 68

Economic value of solar and wind in the WPA

The NPV of the projected generation capacity of the Roxby Downs REZ has been calculated using the same NPV approach used for mineral resources. Cost inputs, including build costs, regional cost factors, connection costs, lead time and fixed operational costs are aligned with the input data used for the ISP 2021-22 market modelling studies.

The ISP uses 'candidate development paths' to assess the risks of investment occurring too early or too late and concluded that Candidate Development Pathway 12 (CDP12) is the Optimal Development Pathway – therefore this assessment has used the CDP12 capacity and generation timeseries used to determine the NPV by scenario (Table 47).

Table 47: Net present value of solar and wind in the WPA

	Economic Impact Scenarios		
	Low	**Medium**	**High**
Solar	650 MW	700 MW	3,400 MW
Wind	0 MW	0 MW	0 MW
NPV ($ million)	**71**	**147**	**693**

Source: Scyne Advisory analysis, 2023

2.4.14 Petroleum and Coal

Petroleum and coal resource prospectivity update from 2018

The assessment of potential for undiscovered petroleum and coal deposits has not been updated from the 2018 Geoscience Australia report (Figures 50, 51). There have been no updates to input data for the petroleum and coal plays in the Officer and Arckaringa basins, and the last petroleum drilling activity was in 2014.

Figure 50: Petroleum potential within the WPA (modified from Geoscience Australia, 2018)

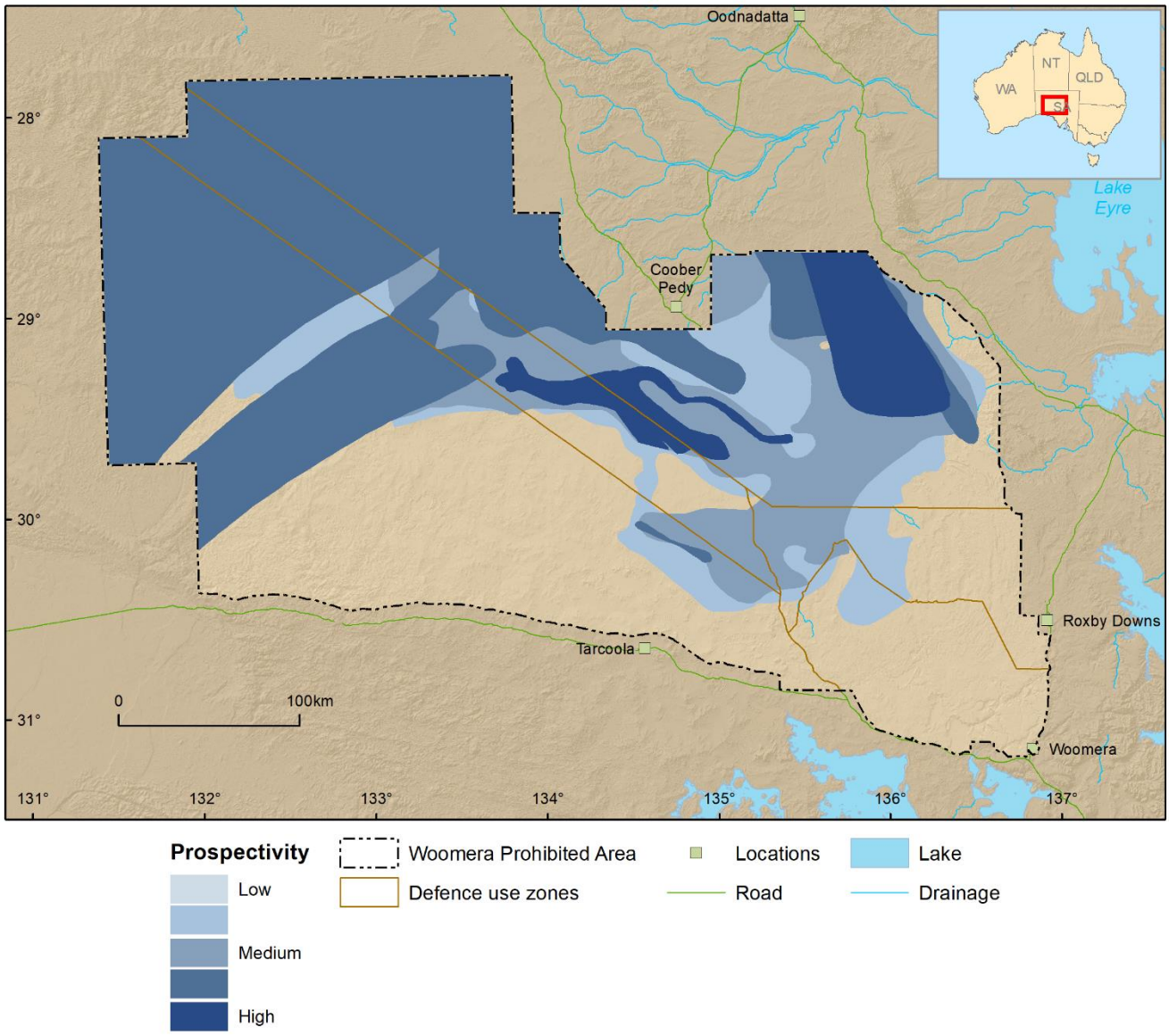
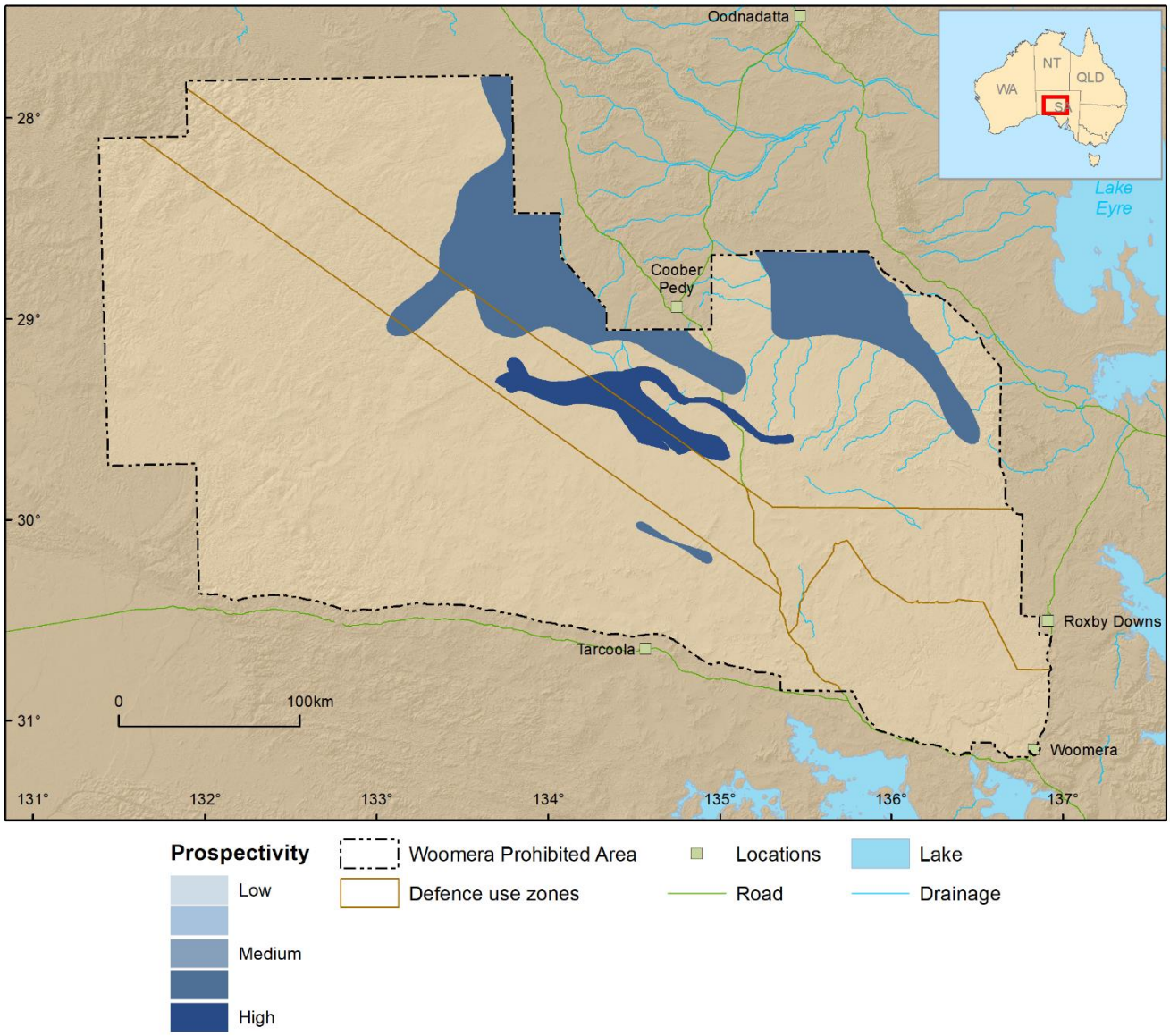


Figure 51: Coal potential within the WPA (modified from Geoscience Australia, 2018)



Economic potential for petroleum in the WPA

No assessment of the future volumetric potential for petroleum or coal in the WPA was performed in this report due to insufficient data to constrain potential field size.

Economic potential for petroleum in the WPA

The NPV of Petroleum and Coal in the WPA was not calculated for this report.

2.4.15 Natural Hydrogen

Natural hydrogen resource prospectivity update from 2018

The assessment of potential for undiscovered natural hydrogen fields was not assessed in the 2018 Geoscience Australia report. Natural hydrogen exploration in SA was enabled via regulatory changes in February of 2021, and hydrogen is emerging as a potential low-emissions energy source for Australia's energy, transport and industrial sectors.

This assessment of the potential of hydrogen in the WPA uses the hydrogen play developed by Department for Energy and Mining (Table 48).[22] Potential hydrogen source rocks include mafic and ultramafic rocks and iron-rich formations, where hydrogen is generated through the oxidation of Fe^{2+} bearing minerals, and uranium-rich basement, where hydrogen is generated by the radiolysis of water[23]. Following generation, the presence of faults aid migration of the hydrogen to a suitable trap and reservoir (such as petroleum type reservoirs in sedimentary basins). This combination of play elements generates the prospectivity map of natural hydrogen in the WPA, Figure 52.

Table 48: Geological inputs used to evaluate natural hydrogen potential in the WPA.

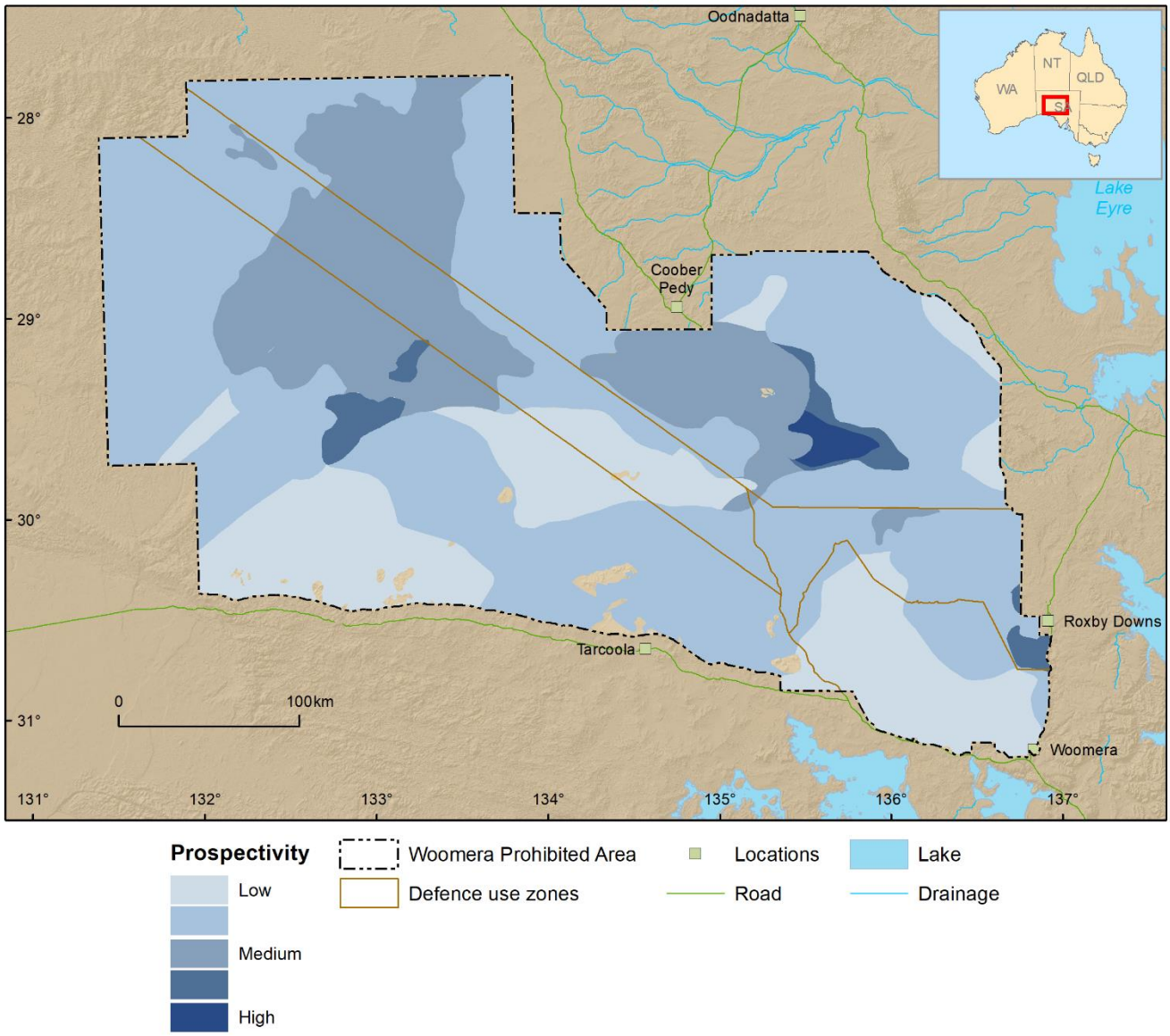
Deposit style	Hydrogen Play Elements	Inputs	Considerations
Hydrogen	Solid Geology	Solid geology units containing gabbros, mafics, ultramafics, iron formations and Fe-rich granitoids and intrusives: • Donington Suite • Engenina Adamellite, Symons Granite, equivalents of Tunkillia Suite • Gawler Range Volcanics • Hiltaba Suite • Hutchison Group • Curramulka Gabbronorite • Kychering Formation; Lake Harris Komatiite • Mount Woods Complex • Muckanippie Suite • Mulgathing Complex • Peake Metamorphics • St Peter Suite • Tunkillia Suite • Iron Formations • Wilgena Hill Jaspilite	
	Uranium-rich rocks	• Location of known IOCG deposits • Maximum drillhole geochemistry Uranium > 10 times crustal abundance	
	Ferruginous duricrusts	Induration ferruginous	
	Structural complexity/active faults	Archean to Mesoproterozoic faults	
	Trap	Sedimentary basins layer	

Source: DEM

22 Bendall, B. (2022) *Current perspectives on natural hydrogen. MESA Journal, 96*, 37-46.

23 Gaucher, EC. (2020). *New Perspectives in the Industrial Exploration for Native Hydrogen. Elements, 16, 8-9.*

Figure 52: Natural hydrogen potential within the WPA



Future potential for natural hydrogen in the WPA

No assessment of the future volumetric potential for natural hydrogen in the WPA was performed in this report.

Economic value of natural hydrogen in the WPA

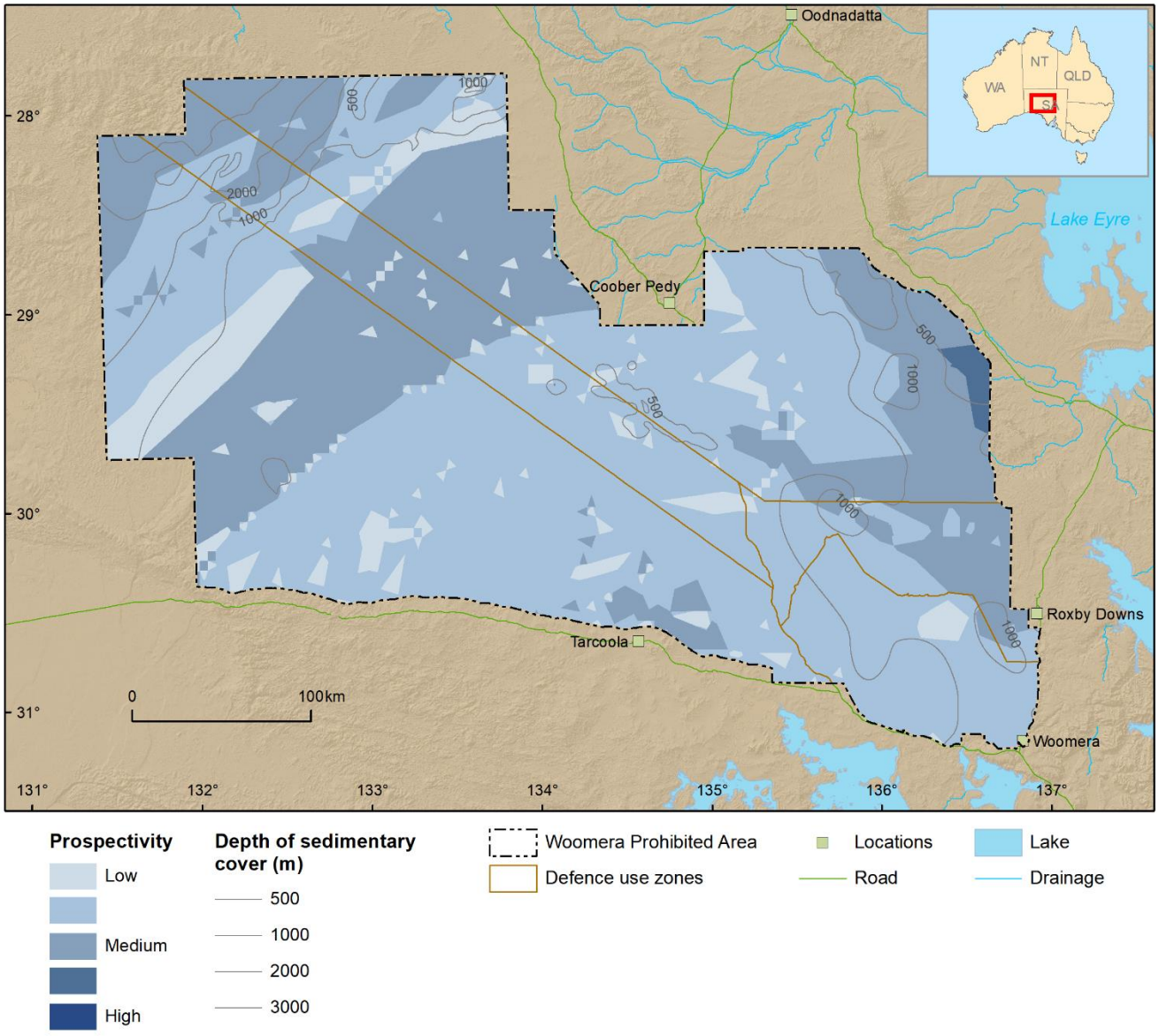
The NPV of Natural Hydrogen in the WPA was not calculated for this report.

2.4.16 Geothermal Energy

Geothermal energy resource prospectivity update from 2018

The assessment of potential for geothermal energy resources has not been updated from the 2018 Geoscience Australia report (Figure 53). No changes were made to the 2010 deposit model and there have been no substantial updates to data inputs.

Figure 53: Geothermal energy potential within the WPA (modified from Geoscience Australia, 2018)



Future potential for geothermal energy in the WPA

No assessment of the future potential for geothermal energy in the WPA was performed in this report.

Economic value of geothermal energy in the WPA

The NPV of Geothermal Energy in the WPA was not calculated for this report.

2.4.17 Groundwater

Groundwater resource prospectivity update from 2018

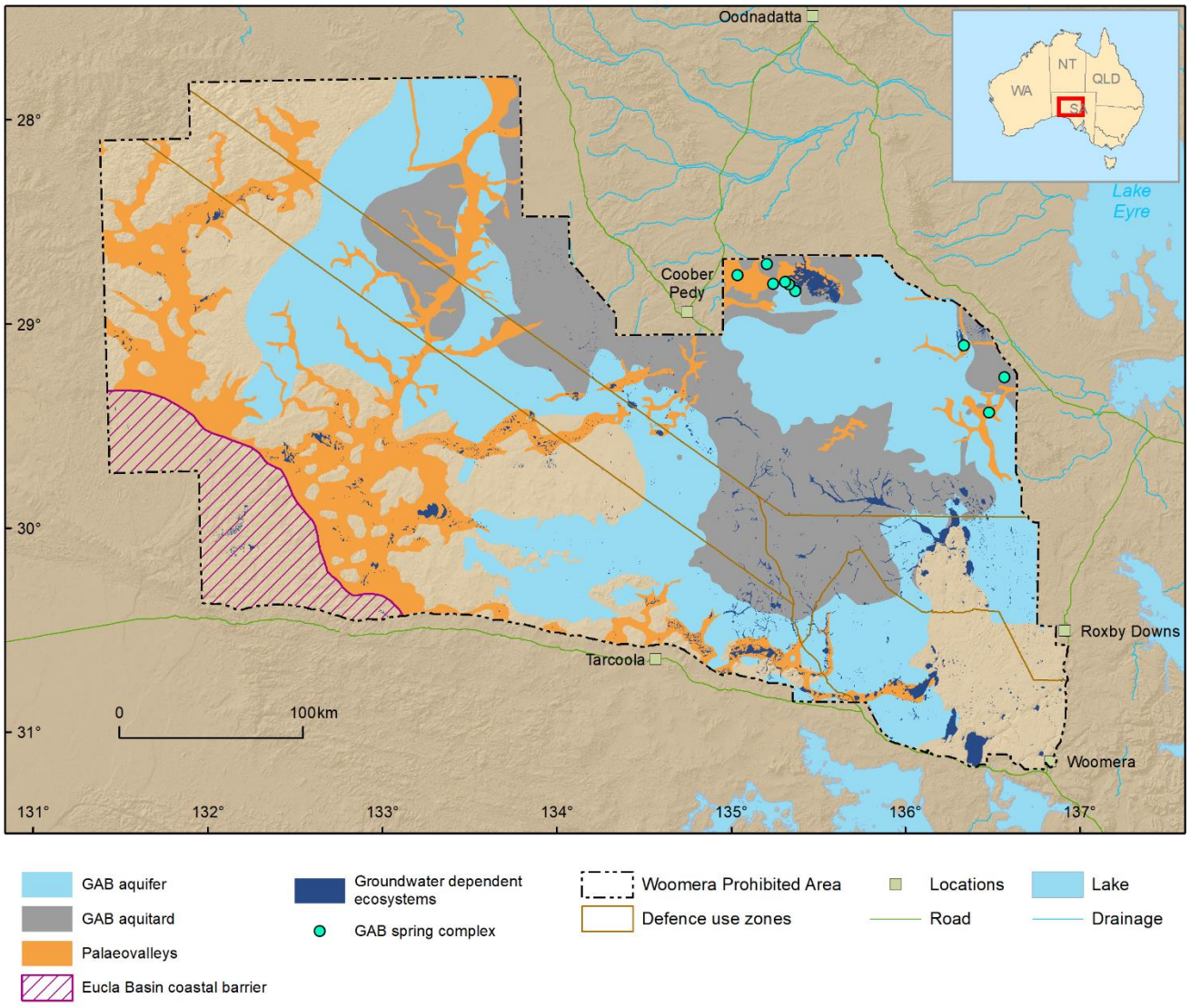
The assessment of potential for groundwater resources has not been updated from the 2018 Geoscience Australia report (Figure 54). No changes were made to the 2010 deposit model and there have been no substantial updates to data inputs (Table 49).

Table 49: Geological inputs used to evaluate groundwater potential in the WPA

Deposit style	Key Systems Components	Inputs	Considerations / Source
Groundwater	Eucla Basin coastal barrier	Presence of Tertiary coastal sediments	
	Groundwater Springs	Great Artesian Basin Spring Complexes	SA Department of Environment, Water and Natural Resources (2015) Location, Physical and Biological Attributes of Great Artesian Basin Spring Complexes - ARC. Bioregional Assessment Source Dataset
	Groundwater Dependent Ecosystems	Groundwater Dependent Ecosystems of the (1) Lake Gairdner, (2) Lake Eyre and (3) Lake Torrens/Mambray Coast River regions	Sourced from the Groundwater Dependent Ecosystems Atlas, Bureau of Meteorology
	Palaeovalleys	Presence of Neogene and Mesozoic palaeovalleys	
	Groundwater Basins	• Great Artesian Basin • Rolling Downs Aquitard of the Great Artesian Basin	Rolling Downs Aquitard sourced from the Hydrogeological atlas of the Great Artesian Basin, GABATLAS

Source: DEM, Geoscience Australia

Figure 54: Key groundwater system components within the WPA (modified from Geoscience Australia, 2018)



Future potential for groundwater in the WPA

No assessment of the future potential of groundwater resources in the WPA was performed in this report.

Economic value of groundwater in the WPA

The NPV of Groundwater in the WPA was not calculated for this report.

2.4.18 Extractives

Extractives resource prospectivity update from 2018

The potential for undiscovered extractive material deposits, such as limestone, salt, sand and gravel, was not assessed in the 2018 Geoscience Australia report. However, the need and demand for local extractives to drive mining and infrastructure development in the WPA has increased and therefore extractive materials has been added to the 2023 assessment (Figures 55, 56). For this assessment, a simple deposit model has been included (Table 50).

Table 50: Geological inputs used to evaluate extractive materials potential in the WPA

Deposit style	Materials	Inputs	Considerations
Extractives	Limestone / Calcrete	Induration Mixed Calcareous and Gypsiferous Induration Calcareous	
	Salt	Surface geology, lacustrine sediments	
	Sand / Gravel	Regolith layer: • Alluvial sediments • Aeolian sediments • Transported sediments	
	Other commodities	• Surface geology units containing: • Basalt • Dolerite • Dolomite • Gabbro • Gneiss • Granite • Schist • Rhyolite	
	Existing occurrences	• Quarries • Mines and Mineral deposits by commodity - Construction materials	

Source: DEM

Figure 55: Distribution of extractive materials occurrences in the WPA.

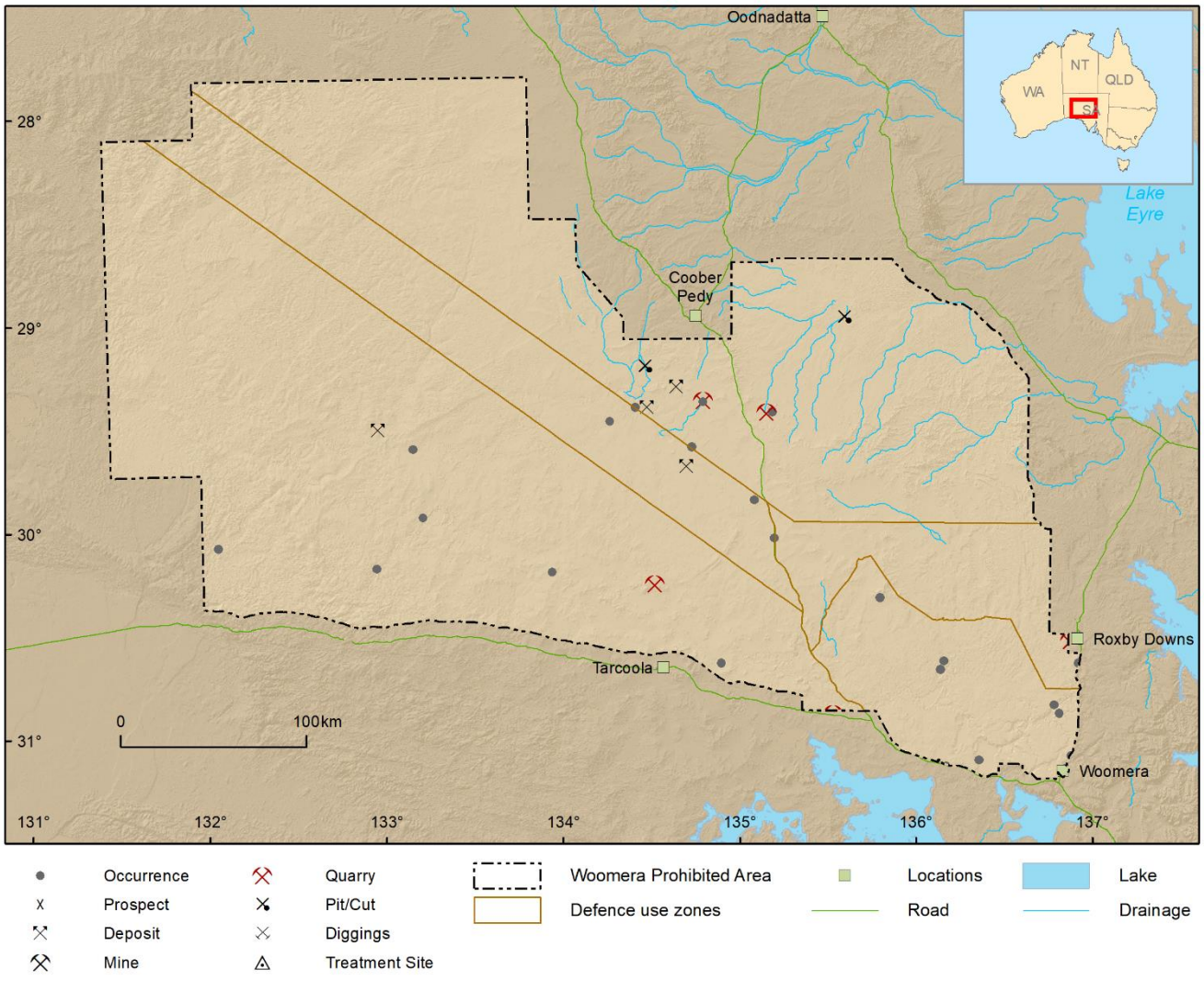
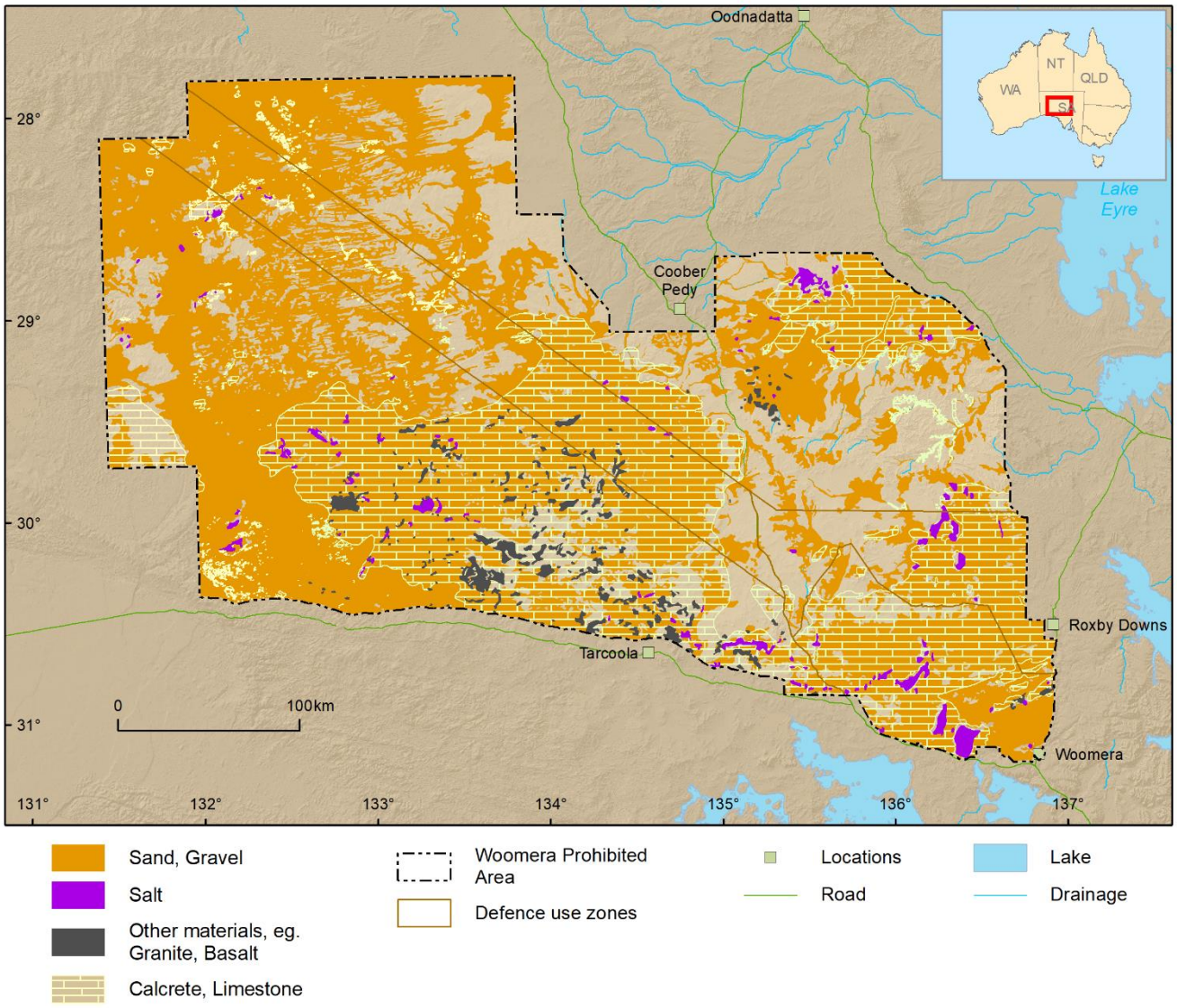


Figure 56: Distribution of extractive materials in the WPA



Future potential for extractives in the WPA

No assessment of the future potential of extractive resources in the WPA was performed in this report.

Economic value of extractives in the WPA

The NPV of Extractive materials in the WPA was not calculated for this report.

3 Economic impact assessment

3.1 Economic impact assessment key findings

An economic assessment has been undertaken to quantify the direct and indirect economic impacts associated with possible future mineral and energy resource developments in the WPA. The assessment reflects the total economy-wide impacts by using a specialised model for this purpose.

The economic modelling framework employed is a computable general equilibrium (CGE) model, which is a sophisticated, multivariate model that measures the effect an investment or initiative has on the national and state/territory economies. A CGE model takes into account the direct and indirect effects as well as the resource constraints of the economy by recognising that increased demand for labour and capital in some sectors comes at the expense of other sectors. The specific model used is Victoria University's Regional Model (VURM); which contains multiple regions, industries and commodities and therefore provides a highly disaggregated representation of the Australian economy. A dynamic version of the model is used, which enables an analysis of the WPA's impacts over the development and operation phases.

Three scenarios are analysed here – the low, best and high scenarios set out in the prior chapter. The key inputs into the economic assessment include, for each of the three scenarios, the development phase costs of exploration expenditure for mining projects and capital expenditure for both mining and energy resource projects.

State level results were the focus of this assessment. As states exist in an economy competing nationally for capital and labour, the gains to the state where possible future mine mineral and energy resource developments are located typically means a relative loss of resources from other states.

The analysis shows significant impacts to gross state product (GSP) and jobs in the SA economy, as well as supporting growth in Australia's gross domestic product (GDP). A summary of the economic impact results is presented in Table 51.

Table 51: Summary of economic impacts

Outcome modelled		Low scenario	Best scenario	High scenario
SA GSP ($2022-23, discounted at 7%)	Development phase (2023/24 – 2033/34)	$4.4bn	$9.4bn	$18.2bn
	Operation phase (2034/35 – 2060/61)	$5.4bn	$14.6bn	$27.4bn
	Total (2023/24 – 2060/61)	$9.8bn	$24.0bn	$45.6bn
Australian GDP ($2022-23, discounted at 7%)	Development phase (2023/24 – 2033/34)	$1.0bn	$2.3bn	$4.4bn
	Operation phase (2034/35 – 2060/61)	$0.3bn	$0.5bn	$2.4bn
	Total (2023/24 – 2060/61)	$1.3bn	$2.8bn	$6.8bn
SA employment (FTE)	Development phase – Average annual (2023/24 – 2033/34)	3,000	6,700	12,900
	Development phase – Peak investment year (2033-34)	5,400	15,300	33,800
	Operation phase – Average annual (2034/35 – 2060/61)	3,600	10,400	18,800
SA state royalties ($2022-23, undiscounted)	Operation phase - Average annual (2034/35 – 2060/61)	$0.1bn	$0.3bn	$0.5bn
	Operation phase - Total (2034/35 – 2060/61)	$1.7bn	$6.3bn	$12.7bn

Source: Scyne Advisory analysis (2023) using Victoria University's VURM CGE model

3.2 Scenarios

The economic impacts of potential future mine developments in the WPA have been modelled under three scenarios, that of a 'Low', 'Best' and 'High' scenario respectively. These scenarios are described in detail in Appendix A of this report. Key points to note of the scenarios are:

- Across the three scenarios, only deposit types with a high likelihood of discovery and with potentially high-value grade-tonnage characteristics for major mineral commodities and key critical commodities have been considered.
- 'Analogue deposits' have been used to represent the potential future mine development scenarios that could occur in the WPA, over a 15–20-year timeframe. It is assumed that the analogue deposits used in this assessment reasonably reflect the characteristics (global resource size, grade, depth of overburden, and other core characteristics) of a deposit that may be discovered in the WPA in the future. Where possible, analogue deposits used in the respective scenarios are based on existing deposits in the WPA (e.g., Prominent Hill).
- The analogues used across the 'Low', 'Best' and 'High' estimates for each commodity were combined in an additive manner, with multiples of the same analogue added to provide scale, to ensure consistency across these three estimates (see Table 52). For example, for Copper, the Low scenario includes one scaled down Emmie Bluff and one scaled down Prominent Hill, while the Best scenario includes these mines at full scale, as well as one Carrapateena, and the High scenario including two of each mine.
- The one exception to this approach is Nickel, where three different analogues are used for 'Low', 'Best' and 'High'. This approach was taken to reflect:
  - the lack of SA analogues
  - the significant increase in scale between the Low, Best and High to reflect the range in potential deposit sizes.
- Using AEMO's 2022 ISP to estimate the future potential for solar and wind in the WPA, the *Progressive Change* scenario has been used as a 'Low' estimate, the *Step Change* scenario as the 'Best' estimate and the *Hydrogen Superpower* scenario as the 'High' estimate of future solar and wind generation potential in the WPA. Under these scenarios, the projected generation capacity by 2050 in the Roxby Downs REZ are shown in Table 52. The capacity is driven entirely by solar PV – the modelling outcomes under all scenarios did not project any wind generation in the Roxby Downs REZ.

Table 52: Summary of analogue deposits and renewable energy projects used in the economic impact assessment

Commodity	Low	Best	High
Gold	1 Prominent Hill (scaled to 110 Mt ore)	1 Challenger	2 Challenger
		1 Carrapateena	2 Carrapateena
		1 Prominent Hill	2 Prominent Hill
Copper	1 Emmie Bluff (scaled to 7.7 Mt ore)	1 Emmie Bluff	2 Emmie Bluff
	1 Prominent Hill (scaled to 110 Mt ore)	1 Prominent Hill	2 Prominent Hill
		1 Carrapateena	2 Carrapateena
Uranium	1 Prominent Hill (scaled to 110 Mt ore)[a]	1 Prominent Hill[a]	2 Prominent Hill[a]
		1 Beverley	2 Beverley
Iron	1 Buzzard/Tui	3 Buzzard/Tui	3 Buzzard/Tui
			1 Central Eyre Iron Project
Heavy Mineral Sands	1 Jacinth-Ambrosia (scaled down to 39 Mt ore)	1 Jacinth-Ambrosia	2 Jacinth-Ambrosia
Silver		1 Prominent Hill	2 Prominent Hill

Commodity	Low	Best	High
	1 Prominent Hill (scaled to 110 Mt ore)	1 Challenger	2 Challenger
	1 Emmie Bluff (scaled to 7.7 Mt ore)	1 Emmie Bluff	2 Emmie Bluff
		1 Carrapateena	2 Carrapateena
Nickel	Cassini (WA)	Nova-Bollinger (WA)	Nebo-Babel (WA)
Cobalt	1 Emmie Bluff (scaled to 7.7 Mt ore)	1 Emmie Bluff	2 Emmie Bluff
Renewable energy	650 MW per Progressive Change AEMO ISP scenario	700 MW per Step Change AEMO ISP scenario	3,400 MW per Hydrogen Superpower AEMO ISP scenario

Source: Scyne Advisory and DEM analysis, 2023
Notes: The scenarios represent possible future mines that may be developed in addition to the currently operating mines in the WPA.
a. Prominent Hill does not currently produce Uranium; however, we have adopted the Uranium production estimate from the 2018 Geoscience Australia report in the best and high scenarios.

3.3 Inputs and assumptions

The potential future mine mineral and energy resource developments within the WPA are likely to generate significant economic impacts for the SA (and national) economy.

At the state level, these impacts are largely driven by a combination of:

- Investment and employment during the development phase of mineral and energy resources – development impacts are relating to expenditure on the development of potential future mineral and energy resources and include the exploration and capital expenditures used to develop these resources within the WPA.
- Business expenditure and employment during the operation phase – operational impacts are relating to the ongoing running and maintenance of the mineral and energy resources once they are commissioned. Operational impacts include the day-to-day activities that occur at the various facilities.
- Productivity benefits during the operation phase - renewable energy investments in the Roxby Downs REZ will enable newly developed mines in the WPA to more quickly uptake cleaner energy sources. This will reduce the CO_2 emissions offset costs otherwise applicable under the Safeguard Mechanism for the mining industry in SA.[24]

At the national level, the impacts are driven by the focus on expanding SA's resources sector and the following assumptions implicit to CGE modelling:

- Australia is a small open economy reliant on net capital inflows to fund investments. The share of foreign ownership by industry in the model is fixed. This assumes that the availability of foreign investment and foreign ownership of capital are limited, and not affected by domestic variables or policies, except that when an industry expands, so does the capital owned by foreigners.
- The model allows the capital stocks in SA industries to deviate from their base case levels. The size of the capital stock is determined through demand from the production sector, given the rental price for capital. This implies a long-run assumption in which the size of the capital stock is flexible. The model also assumes that investment in each regional industry in the long-run will deviate from the base case in line with deviations in the industry's capital stock.

[24] Other than this productivity shock, the analysis assumes no changes in technologies or new innovations other than those that would be employed by the selected analogous already. This assumption applies both over time and across all scenarios.

- An increase in investment during the development phase increases the cost of capital for other industries in Australia. During the development phase, real wages rise as employment expands and wages in SA rise relative to wages elsewhere in Australia. At the end of the development phase these cost pressures suddenly cease and real wages in SA begin to fall. Real wages respond sluggishly in the model and rise in relative terms in the rest of Australia. Also, the concentration of investment in SA is reflected in the relative size of the impacts in SA compared to the national impacts.
- The scenario modelled focusses on expanding SA's resource sector. Apart from the renewable energy source substitution, we have not assumed any complementary policy adjustments affecting mining inputs or productivity that would exogenously drive growth of the mineral mining sector in Australia. To that effect, the results present the economic impact of the project itself – rather than accounting for any external factors that may lead to additional economic growth.

To estimate the benefits that will be generated in each of the scenarios modelled, a series of 'shocks' or inputs are applied that vary the CGE model from its base case. These shocks are described below.

3.3.1 Development expenditure

The low, best and high scenarios described above have been valued for use as inputs into the CGE model. In estimating investment into the development of the mines in the WPA, the following assumptions are made:

- Only development capital expenditure and exploration costs (Table 53) are used as investment inputs in the CGE model. Annual operating expenditure and sustaining capital expenditure is accounted for within the CGE model.
- As noted in Chapter 2, in the absence of alternative assumptions, all discoveries of deposits are assumed to be made in the 2023-24 financial year, with a 10-year exploration period following discovery assumed for each mine site. The total exploration cost per discovery is assumed to be $210 million for each mine.[25]
- All other figures used as inputs into the CGE model, such as specific development capital expenditures, construction time and operation periods specific to each analogue can be found within Appendix A of this report under Section 1.4.6.

Table 53: Total investment expenditure ($2022-23, real, billions, undiscounted)

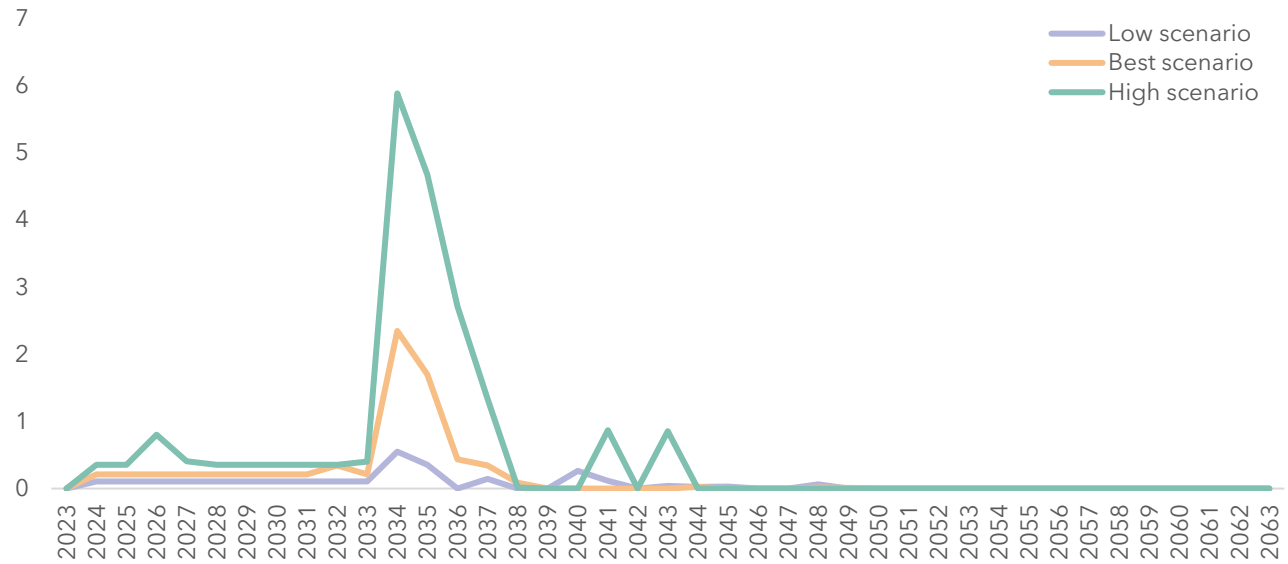
	Low scenario	Best scenario	High scenario
Sub-total exploration expenditure	1.0	2.1	3.6
Sub-total capital expenditure	1.6	5.1	16.9
Total development expenditure	**2.6**	**7.2**	**20.5**

Source: Scyne Advisory and DEM analysis, 2023

The annual investment expenditure on potential future mine mineral and energy resource developments within the WPA in each scenario is illustrated in Figure 57.

[25] Schodde, R., 2019, Long term trends in gold exploration, NewGenGold Conference

Figure 57: Annual capital investment expenditure ($2022-23, real, billions, undiscounted)



Source: Department for Energy and Mining, Scyne Advisory analysis, 2023

From 2023 to 2032, expenditure on exploration costs for each discovery are input into the model within each scenario. As more mine sites are included in each option, this investment expenditure is larger for the Best and High scenarios respectively. Following this 10-year period, development expenditure on constructing the mine sites is included. Similarly, this expenditure is larger for the Best and High scenarios, as a larger number of mines are included. During this stage, the peak year of investment expenditure in each scenario is in the 2033/34 financial year. In addition to the expenditure on the mine sites, capital expenditure identified in AEMO's ISP on solar investments in the WPA are included. As a result, ongoing investment is included in the modelling within the renewable electricity generation sector until as late as 2049 in the High scenario.

3.3.2 Productivity benefits

The mining industry in Australia is one of the country's largest greenhouse gas emitters.[26] These emissions are largely made up of stationary energy emissions from the burning of fuels for energy. Emissions from iron ore and other minerals mining are estimated to account for around 10 Mt C02-e in 2020.[27] This is projected to remain largely stable to 2030, with a 20 per cent decline forecast between 2030 and 2035. This trend is expected to accelerate after this in anticipation of net-zero targets by 2050.

The key driver of this decrease in emissions will be through the electrification of mining equipment, and by switching from diesel to electricity use. [28] The renewable energy investments in the Roxby Downs REZ will support this switch – enabling the newly developed mines in the WPA to more quickly uptake cleaner energy sources. The productivity gain included as a shock in the model is therefore based on the avoided CO_2 emissions offset costs otherwise applicable under the Safeguard Mechanism – estimated by the average diesel emissions intensity (sourced from 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories) and the Australian Carbon Credit Unit price (sourced from the Clean Energy Regulator).

---

[26] DCCEW (2022), Australia's emissions projections 2022

[27] Ibid.

[28] Ibid.

3.4 Results

This section outlines the key economic impacts including the net impacts to GSP/GDP, employment, household consumption, exports, investment, real wages, gross value add (GVA) at the industry level, and royalties. All percentage change impacts reported represent percentage increases in addition to baseline level growth.

As a background to understanding the simulation results it is important to note that the future mine mineral and energy resource developments will attract resources (both labour and capital) from other States and Territories in Australia. In other words, there will be a redistribution of labour and capital from other industries and regions in Australia to these future development activities. For this reason, the results described below focus on the impacts at the SA level, with a summary level analysis for national results.

3.4.1 Development phase impacts

The timing of the development phase differs slightly in each of the modelled scenarios, due to varied construction time requirements for some of the mines included in the Best and High scenarios.

SA's development phase impacts

Table 54 shows the SA results across investment, employment, household consumption and GSP in the peak year of investment across all three scenarios, which is 2033-34.

Table 54: Change in selected macroeconomic indicators in the peak year of the development phase (2033-34) in SA

Economic indicator	Low Scenario	Best Scenario	High Scenario
Investment	+2.2%	+8.2%	+19.6%
Employment	+0.5%	+1.5%	+3.4%
Household consumption	+0.3%	+0.9%	+2.0%
Gross state product (GSP)	+0.6%	+1.6%	+3.4%

Source: Scyne Advisory analysis 2023, VURM model.

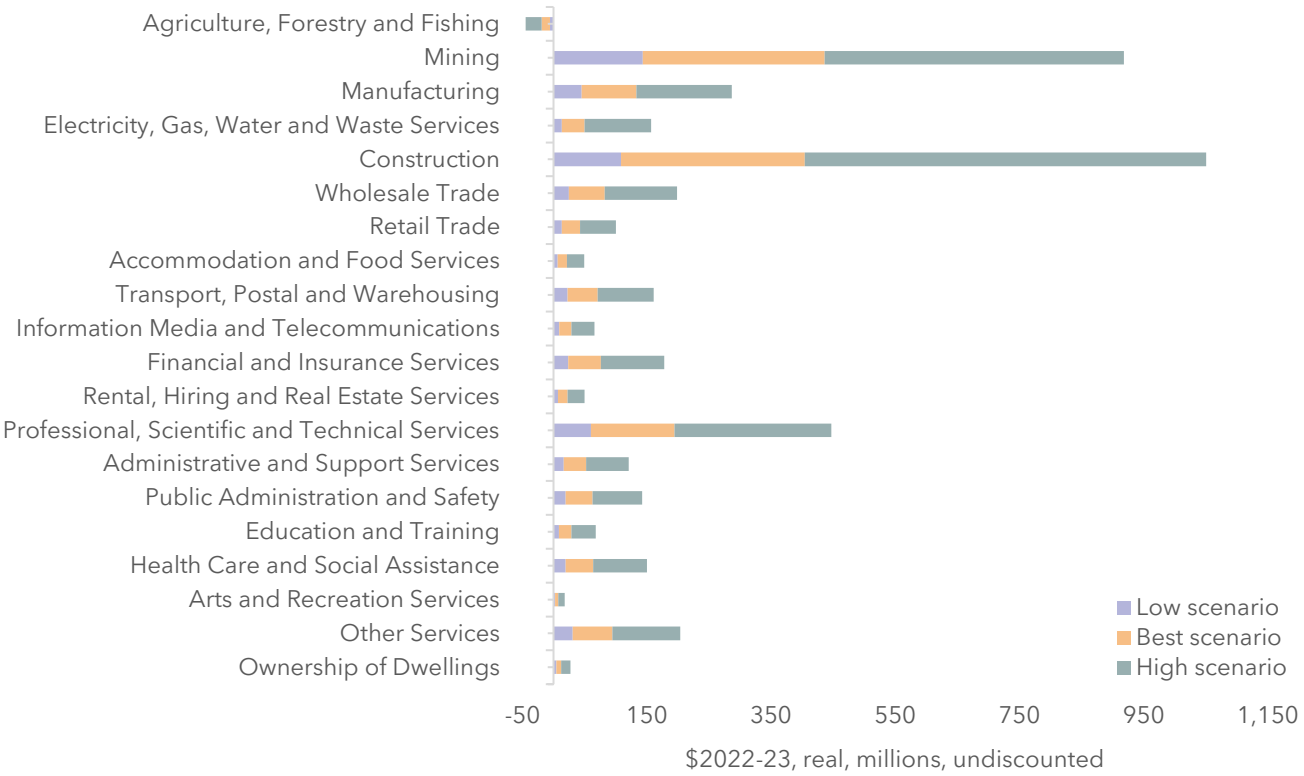
The following points are noted about SA's macroeconomic impacts in the development phase:

- Large increases in investment across each of the scenarios are a direct result of the expenditure on exploration and development of potential future mineral and energy resources in the WPA. This indicates SA's total investment in the peak year of development will be between 2.2 per cent (in the Low Scenario) and 19.6 per cent (in the High Scenario) higher than it would otherwise be.
- The exploration and construction of the mining and energy resources of the WPA will require a range of skilled workers in SA. Employment is boosted by 0.5 per cent in the Low Scenario, 1.5 per cent in the Best Scenario and 3.4 per cent in the High Scenario during the peak year of investment expenditure.
- SA's household consumption – the spending by households on goods and services and which is a measure of economic standard of living – will increase during the development phase due to a rise in local employment, meaning household incomes rise.
- As a result of these impacts to investment and household consumption, SA's GSP is anticipated to grow by 0.6 per cent in the Low Scenario, 1.6 per cent in the Best Scenario and up to 3.4 per cent in the High Scenario in the peak year of investment expenditure.

In addition to the above macroeconomic impacts, an industry breakdown of the contribution to GSP in SA is provided in Figure 58 for the development phase and Table 56 for the operations phase. The contribution of industries to overall GSP is illustrated by its GVA. GVA is a measure of the dollar value of goods and services produced by an industry, less the cost of all inputs attributable to that production. During the development phase, the Construction industry provides the largest contribution to SA's change in GSP. The following points are made about the industry impacts in the development phase:

- In the Low scenario, the Construction industry is expected to generate $110 million in GVA, $300 million in the best scenario, and $650 million in the High scenario.
- The Mining industry also delivers a strong contribution to SA's GSP – largely due to early production of minerals from mines with a shorter development phase.
- In addition to Mining and Construction, most SA industries are expected to generate increased GVA during the development phase. Industries that directly support the Construction industry by providing inputs, including Manufacturing, Electricity, Gas, Water and Waste Services, Wholesale Trade, Transport, Postal and Warehousing, Financial and Insurance Services and Professional, Scientific and Technical Services are all anticipated to expand their output as a result of the development of potential mine sites in the WPA.
- Consumer facing industries including Retail Trade, Accommodation and Food Services and Health Care and Social Assistance are also expected to contribute to increased GSP in SA during the development phase. This is a result of increased household consumption, driven by higher employment and real wages in the state.
- The only industry with a negative impact to GVA is the Agriculture, Forestry and Fishing industry. As another primary production industry (like Mining), that does not directly provide inputs to mining development, the impacts from increased investment in the Mining industry to real wages result in a diversion of inputs away from Agriculture, Forestry and Fishing. Furthermore, being that this sector is also export focussed, the higher terms of trade and appreciating exchange rate mean food and fibre exports will be less competitive.

Figure 58: Average annual GVA impact in SA by industry during development phase (2023/24 – 2033/34), ($2022-23, real, millions, undiscounted)



Source: Scyne Advisory analysis 2023, VURM model.

Australia's development phase impacts

Table 55 shows the national results across investment, employment, household consumption and GDP in the peak year of investment (2033-34) across all three scenarios.

Table 55: Change in selected economic indicators in the peak year of the development phase (2033-34) in Australia

Economic indicator	Low Scenario	Best Scenario	High Scenario
Investment	+0.07%	+0.31%	+0.79%
Employment	0.00%	0.00%	0.00%
Household consumption	+0.02%	+0.07%	+0.17%
Gross domestic product (GDP)	+0.01%	+0.02%	+0.04%

Source: Scyne Advisory analysis 2023, VURM model.

The following comments are noted about Australia's impacts in the development phase:

- National investment is anticipated to grow in each of the modelled scenarios. This is largely driven by the increase seen in SA. The national impact is dampened as compared with the result in SA, as the significant investment expenditure in the state diverts capital for business investment away from other sectors and regions of the national economy.
- While the labour market impacts are concentrated in SA, the project also draws in labour from interstate. There is a decline in employment interstate, which on a national level is offset by the increase in labour demand in SA

meaning there is a temporary net increase in employment nationally. This is because the CGE model emulates the real economy in which competition for labour and resources exists between states in a constrained system. Here, the remaining states and territories compete for labour and net to a negative result where SA experiences positive jobs growth in the short term. As the peak investment year in the development phase is in the 10th year of expenditure, the overall impact on national employment is negligible by this stage in each of the scenarios, as increases to real wages start to dampen the short-term increase in the earlier years.

- Household consumption across Australia is marginally boosted, despite no overall increase in employment nationally. This is largely due to increases in real wages resulting from the significant demand for employment in SA.
- Overall, the possible future mine mineral and energy resource developments within the WPA are anticipated to have a positive impact on economic activity in Australia. In the peak year of the development phase, the project will increase Australia's GDP by between 0.01 per cent and 0.04 per cent.

3.4.2 Operational phase impacts

The impacts during the operational phase represent the economic activity generated by the ongoing operation of the mine sites and electricity generation investments, as well as the productivity benefits detailed in Section 3.2.2. For consistency of reporting, the operational phase for each of the scenarios is assumed to begin in the same year, 2035-36.[29]

SA's operational phase impacts

Table 56 shows the average annual results to SA's exports, investment, employment, household consumption and GSP over the operations phase across all three scenarios (2034/35 – 2060/61).

Table 56: Average annual change in selected economic indicators during the operations phase (2034/35 – 2060-61) in SA

Economic indicator	Low scenario	Best scenario	High scenario
Exports	+1.4%	+4.5%	+8.6%
Investment	+0.4%	+1.0%	+2.1%
Employment	+0.3%	+0.9%	+1.6%
Household consumption	+0.2%	+0.6%	+1.1%
Gross state product (GSP)	+0.4%	+1.0%	+2.0%

Source: Scyne Advisory analysis 2023, VURM model.

The following comments are noted about SA's impacts in the operational phase:

- Significant increases in exports are observed in SA due to increased mineral production in the state, ranging on average from 1.4 per cent in the low scenario, to 8.6 per cent in the high scenario, annually.
- Investment continues to expand in the operational phase as renewable energy projects are developed into the 2040s. Furthermore, a shift away from diesel usage in the mining industry in SA leads to a productivity improvement in the industry. As a result of this cost saving, business investment expands in the state during the operational phase – largely driven by sustaining capital expenditure in the mining industry.
- An increased level of employment in SA is expected to continue over the course of the operations phase to support the increased level of mineral mining in the WPA.

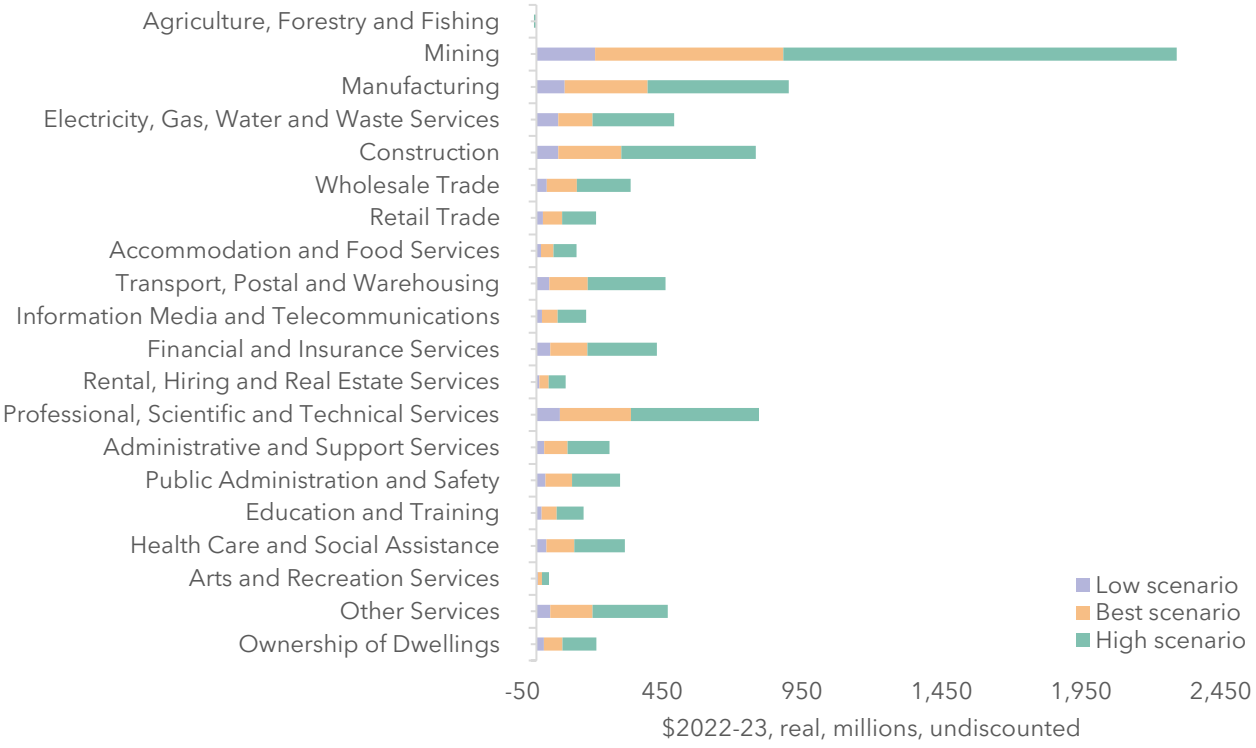
[29] The final year of investment expenditure is 2033/34 for the Low scenario, 2034/35 for the Best scenario and 2035/36 for the High scenario

- Household consumption will rise due to increased employment in SA.
- Cumulatively, potential future mine developments in the WPA will have a positive impact on the SA economy during operation. On average, SA's GSP will rise between 0.4 per cent and 2 per cent annually. Comparatively, SA's GSP has risen by an average of 1.7 per cent annually over the last decade.[30]

In addition to the above macroeconomic impacts, an industry breakdown of the contribution to GSP in SA is provided in Figure 59 for the operations phase. The industry impacts during the operations phase follow a similar pattern to those during the development phase. However, due to increased mineral production in the WPA, the Mining industry is the largest contributor to SA's increased GSP during the operations phase. The following comments are key to understanding the industry impacts in the operational phase:

- The Mining industry is projected to boost its annual GVA on average by $220 million in the Low scenario, $690 million in the best scenario, and $1.4 billion in the High scenario.
- Industries that directly support the Mining industry are all anticipated to benefit from the development of potential mine sites in the WPA. Sectors in the Mining supply chain that expand include: Manufacturing, Electricity, Gas, Water and Waste Services, Wholesale Trade, Transport, Postal and Warehousing, Financial and Insurance Services and Professional, Scientific and Technical Services.
- Consumer facing industries are expected to increase their economic contribution due to increased employment in the state.

Figure 59: Average annual GVA impact in SA by industry during operations phase (2034/35 – 2060/61), ($2022-23, real, millions, undiscounted)



Source: Scyne Advisory analysis 2023, VURM model.

30 ABS (2022), Australian National Accounts: State Accounts

Australia's operational phase impacts

Table 57 shows the average annual results to national exports, investment, employment, household consumption and GSP/GDP over the operations phase across all three scenarios (2034/35 – 2060/61).

Table 57: Average annual change in selected economic indicators during the operations phase (2034/35 – 2060/61) in Australia

Economic indicator	Low Scenario	Best Scenario	High Scenario
Exports	-0.01%	-0.03%	-0.03%
Investment	0.00%	-0.01%	+0.01%
Employment	0.00%	0.00%	0.00%
Household consumption	0.00%	+0.01%	+0.02%
Gross domestic product (GDP)	0.00%	0.00%	+0.01%

Source: Scyne Advisory analysis 2023, VURM model.

The following comments are noted about Australia's impacts in the operational phase:

- Despite a significant increase in exports in SA, national exports are modelled to decline during the operational phase. This is as a result of the 'Dutch Disease' phenomenon, which is where the initial investment in the development phase causes the Australian dollar to appreciate due to the increased sourcing of capital from offshore. The Australian dollar is estimated to stay above the base case for the duration of the operational phase, and hence other exporting sectors become less competitive because their products are now more expensive in an international market.
- The overall impact on national investment in the operations phase is minor, with the increases seen in SA's investment largely being offset by diverting investment capital from other states and by pushing up the cost of capital, which makes other sectors' investments less attractive at the margin.
- The overall employment impact across Australia is negligible, as a standard assumption of the CGE model is that nationally the labour market is assumed to return to normal levels that are determined by long run demographic trends such as population growth and labour force participation.
- The development of mineral mining and energy resources in SA is expected to deliver a small increase nationally in household consumption. This is largely due to small rises in real wages as a result of the productivity benefits to the mining sector.
- The annual average impact on GDP in Australia during the operations phase of the project is anticipated to be negligible in the Low and Best Scenarios. This is due to decreases to exports outside of SA. In the High Scenario, the development of mineral mining and energy resources in SA is expected to increase Australia's GDP by 0.01 per cent on average from 2034/35 to 2060/61.

3.4.3 State royalties

Mineral commodities recovered from mineral land in SA are subject to state royalty payments, as specified in the provisions of the *Mining Act 1971* and the *Mining Regulations 2020*. Table 58 shows the average annual and total royalty returns paid to the SA government as a result of future mine developments in the WPA across the Low, Best and High scenarios. The key findings are:

- Increased mineral production in the WPA results in significant royalty payments received by the SA government. Average annual royalty payments across the three scenarios measure at $70 million, $250 million and $492 million respectively.

- Total royalty payments received across all categories by the state government in FY2022 was $383 million,[31] or $413 million in 2023-dollar terms. Therefore, the additional revenue from mining developments in the WPA represent a 17 per cent, 61 per cent and 123 per cent increase to royalty payments across the three scenarios.

[31] Department of Treasury and Finance, Consolidated Financial Report (2021-2022)

Table 58: Change in royalties payments to the SA Government ($2022-23, real, millions, undiscounted)

Royalties		Low Scenario	Best Scenario	High Scenario
Operations phase (2034/35 – 2060/61)	Average annual	70	250	500
	Total	1,700	6,300	12,700

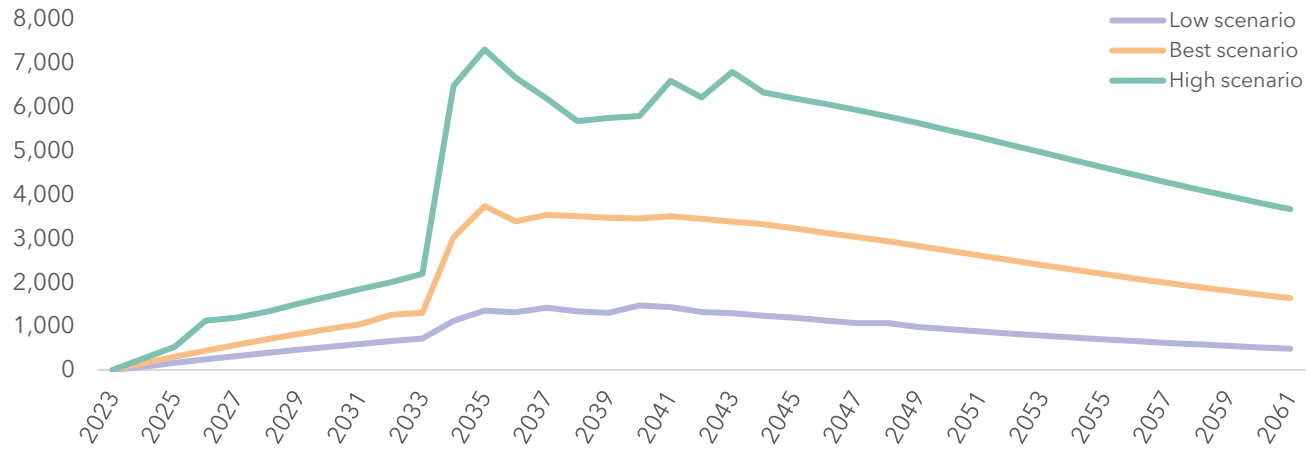
Source: Scyne Advisory analysis 2023, VURM model.
Note that the royalties have been estimated using the change in capital stock in the economic modelling multiplied by the base case royalties payments. They have not been calculated on the basis of production level or commodity prices.

3.4.4 Aggregate results

The possible future mine mineral and energy resource developments within the WPA will stimulate economic activity and raise aggregate demand in SA – observed in the increase SA's GSP as indicated in Figure 60.

In SA, GSP receives a positive increase during development phase, gaining up to $1.3 billion, $3.7 billion and $7.3 billion in 2035 in the Low, Best and High scenarios respectively. By 2061 SA's GSP is $480 million, $1.63 billion and $3.66 billion higher per annum than in the base case in the Low, Best and High scenarios respectively, reflecting increased activity associated with the developments and the productivity improvements.

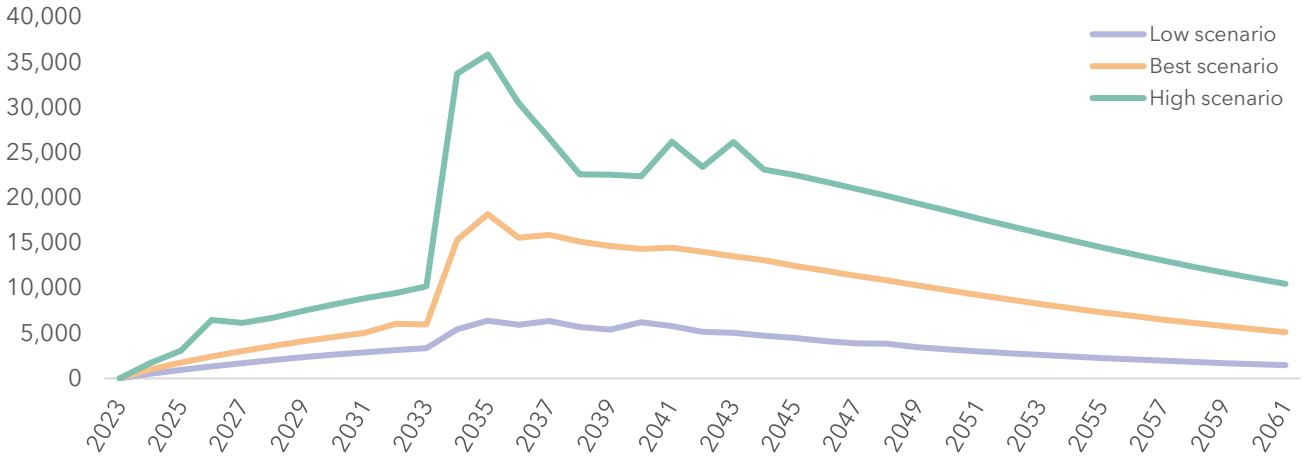
Figure 60: Change in GSP in SA over the development and operations phases ($2022-23, real, millions, undiscounted)



Source: Scyne Advisory analysis 2023, VURM model.

The employment impacts in SA are largest during the development phase, reaching a peak of 6,400, 18,200 and 35,900 jobs supported in 2035 in the Low, Best and High scenarios respectively (Figure 61). By 2061 employment in SA is beginning to return to equilibrium levels, with 1,500, 5,100 and 10,500 jobs in the Low, Best and High scenarios respectively also a result of increased activity associated with the developments.

Figure 61: Change in employment in SA over the development and operations phases (FTE)



Source: Scyne Advisory analysis 2023, VURM model.

Table 59 contains a summary of the key economic impacts of possible future mine mineral and energy resource developments within the WPA on the SA and Australian economies. Key findings include:

- In the Low scenario, SA's GSP increases in total by $9.8 billion (in present value terms) over the next 39 years ($4.4 billion during the development phase and $5.4 billion during the operational phase). In total GDP increases by $1.3 billion (in present value terms) over the next 39 years – of which $1.0 billion is during the development phase and $0.3 billion during the operational phase.
- In the Best scenario, the future developments in the WPA are projected to contribute $24.0 billion and $2.8 billion (in present value terms) over the next 39 years in SA's GSP and Australia's GDP respectively – of which $9.4 billion in SA's GSP and $2.3 billion in Australia's GDP is during the construction phase, and $14.6 billion in SA's GSP and $0.5 billion in Australia's GDP during the operational phase.
- In the High scenario, the development of potential mine sites is projected to contribute $45.6 billion (in present value terms) to SA's GSP, and $6.8 billion to Australian GDP, over the next 39 years. In SA, $18.2 billion is attributed to the development phase and $27.4 billion to the operation phase, while nationally, the development and operation phase contribute $4.4 billion and $2.4 billion, respectively.

Table 59: Aggregate results to GSP in SA, GDP and employment

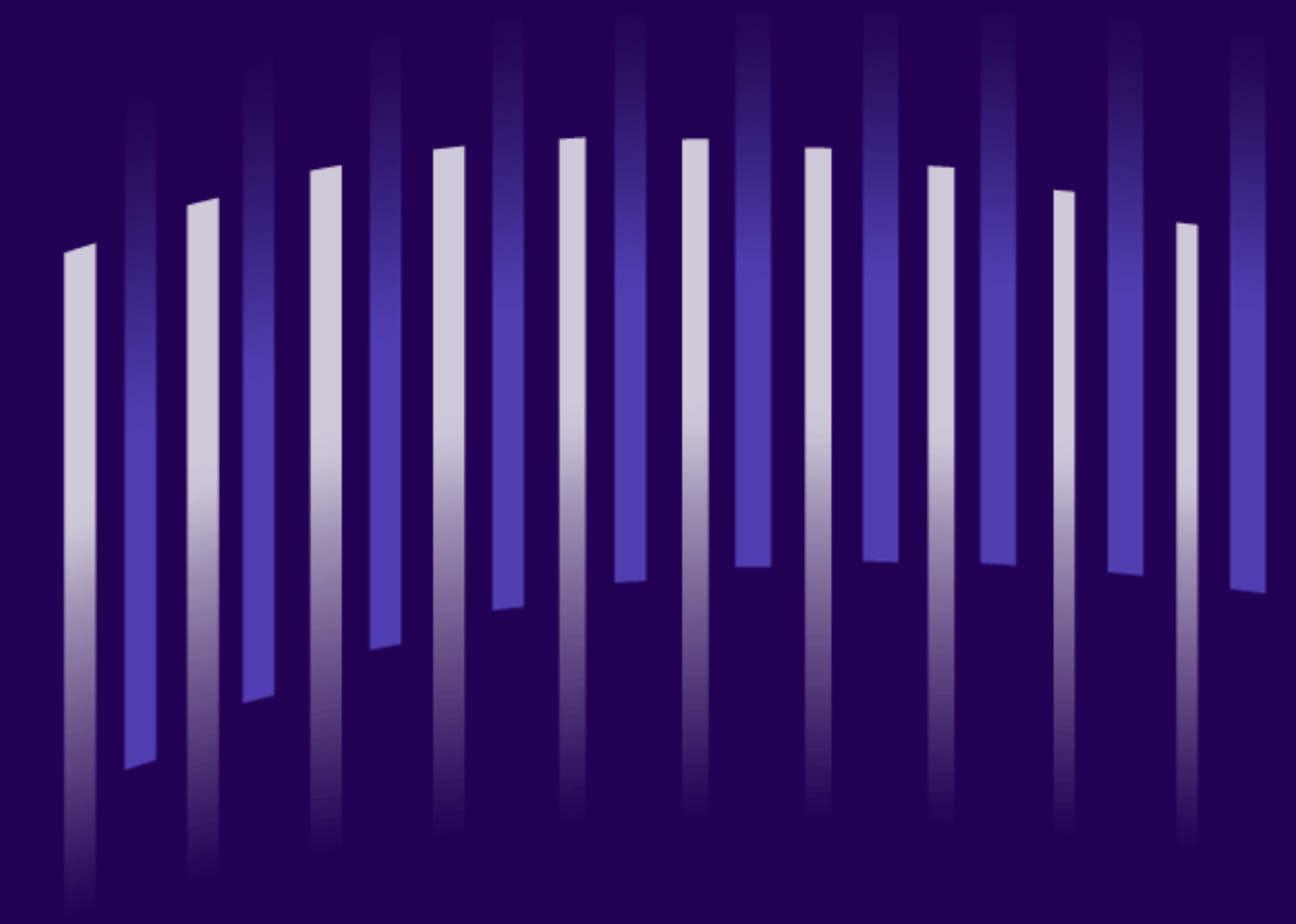
	Low scenario	Best scenario	High scenario
Development phase			
SA GSP ($2022-23, 7% discount rate)	$4.4bn	$9.4bn	$18.2bn
Australia GDP ($2022-23, 7% discount rate)	$1.0bn	$2.3bn	$4.4bn
SA Employment – Average annual	3,000	6,700	12,900
SA Employment – Peak investment year (2033-34)	5,400	15,300	33,800
Operations phase (2034/35 – 2060/61)			
SA GSP ($2022-23, 7% discount rate)	$5.4bn	$14.6bn	$27.4bn
Australia GDP ($2022-23, 7% discount rate)	$0.3bn	$0.5bn	$2.4bn
SA Employment – Average annual	3,600	10,400	18,800
Total (2023/24 – 2060/61)			
SA GSP ($2022-23, 7% discount rate)	$9.8bn	$24.0bn	$45.6bn
Australia GDP ($2022-23, 7% discount rate)	$1.3bn	$2.8bn	$6.8bn

Source: Scyne Advisory analysis 2023, VURM model.

Appendices

scyne ADVISORY

A Resource prospectivity technical appendix



A Resource prospectivity technical appendix

A.1 Resource potential maps

A.1.1 Approach

There have been two approaches to developing the updated resource potential maps, or prospectivity maps, that have been presented in this report.

1 **Interpretive approach:** This approach has been adopted for commodities with more than three input layers. The number and type of inputs do not define exact permissive tracts areas and interpretation was required to translate the alignment of inputs from the mineral deposit model into permissive tracts and prospectivity ratings. This approach is described in additional detail below. The commodities/deposit styles in this report mapped with this approach are:

Iron-oxide Copper Gold	**Lode Gold**	**Natural Hydrogen**
Uranium (all styles)	**Iron**	**Sedimentary-hosted Copper**

2 **Data-constrained approach:** This approach has been adopted for commodities with 3 or less input layers. The output map presents the potential distribution of the commodity based on the geospatial distribution of the input layers. A single input layer represents a prospectivity rating of 1 level, and an area with overlapping inputs is rated as the sum of the number of inputs, in other words, two overlapping inputs is assigned a rating of Low/Moderate. The commodities/deposit styles in this report mapped with this approach are:

Clay-hosted REEs	**High Purity Alumina**	**Lead and Zinc**

Exceptions to these two approaches are:

- Any maps unchanged from Geoscience Australia's 2018 or 2010 assessment
- Lithium, where the prospectivity map and ratings were adopted from Mernagh's 2013 assessment
- Solar and Wind, where areas suitable for solar and wind energy are defined using threshold values of direct normal irradiation and average wind speed
- Groundwater and Extractive Materials, where the maps are defined by the presence of inputs and a prospectivity rating is not assigned.

Interpretive methodology:

The approach to mapping the Iron-oxide Copper Gold prospectivity map will be used as an example for this methodology:

The inputs proposed by the Department for Energy and Mining for IOCG deposits are listed in Appendix Table 1.

Appendix Table 1: Geological inputs used for the Iron-oxide Copper Gold deposit model

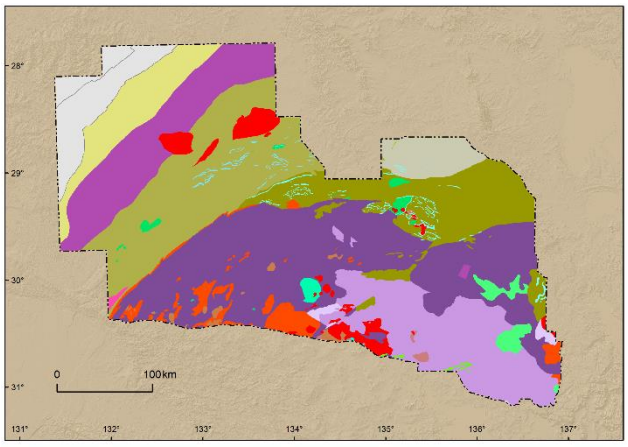
Deposit style	Geological Criteria	Inputs	Considerations
Iron-oxide Copper Gold	Key host units and fluid sources	• Hiltaba Suite • Donington Suite • Mount Woods Complex • Wallaroo Group • Hutchison Group • Banded Iron Formations	
	Faults	Archean to Early Mesoproterozoic faults	1 km buffer
	Drillhole Geochemistry	Locations where maximum drillhole geochemistry indicate Copper > 10 times crustal abundance	2 km buffer added around drillhole location
	Geophysics	• Co-incident gravity and magnetic anomalies • Magnetotellurics	23.5 to 26.2 km depth slice used for MT response

An overview of the approach followed, including a graphical representation, is provided below:

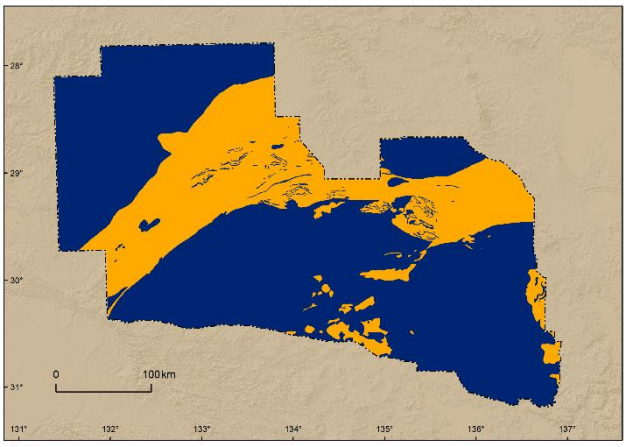
Methodology:

1. Collate input data and filter based on specified constraints. Convert the input layers to rasters, where the presence of the geological input is defined with a value of 1, all other areas as zero.

1.1. Define the solid geology input layer from the Solid Geology Archaean-Early Mesoproterozoic polygons layer, edited to only include the specified units.



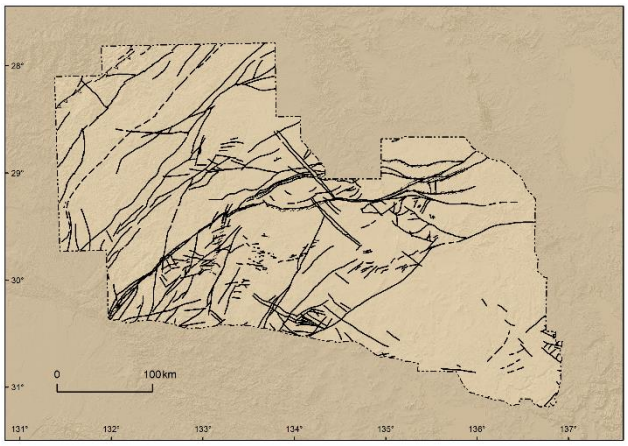
Input: Solid Geology



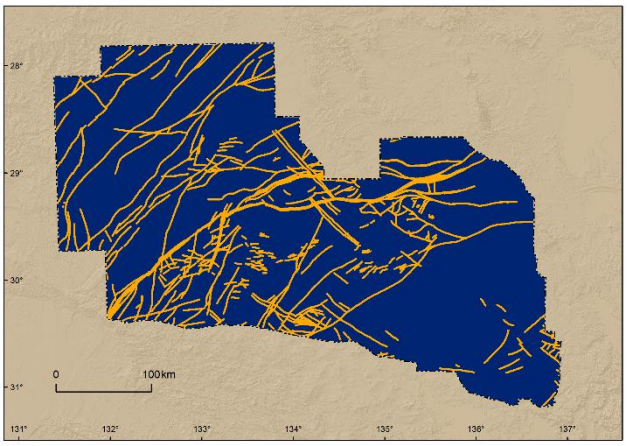
Stack Layer: Solid Geology

Methodology:

1.2. Define the fault input layer from the Archaean-Early Mesoproterozoic faults layer, apply a 1 km buffer to the line data.

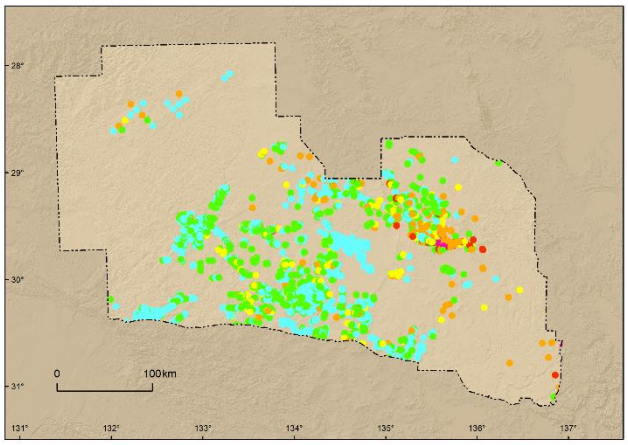


Inputs: Faults

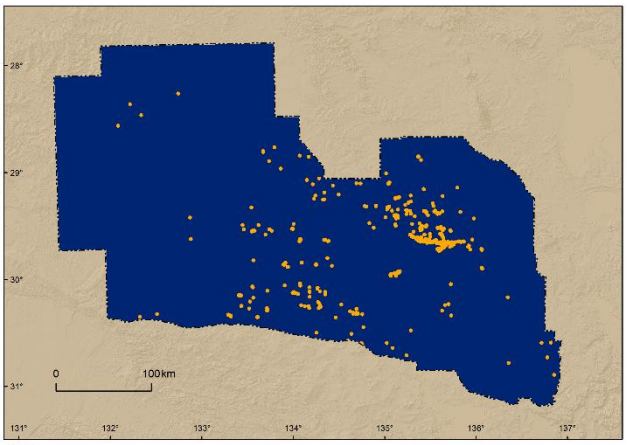


Stack Layer: Faults

1.3. Define the drillhole chemistry input layer by filtering for occurrences where Copper > 270 ppm and apply a 2 km buffer to the point data/



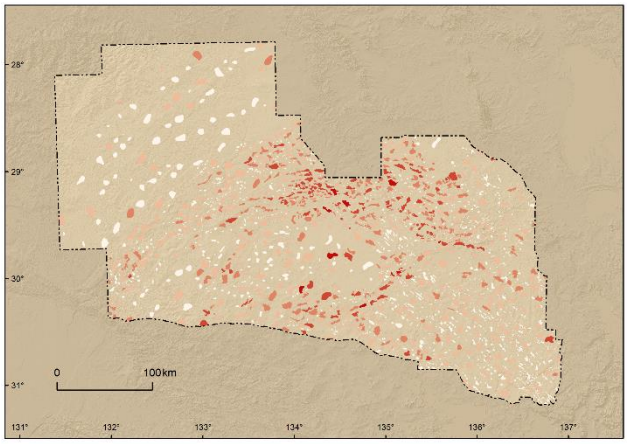
Input: Drillhole Geochemistry (Copper)



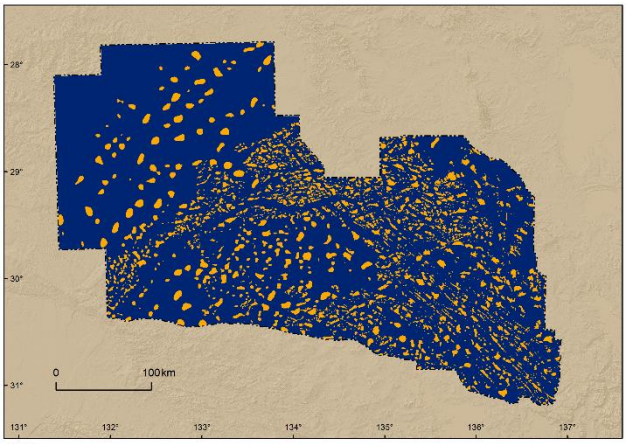
Stack Layer: Geochemistry

Methodology:

1.4. Define the gravity anomaly input layer.

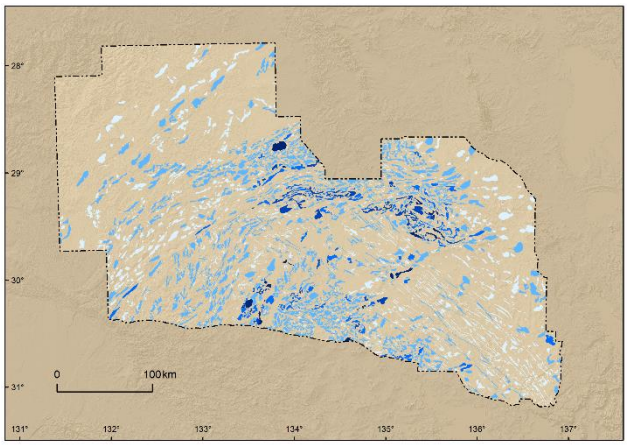


Input: Residual Gravity Anomalies

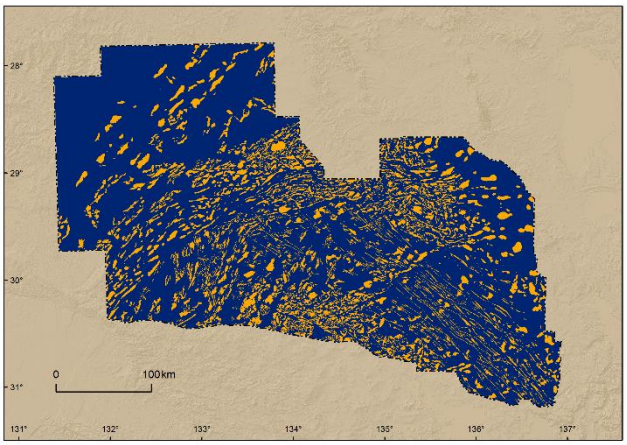


Stack Layer: Co-incident Gravity Anomalies

1.5. Define the magnetic anomaly input layer.



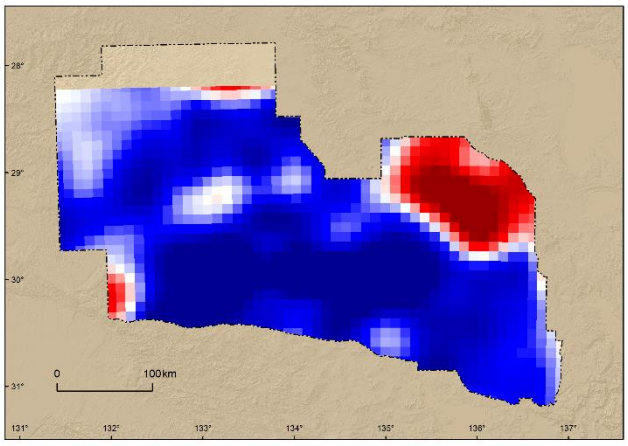
Input: Residual TMI Anomalies



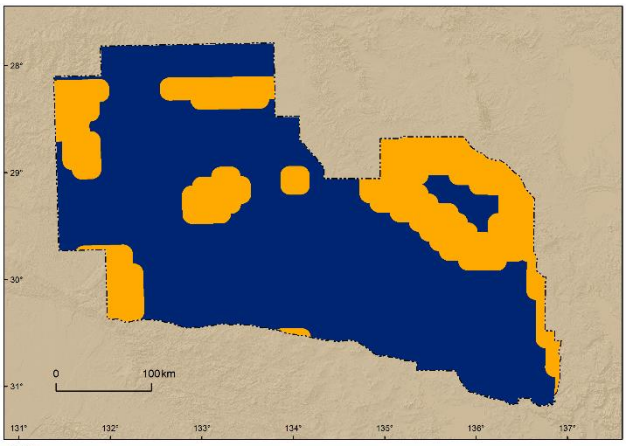
Stack Layer: Co-incident Magnetic Anomalies

Methodology:

1.6. Define the magnetotellurics layer using the depth slice around 25 km. Define the boundary of structures by selecting where the MT response is changing at the greatest rate, where Band 1 or R values > 189. Reclassify the raster and convert to a polygon, apply a 10 km buffer.



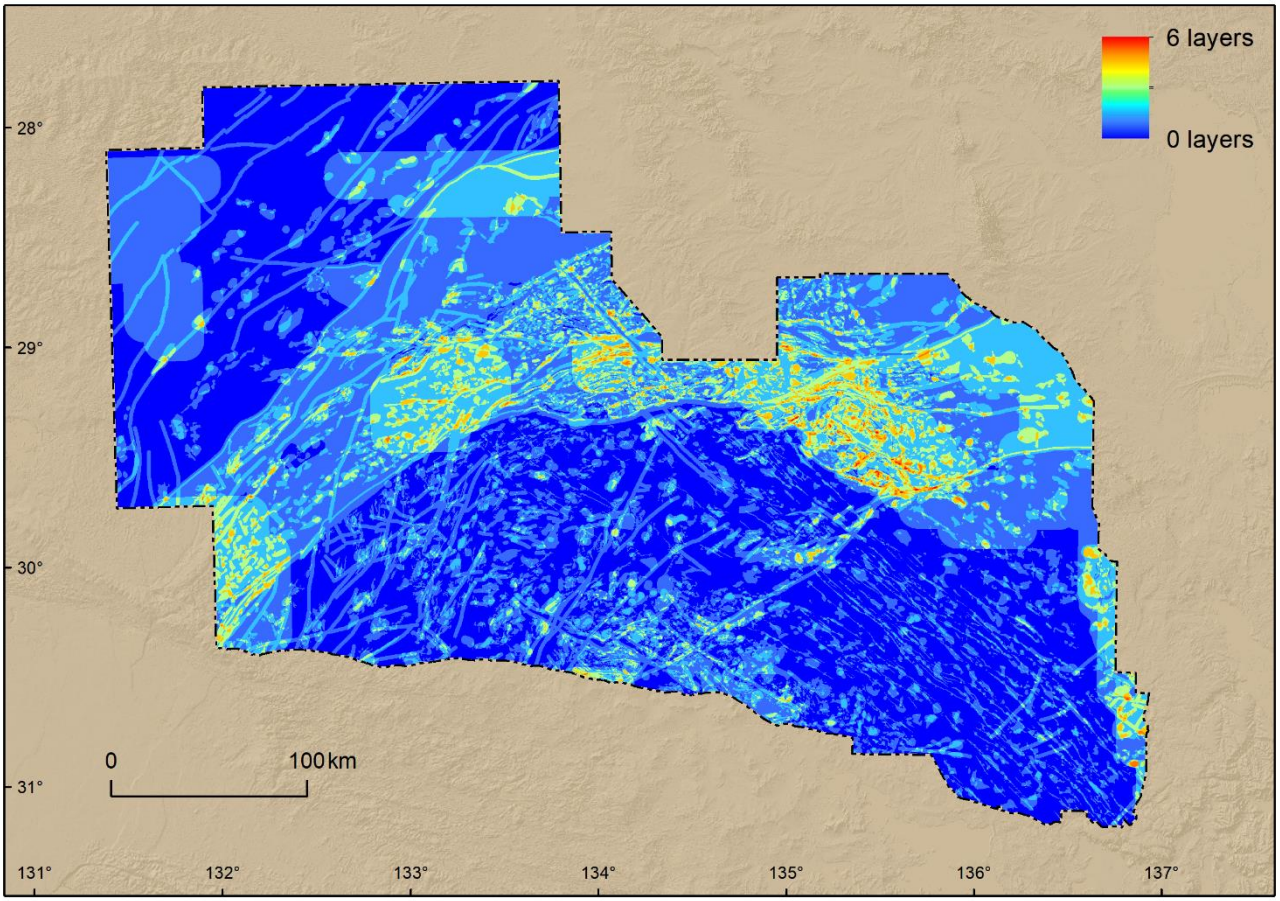
Input: MT Response (Depth 23.5 to 26.2 km)



Stack Layer: MT Response (23.5 to 26.2 km depth)

Methodology:

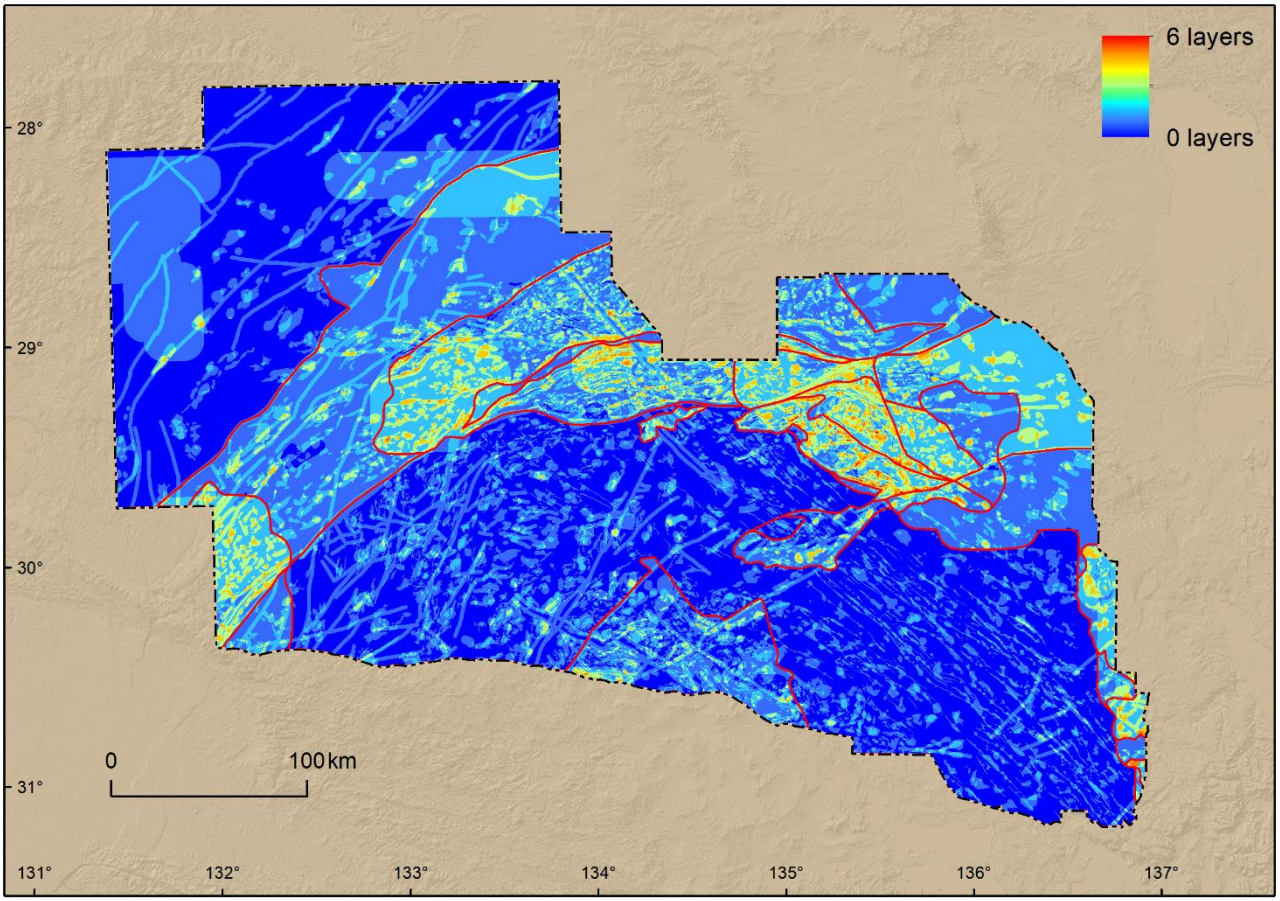
2. Sum the input layers, with equal weighting, into a single stack.



Full Stack

Methodology:

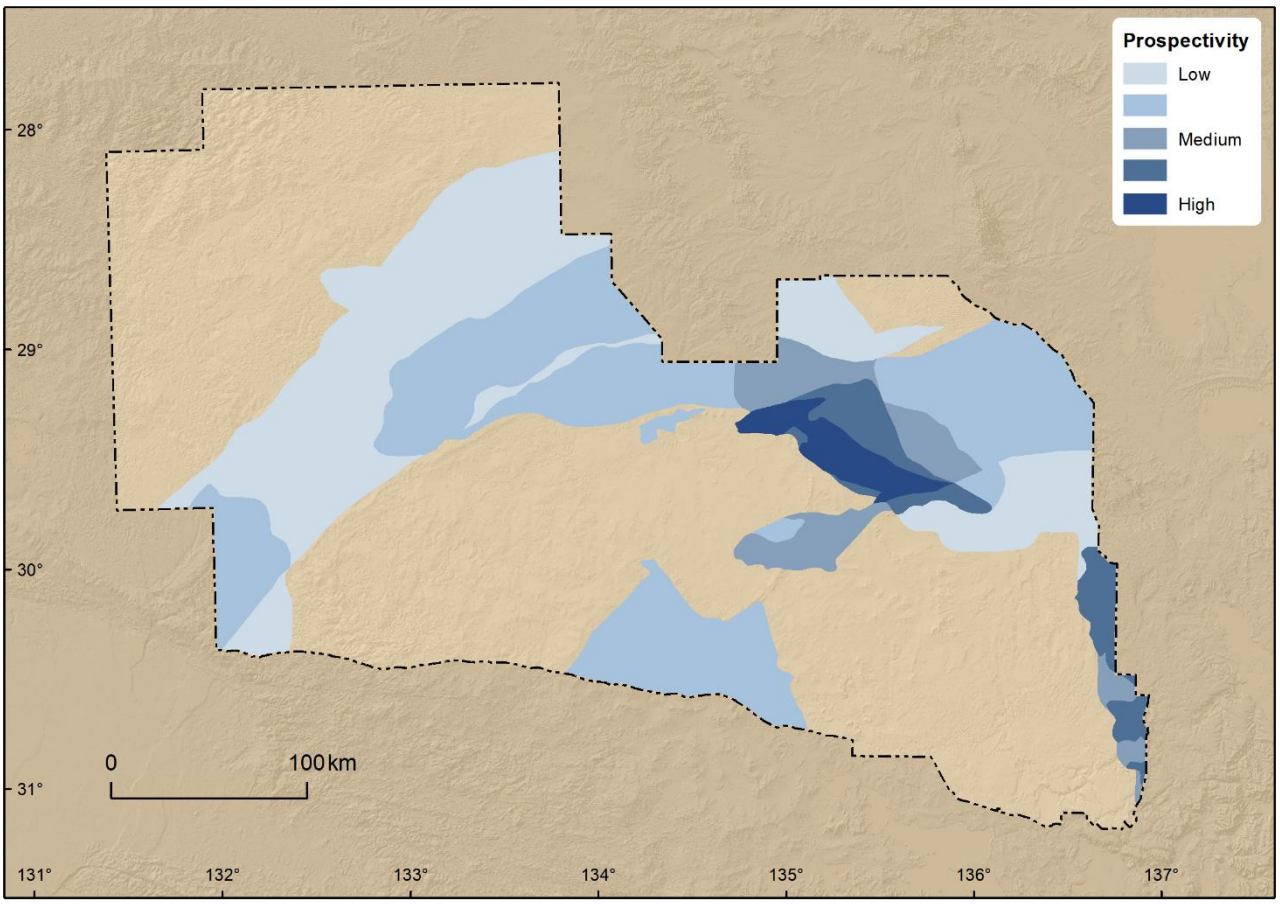
3. **Interpret areas with similar input combinations and delineate them.** The boundary of delineated areas is subjective and is based on the number of inputs, the concentration of inputs, the character of the geophysical inputs, the presence of major faults and the absence of critical inputs for the mineral deposit model (such as key host units and fluid sources).



Full Stack: Polygon Outlines

Methodology:

4. **Assign a prospectivity rating (Low, Low/Moderate, Moderate, Moderate/High and High) to each area based on the presence of mineral deposit model components. Where all inputs for the mineral deposit model are present, or areas with known deposits of the type, a rating of 5 or 'High' prospectivity is assigned.** Interpretation is subjective and has been based on the type of inputs present, the concentration of inputs, the presence of known deposits/occurrences and the absence of critical inputs for the mineral deposit model (such as key host units and fluid sources).



Prospectivity Assignment

A.2 Approach to estimating undiscovered resources in the Woomera Prohibited Area

A.2.1 Group A: Singer's approach

Mineral Deposit Densities for Estimating Mineral Resources [32]

Singer (2008) first introduced the approach for estimating mineral resources using mineral deposit densities, which was then built upon by Singer and Kouda (2011), forming the basis of the WPA quantitative undiscovered resource estimation model.[33] [34]

The empirical evidence presented in Singer's 2008 study indicates that the "processes affecting the number and quantity of resources in geological settings are very general across many types of mineral deposits".[35] The variables of permissive area and deposit size are used to perform a multiple linear regression to estimate the total amount of mineralisation and the number of deposits. The variables are based on ten different types of mineral deposits from 108 permissive control tracts around the world, which aims to generalise across deposit types and sizes. The regression models proposed have a high predictive power with an R^2 of 0.91 for deposit count and 0.95 for total tonnage.

Typically, undiscovered deposits are estimated by expert judgement. However, these expert estimations can be combined with deposit density models. Results from previous studies reveal patterns between permissive tracts areas and deposit sizes with deposit density and total resources in a tract.

The data set in the paper only uses grades and tonnages from well-explored deposits that meet the rules appropriate to the deposit type. Additionally, all mineralised rock or alteration separated by less than two kilometres of un-mineralised or unaltered rock was combined into one deposit, i.e., if alteration zones of two deposits are within two kilometres of each other, the deposits are treated as a single deposit. For most deposits and densities used in the study, parts of the permissive area were excluded because there are areas where the mineral could not exist.

The relationship between permissive area and deposit density applies across deposit types, which allows this model to be a general estimator deposit density and total tonnage.

The data must be transformed into log-log space so that the residuals meet the assumptions of linear regression which is why there appears logarithm functions on the variables in the regression equation.

---

32 Singer, D. A. (2008). Mineral deposit densities for estimating mineral resources. Mathematical Geosciences, 40, 33-46.

33 Ibid.

34 Singer & Kouda. (2011)

35 Singer. (2008)

The first regression model which estimates Density is:

$$\log(Density) = 4.2474 - 0.5146\log(A) - 0.2254\log(Deposit\ Size)$$

where:
$Density$ = number of deposits per $100{,}000km^2$
A = permissive area in km^2
$Deposit\ size$ = the median of the tonnage of interest (in millions of metric tons)

To convert the regression output into number of deposits for the permissive area and deposit size, the following formula is used:

$$Number\ deposits = \frac{permissive\ area}{100{,}000} \times 10^{\log(Density)}$$

Similarly, permissive area and deposit size also allow an estimation of total mineralised rock which can be determined by the following equation:

$$\log(Total\ tonnage) = -1.038 + 0.6784\log(A) + 0.6193\log(Deposit\ Size)$$

where:
$Total\ tonnage$ = total tonnage of all mineralised rock in the delineated tract of the deposit type
A = permissive area in km^2
$Deposit\ size$ = the median of the tonnage of interest (in millions of metric tons)

The equations appear to be capable of estimating number of deposits and total mineralised rock for any deposit type.

Probabilistic Estimates of Number of Undiscovered Deposits and Their Total Tonnages in Permissive Tracts Using Deposit Densities[36]

This paper builds upon Singer's 2008 study and introduces prediction intervals and a method to account for discovered deposits.[37]

[36] Singer & Kouda. (2011)

[37] Singer. (2008)

Generalised Deposit Estimate

Estimators based on 109 permissive areas and 10 deposit types enable a generalised deposit estimation with an R^2 of 0.91. The updated regression equation from Singer (2011) is:[38]The updated regression equation from Singer and Kouda (2011)[39] is:

$$log_{10}(Density_{50}) = 4.21 - 0.499\log_{10}(a) - 0.225\log_{10}(s)$$

where:
$Density_{50}$ = the 50th percentile estimate in number of deposits per $100{,}000km^2$
a = permissive area in square kilometres
s = mean deposit size in millions of metric tons

To account for the uncertainty in predicting number of deposits in a permissive area, the addition of a prediction interval was introduced in this paper. The 90th and 10th percentile limits are calculated using the following equation:

$$\log_{10}(Density_{90}, Density_{10}) = \log_{10}(Density_{50}) \pm 1.290 \cdot 0.3484 \cdot \sqrt{1 + \frac{1}{109} + \frac{(3.173 - \log_{10}(a))^2 \cdot (-0.3292 - \log_{10}(t))^2}{(109-1) \cdot 2.615 \cdot 1.191}}$$

where:
$\log_{10}(Density_{50})$ = 50th percentile estimate in the number of deposits per $100{,}000km^2$
1.290 = Student's t at the 10% significant level with 106 degrees of freedom
0.3484 = standard deviation of the log of deposit density
109 = number of control tracts
3.173 = mean of the log of control tract area in square kilometres

a = permissive area
-0.3292 = mean of the log of deposit tonnage in millions of metric tons in control tracts
t = 1.290, Student's t
2.615 = standard deviation of log of deposit tonnages in control tracts
1.191 = standard deviation of log of control tract area in square kilometres

To convert the median, 90th and 10th percentiles into km^2. This is used to translating the model outputs back into units that are the same as the inputs (i.e., tract size).

$$N_{\%ile} = \frac{a}{100{,}000} \cdot 10^{\log_{10}(Density_{\%ile})}$$

where:
$Density_{\%ile}$ is the percentile calculated from the presenting two equations

[38] Singer & Kouda. (2011)

[39] Singer & Kouda (2011)

The expected number (mean) number of deposits can be estimated as:

$$\log_{10} E(N) = \log_{10}(N_{50}) + \frac{\left[\frac{(\log_{10}(N_{10}) - \log_{10}(N_{50})}{t}\right]^2}{2}$$

where:
N_{50} = median number of deposits
N_{10} = 10th percentile number of deposits
t = 1.290 (Student's t at 10% significance with 106 degrees of freedom)

The following steps are part of the process to incorporate current deposits into the estimation of undiscovered deposit density. This involves subtracting the known number of deposits from the expected number of deposits. This requires revising the median, mean and percentiles.

Regression variance is estimated as:

$$var_N = \left[\frac{(\log_{10}(N_{10}) - \log_{10}(N_{50})}{t}\right]^2$$

where:
N_{10} = 10th percentile from the original regression output
N_{50} = 50th percentile from the original regression output
t = Student's t at 10% significance, 106 degrees of freedom = 1.290

To account for known deposits, the median needs to be adjusted with the following formula:

$$\log_{10}(N_{50}) = \log_{10}(E(N) - known\ number) - \frac{var_N}{2}$$

where:
$E(N)$ = expected number of deposits
$known\ number$ = known number of deposits
var_N = regression variance

The revised median is then used in new $Density_{90}$ and $Density_{10}$ calculations, using the equation for $\log_{10}(Density_{90}, Density_{10})$ introduced before.

Generalised Tonnage Estimate

The process to obtain a total ore tonnage estimate is the same as the number of deposits. The following regression equation can be used for all deposit types and has an R^2 of 0.95.

$$\log_{10}(Tonnage_{50}) = -1.096 + 0.7039 \log_{10}(a) + 0.6202 \log_{10}(s)$$

where:
$Tonnage_{50}$ = the 50th percentile estimate of total mineralised rock
a = permissive area in square kilometres
s = mean deposit size in millions of metric tons

The prediction interval formula is as follows:

$$\log_{10}(Tonnage_{90}, Tonnage_{10}) = \log_{10}(Tonnage_{50}) \pm 1.290 \cdot 0.5144 \cdot \sqrt{1 + \frac{1}{109} + \frac{(3.173 - \log_{10}(a))^2 \cdot (-0.3292 - \log_{10}(t))^2}{(109 - 1) \cdot 2.615 \cdot 1.191}}$$

where:
$\log_{10}(Tonnage_{50})$ = 50th percentile estimate of total mineralised rock
1.290 = Student's *t* at the 10% significant level with 106 degrees of freedom
0.5144 = standard deviation of the log of tonnage
109 = number of control tracts
3.173 = mean of the log of control tract area in square kilometres
a = permissive area
-0.3292 = mean of the log of deposit tonnage in millions of metric tons in control tracts
t = 1.290, Student's t
2.615 = standard deviation of log of deposit tonnages in control tracts
1.191 = standard deviation of log of control tract area in square kilometres

To convert the median, 90th and 10th percentiles into non-logarithmic units, the following equation can be used:

$$Tons_{\%ile} = 10^{\log_{10}(Tonnage_{\%ile})}$$

The method to obtain the revised mean and percentiles are the same as deposit size from above.

Additional steps to Singer and Kouda (2011)

Scaling of outputs to align with prospectivity rating

The permissive tract, the area of which is input into the equations above, as described by Singer and Kouda (2011) are based on geological criteria found in the deposit model.[40] In Singer et al., (2018), the margins of permissive tract areas are delineated in such a way that the probability of deposits of the type assessed existing outside the geologically-permissive tract is insignificant, less than 1 in 100,000.[41]

In the resource prospectivity mapping approach described in the *Resource potential maps* section of the *Resource prospectivity technical appendix*, the prospectivity of the mapped areas can be assigned 5 possible levels (Low, Low/Moderate, Moderate, Moderate/High and High), based on the number of inputs from the deposit model that are present in that area. Therefore, only areas classified as 'High' meet the conditions of a permissive tract as intended by Singer and Kouda (2011), and in areas with a lower prospectivity rating, aspects of the mineral deposit model are either not present, or there is no data to confirm the presence of aspects of the mineral deposit model.

To reflect the diminishing confidence level that the mapped areas are true permissive tracts, an exponential decay function has been used as a scalar for tonnage and deposit density. Only areas mapped as 'High' prospectivity meets the conditions described of a permissive tract and reflect the output of the Singer and Kouda (2011) equations, and confidence that the tract could be a permissive tract decays exponentially with each rating lower than high (Appendix Figure 1).[42]

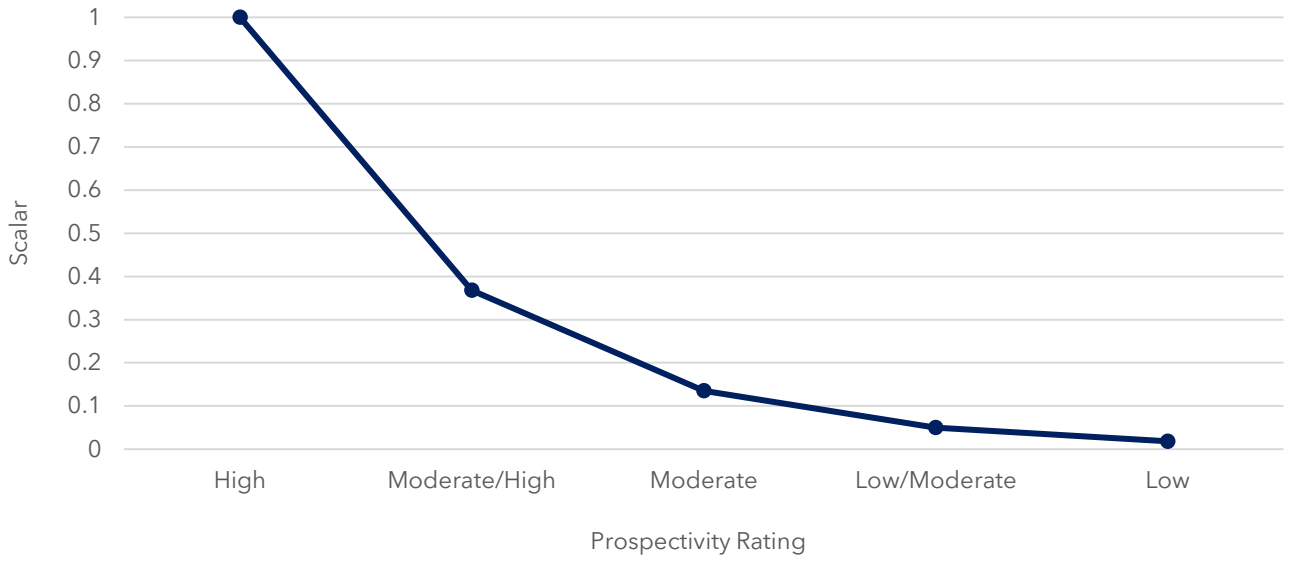
---

40 Singer & Kouda. (2011)

41 Singer, D. A., Jaireth, S., & Roach, I. (2018). *A three-part quantitative assessment of undiscovered unconformity-related uranium deposits in the Pine Creek region of Australia.*

42 Singer & Kouda. (2011)

Appendix Figure 1: Exponential decay scalar applied to the outputs of Singer and Kouda (2011), by prospectivity rating of the tract area.



Source: Scyne Advisory analysis, 2023

This scalar has been incorporated into the method as follows:

1 Perform calculations as per Singer and Kouda (2011) for all mapped prospectivity areas.[43]
2 Apply the prospectivity scalar to the revised (i.e., accounting for known deposit(s)) 50th, 90th and 10th percentiles. The decay scalars for each level are 1, 0.37, 0.14, 0.05 and 0.02 for High, Moderate/High, Moderate, Low/Moderate and Low respectively.
3 Sum the 5 categories after they have been reduced by the scalar to give the estimated deposit and tonnage.

In other words, there are 5 regressions taking place, each for the total area mapped by prospectivity level, and each one is scaled based on the confidence level that the geological conditions of the mineral deposit model are being met.

This method also has repercussions for the subtraction/revision step in the paper, in which the subtraction only occurs in the high prospectivity category as that is where existing deposits are.

Contained metal tonnage

The output of the total tonnage regression in the papers is the amount of host rock for the metal, so to estimate the tonnage of each metal in the mineralised rock, an additional calculation is required. Grade and tonnage models, informed by academic papers, DEM and company reports provide insight into the contained metal content. The median grade from grade and tonnage models for each deposit style has been used to determine the contained metal content. Therefore, the contained uranium metal is the product of the calculated total tonnage (ore) for IOCG deposits and the uranium median grade.

[43] Ibid.

Available data for analysis

The table included below provides an overview of the datasets used for this 2023 report, and relevant prior studies.

Appendix Table 2: Summary of datasets used and their availability

Datasets by year

Atlas: Original page and title	Data updated since 2013?	Data updated since 2018?	New Dataset
Land Access and Administration			
WPA Access Zones and Digital Elevation Model	N	N	N
Pastoral Stations	?	N	N
Native Titles	Y	N	N
Major Mines and Advanced Projects	Y	N	N
Active Exploration Licences	Y	N	N
Active Petroleum Exploration Licences			Y
Petroleum Exploration Licence Applications			N
Gas Storage Tenements – Current			Y
Geothermal Tenements – Current			Y
Coal Deposits			Y
Precious Stones Field			Y
Geology			
Surface Geology	Y	Y, 100K Geology with Map Units	N
Surface Geology Legend	Y	Y, 100K Geology with Map Units	-
Regolith Geology	?	?	N
Palaeodrainage Systems	N	N	N
Sedimentary Basins	Probably	N	N
Solid Geology	Y	Y	N
Solid Geology Legend	Y	Y	-
Regolith Material		N	N
Geological Provinces			N
Gawler Domains			N
2019 Au Deposits & Mineral Systems			Y
Groundwater Basins			Y
Groundwater Resources Aquifers			Y
Groundwater Resources Salinity			Y
Prescribed Wells Areas			Y
Shallow Groundwater Depth (SWL)			Y
Shallow Groundwater Yield			Y
Shallow Groundwater Salinity (TDS)			Y
Groundwater Monitoring Networks			Y
Great Artesian Basin Springs dataset		N	N
Great Artesian Basin Atlas digital datasets		N	N
Groundwater Dependent Ecosystems Atlas		N	N
National Geochemical Survey of Australia Catchments		N	N
Geoscience Australia GEODATA TOPO Waterbodies		N	N
Induration Mixed Calcareous and Gypsiferous		N	N
Induration Ferruginous		N	N

Atlas: Original page and title	Data updated since 2013?	Data updated since 2018?	New Dataset
SA Cover Thickness			Y
Geophysics			
Gravity	Y	Y	N
Residual Gravity	Y	Y	N
Gravity Gradient Strings	N	N	N
Gravity Stations	Y	N	N
2013 WPA Gravity Survey Stations	Y	N	N
Total Magnetic Intensity (TMI)	Y	Y	N
SA TMI VRTP			Y
SA TMI VRTP 1VD			Y
WPA – TMI (RTP) 1st Vertical Derivative	Y	Y	-
WPA – Gravity overlain by 1st Vertical Derivative of TMI (RTP)	Y	Y	-
Pseudo Gravity of TMI	Y	Y	N
Tilt of TMI	Y	Y	N
TMI Gradient Strings	N	N	N
Government Airborne Geophysical Surveys	Y	N	N
Company Airborne Geophysical Surveys	Y	N	N
Gawler Craton Airborne Surveys	Y	Y	N
Airborne Geophysical Surveys with line spacing < 400m	Y	N	-
Radiometrics – Uranium	Y	Y	N
Radiometrics – Thorium	Y	Y	N
Radiometrics – Potassium	Y	Y	N
Radiometrics – U2/Th	Y	Y	-
Radiometrics – Total Count	Y	Y	-
Radiometrics – KthU			Y
Radiometrics – Dose			Y
Geophysical Spatially Coincident Residual TMI and Gravity Anomalies			Y
Magnetotelluric and Airborne Electromagnetic Survey coverage	Y	Y	N
AusLAMP SA Gawler Resistivity 30716m Depth Slice			Y
Seismic Lines	N	N	Y
Seismic Interpreted Depth to Basement	N	N	N
Frogtech Structurally Enhanced View of Economic Basement (SEEBASE)™	N	N	N
Airborne EM Survey Areas			Y
Geophysical Electrical Surveys			Y
2D Seismic Lines with SEG-Y Data			Y
Passive Seismic			Y
Magnetic Source Depths Estimates			Y
Magnetic Source Cover Thickness grid			Y
Global Wind Atlas			Y
Global Solar Atlas			Y
Drillholes and Rock Samples			
Depth to Basement – Crystalline Basement Intersecting Drillholes	Y	N	N
Drillholes with Stratigraphy	Y	N	N
PACE Co-funded Drillholes	Y	N	N
Drillholes with HyLogger™ Data	Y	N	N

Atlas: Original page and title	Data updated since 2013?	Data updated since 2018?	New Dataset
Calcrete Analysis/Reanalysis & Rock Sample Geochemistry	N	N	N
Drillhole Depth to Top Neoproterozoic			Y
Petroleum Wells			Y
Water Wells			Y
Geochronology			Y
Petrology Analysis			Y
Biostratigraphy Analysis			Y
GP2 program sample sites			Y
Geochem_maxdh_zn			Y
Geochem_maxdh_u			Y
Geochem_maxdh_ag			Y
Geochem_maxdh_ni			Y
Geochem_maxdh_li			Y
Geochem_maxdh_pb			Y
Geochem_maxdh_fe			Y
Geochem_maxdh_au			Y
Geochem_maxdh_cu			Y
Geochem_maxdh_co			Y
National Weathering Intensity Model			Y
Felsic Nd sited			Y
Mafic Nd sites			Y
Felsic WPA Nd eps			Y
Felsic WPA Nd tdm			Y
Mafic WPA Nd eps			Y
Remote Sensing			
ASTER – VNIR-SWIR – AlOH Group Composition	N	N	N
ASTER – VNIR-SWIR – AlOH Group Content	N	N	N
ASTER – VNIR-SWIR – FeOH Group Content	N	N	N
ASTER – VNIR-SWIR – Ferric Oxide Composition	N	N	N
ASTER – VNIR-SWIR – Ferric Oxide Content	N	N	N
ASTER – VNIR-SWIR – Ferrous Iron Content in MgOH	N	N	N
ASTER – VNIR-SWIR – Ferrous Iron Index	N	N	N
ASTER – VNIR-SWIR – Green Vegetation Content	N	N	N
ASTER – VNIR-SWIR – Kaolin Group Index	N	N	N
ASTER – VNIR-SWIR – MgOH Group Content	N	N	N
ASTER – VNIR-SWIR – MgOH Group Composition	N	N	N
ASTER – VNIR-SWIR – Opaque Index	N	N	N
ASTER – VNIR-SWIR – Regolith Ratios	N	N	N
ASTER – TIR – Quartz Index	N	N	N
ASTER – Night Time Thermal	N	N	N
Historic Exploration			
Mineral Deposits and Occurrences	Y	N	N
Historic Exploration Licences – Base Metals	N	N	N
Historic Exploration Licences – Coal	N	N	N
Historic Exploration Licences – Diamonds	N	N	N
Historic Exploration Licences – Gold	N	N	N
Historic Exploration Licences – Heavy Mineral Sands	N	N	N

Atlas: Original page and title	Data updated since 2013?	Data updated since 2018?	New Dataset
Historic Exploration Licences – IOCG±U	N	N	N
Historic Exploration Licences – MVT	N	N	N
Historic Exploration Licences – Uranium	N	N	N
Petroleum Exploration Licence - Expired			Y

A.3 Net Present Value methodology

A.3.1 Approach

This study applies the Net Present Value (NPV) used by Geoscience Australia in its 2018 assessment of resource prospectivity in the WPA (*Mineral and petroleum resources and potential of the Woomera Prohibited Area)*. Specifically, the Net Present Value approach involves projecting the expected future net income generated by the mineral resource, and then discounting this value by an appropriate rate over the life of the resource.

Net Present Values are calculated using the equation below:

$$NPV = \sum_{t=0}^{T} \frac{(P - C)Q}{(1 + r)^t}$$

Appendix Table 3: Key variables, inputs and assumptions underpinning the Net Present Value calculations

Variable	Details	Sources
NPV = Net Present Value	The present value of the mineral resource	Derived
P = Commodity prices	Price per unit of saleable production	Australia Government Department of Industry, Science and Resources, Consensus Economics
C = Cost per unit	Cost per unit of production	Company reports, S&P Global, SA Government Department for Energy and Mining
Q = Production	Quantity of the mineral resource produced in year t	Company reports, Scyne Advisory analysis, S&P Global, SA Government Department for Energy and Mining
T = Resource life	Resource life = Size of mineral resource/Production rate	Derived for EDR NPV, Company Reports
r = Discount rate	7 per cent	Adopted for consistency with Geoscience Australia and confirmed with Department for Energy and Mining, Government of SA
t = year	Each year of production	

Source: Geoscience Australia, Scyne Advisory and DEM analysis, 2023

A.3.2 Analogue mines included in the NPV analysis

The following analogues are included in the NPV analysis. These analogues were determined with the SA Government DEM, in a workshop in July 2023, and with subsequent refinement in August 2023.

Use of volume estimates to define the upper bound for low, best and high estimates

To identify relevant analogues, the volume estimates presented in Section 2 of this report were used as upper bounds, for the 'Low', 'Best' and 'High' estimates. These volumes constrained the selection of relevant analogues included in the build-up of the aggregate NPV for each of the three estimates.

Selection of relevant analogues within the upper bound estimates for low, best and high

With these upper bounds for volume in place, analogues were selected for each resource. The suite of analogues selected were chosen on the basis that they could be developed in the next 15-20 years. Analogues included also reflect the deposit style and relevance to the WPA (for example, with SA analogues a preference, followed by other Australian jurisdictions).

The analogues used across the Low, Best and High estimates for each commodity were combined in an additive manner, with multiples of the same analogue added to provide scale, to ensure consistency across these three estimates. For example, for Copper, the Low scenario includes one scaled down Emmie Bluff and one scaled down Prominent Hill, while the Best includes these mines at full scale, as well as one Carrapateena, and the High scenario including two of each mine. The one exception to this approach is Nickel, where three different analogues are used for Low, Best and High. This approach was taken to reflect a) the lack of SA analogues and b) the significant increase in scale between the Low, Best and High, which also supported the use of three analogues of vastly different scale.

It is important to note that the upper bound for each of the Low, Best and High estimates for a given resource is representative of the potential resource that could be discovered in the WPA. Therefore, the production from the analogue mines in each scenario will not sum undiscovered resource potential. This gap reflects the following geological considerations:

- Some of the undiscovered resource potential exists in non-economic discovery sizes: these can be expected to be left in the ground and not developed.
- The WPA itself is a large geographic area (this area is noted to be the size of England) and exploration is focused in certain areas.
- Once a discovery is made, companies will invest in the appraisal and development of that resource, and development timeframes for discoveries can be up to 15-20 years. Therefore, within the timeframe of this analysis, not all resources that could be discovered will be developed into operating mines.

Appendix Table 4: Mine analogues selected for NPV analysis

Resource	Low estimate	Best estimate	High estimate
IOCG Gold	*34 t*	*156 t*	*722 t*
Lode Gold	*64 t*	*298 t*	*1,381 t*
Gold, total	98 t	453 t	2,104 t
Gold, NPV scenario analogues	**1 Prominent Hill (scaled to 110 Mt ore)**	**1 Challenger**	**2 Challenger**
		1 Carrapateena	**2 Carrapateena**
		1 Prominent Hill	**2 Prominent Hill**
IOCG Copper	*970,000 t*	*4,510,000 t*	*20,950,000 t*
Sediment-hosted Copper	*109,000 t*	*507,000 t*	*2356,000 t*
Copper, total	1,080,000 t	5,020,000 t	23,310,000 t
Copper, NPV scenario analogues	**1 Emmie Bluff (scaled to 7.7 Mt ore)**	**1 Emmie Bluff**	**2 Emmie Bluff**
	1 Prominent Hill (scaled to 110 Mt ore)	**1 Prominent Hill**	**2 Prominent Hill**
		1 Carrapateena	**2 Carrapateena**
Unconformity-associated	*3,400 t*	*15,800 t*	*73,200 t*
Sandstone-hosted Channel type	*12,500 t*	*58,000 t*	*269,100 t*
Sandstone-hosted Rollfront type	*11,400 t*	*53,000 t*	*246,100 t*
Calcrete-hosted	*1,500 t*	*6,900 t*	*32,000 t*
IOCG associated	*47,000 t*	*218,000 t*	*1,012,100 t*
Uranium, total	75,800 t	351,700 t	1,632,500 t
Uranium, NPV scenario analogues	**1 Prominent Hill (scaled to 110 Mt ore)**	**1 Prominent Hill**	**2 Prominent Hill**
		1 Beverley	**2 Beverley**
Iron	39 Mt	182 Mt	847 Mt
Iron, scenario analogues	**1 Buzzard/Tui**	**3 Buzzard/Tui**	**3 Buzzard/Tui**

Resource	Low estimate	Best estimate	High estimate
			1 Central Eyre Iron Project
Heavy Mineral Sands	836,000 t	3,880,000 t	18,010,000 t
Heavy Mineral Sands, NPV scenario analogues	**1 Jacinth-Ambrosia (scaled down to 39 Mt ore)**	**1 Jacinth-Ambrosia**	**2 Jacinth-Ambrosia**
Silver (assoc. with Sediment-hosted copper)	*73 t*	*340 t*	*1,579 t*
IOCG Silver	*275 t*	*1,275 t*	*5,900 t*
Silver, total	348 t	1,600 t	7,500 t
Silver, NPV scenario analogues	**1 Prominent Hill (scaled to 110 Mt ore)**	**1 Prominent Hill**	**2 Prominent Hill**
		1 Challenger	**2 Challenger**
	1 Emmie Bluff (scaled to 7.7 Mt ore)	**1 Emmie Bluff**	**2 Emmie Bluff**
		1 Carrapateena	**2 Carrapateena**
Nickel	58,800 t	269,700 t	1.122 Mt
Nickel, NPV scenario analogues	**Cassini (WA)**	**Nova-Bollinger (WA)**	**Nebo-Babel (WA)**
Cobalt (assoc. with Sediment-hosted copper)	3,400 t	15,600 t	72,500 t
Cobalt, NPV scenario analogues	**1 Emmie Bluff (scaled to 7.7 Mt ore)**	**1 Emmie Bluff**	**2 Emmie Bluff**

Source: Scyne Advisory and DEM analysis, 2023

A.3.3 Results

Results for each analogue mine included in the NPV analysis are included here, along with their supporting assumptions.

Appendix Table 5: Challenger

Variable	Assumption
Construction time	1 year
Capital cost (pre-production)	$57 million[a]
Average annual operating expenditure	$77 million[a]
Average annual sustaining capital expenditure	$5.7 million[a]
Average annual production per annum gold	2.5 t
Average annual production per annum silver	0.1 t
Mine life	15 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 6: Prominent Hill

Variable	Assumption
Construction time	2 years
Capital cost (pre-production)	$1,681 million[a]
Average annual operating expenditure	$524 million[a]
Average annual sustaining capital expenditure	$170 million[a]
Average annual production per annum gold	4 t
Average annual production per annum silver	18 t

Variable	Assumption
Average annual production per annum copper	101 kt
Average annual production per annum uranium	2 kt
Mine life	22 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 7: Carrapateena

Variable	Assumption
Construction time	3 years
Capital cost (pre-production)	$1,024 million[a]
Average annual operating expenditure	$298 million[a]
Average annual sustaining capital expenditure	$104 million[a]
Average annual production per annum gold	2.6 t
Average annual production per annum silver	24 t
Average annual production per annum copper	55 kt
Mine life	20 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 8: Central Eyre Iron Project

Variable	Assumption
Construction time	4 years
Capital cost (pre-production)	$5,111 million[a]
Average annual operating expenditure	$1,224 million[a]
Average annual sustaining capital expenditure	$93 million[a]
Average annual production per annum iron	21.5 Mt
Mine life	25 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 9 Buzzard

Variable	Assumption
Construction time	1 year
Capital cost (pre-production)	$29 million[a]
Average annual operating expenditure	$141 million[a]
Average annual sustaining capital expenditure	$17 million[a]
Average annual production per annum iron	2.5 Mt
Mine life	5 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 10: Emmie Bluff (Elizabeth Creek)

Variable	Assumption
Construction time	2 years
Capital cost (pre-production)	$277 million[a]
Average annual operating expenditure	$277 million[a]
Average annual sustaining capital expenditure	$80 million[a]
Average annual production per annum silver	18 t
Average annual production per annum copper	25 kt
Average annual production per annum cobalt	1 kt
Mine life	14 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 11: Beverley

Variable	Assumption
Construction time	3 years
Capital cost (pre-production)	$285 million[a]
Average annual operating expenditure	$111 million[a]
Average annual sustaining capital expenditure	$29 million[a]
Average annual production per annum uranium	1,367 t
Mine life	22 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 12: Jacinth-Ambrosia

Variable	Assumption
Construction time	1 years
Capital cost (pre-production)	$507 million[a]
Average annual operating expenditure	$264 million[a]
Average annual production per annum zircon	231 kt
Average annual production per annum rutile	24 kt
Average annual production per annum ilmenite	102 kt
Mine life	22 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 13 Nebo-Babel (West Musgrave)

Variable	Assumption
Construction time	3 years
Capital cost (pre-production)	$1,700 million[a]
Average annual operating expenditure	$459 million[a]
Average annual sustaining capital expenditure	$48 million[a]
Average annual production per annum nickel	28.6 kt
Mine life	24 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 14 Nova Bollinger

Variable	Assumption
Construction time	2 years
Capital cost (pre-production)	$521 million[a]
Average annual operating expenditure per year	$147 million[a]
Average annual sustaining capital expenditure	$13 million[a]
Average annual production per annum nickel	26.7 kt
Mine life	10 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

Appendix Table 15 Cassini

Variable	Assumption
Construction time	1 year
Capital cost (pre-production)	$30 million[a]
Average annual operating expenditure per year	$47 million[a]
Average annual sustaining capital expenditure	$11 million[a]
Average annual production per annum nickel	7.1 kt
Mine life	5 years

Source: Scyne Advisory analysis of Geoscience Australia and public data, 2023
Note: a. 2023-dollar terms.

A.4 Net present value inputs

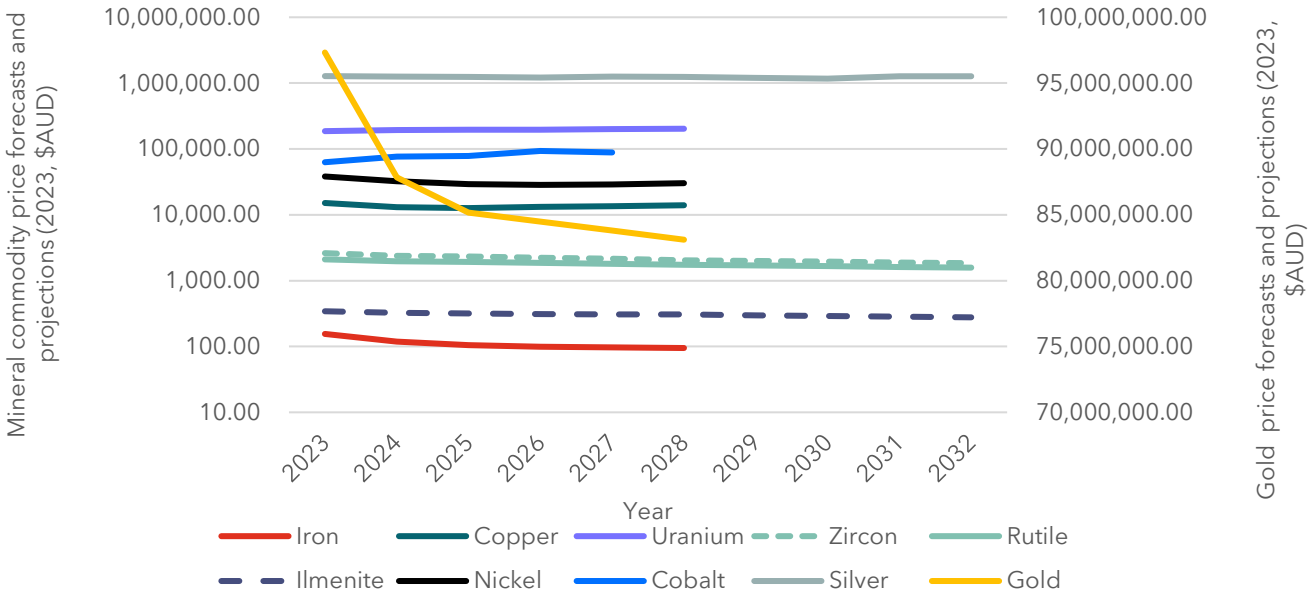
A.4.1 Commodity prices and exchange rates

Commodity price forecasts and projections are required to estimate the flow of revenue from mineral production. Forecasts and projections used in this report reflect benchmark commodity prices (i.e., London Metal Bullion Association (LMBA) spot prices for gold and silver, London Metal Exchange (LME) spot prices for Base metals, and the Iron ore 62 per cent fines Free on Board Australia price).

Forecasts and projections are compiled using the March 2023 edition of the *Resources and Energy Quarterly* for the period to 2028. The forecasts in the *Resources and Energy Quarterly*[44] are based on an assessment of market fundamentals, economic conditions and changes to government policies with the potential to impact supply or demand. The publication has been produced for 30 years and contains the Office of the Chief Economist's forecasts for the value, volume and price of Australia's major resources and energy commodity exports. Select commodities covered in this report that were not included in the *Resources and Energy Quarterly* include silver, cobalt, and the heavy mineral sands of zinc, rutile and ilmenite. Silver and cobalt price forecasts were compiled from the July 2023 release of S&P Market Intelligence's Commodities Estimates. S&P Market Intelligence estimates are collected from broker research reports or from estimates feeds provided by brokers directly. Heavy mineral sands price forecasts were compiled with data from global macroeconomic survey firm Consensus Economics' July 2023 release.

Beyond 2028, commodity prices have been assumed to remain static in real dollar terms. Exceptions include Cobalt, where prices have been assumed to remain static beyond 2027, and beyond 2032 for silver and heavy mineral sands. Commodity price assumptions were compiled in US dollars, and an exchange rate of US$/A$ 0.66[45] was applied across all commodities and years.

Appendix Figure 2: Mineral price forecasts and projections



44 Department of Industry, Innovation and Science (2023) Resources and Energy Quarterly, Office of the Chief Economist, Canberra, https://industry.gov.au/req

45 Reserve Bank of Australia, US$/A$ exchange rate, August 2023

Source: Resources and Energy Quarterly, March 2023 release; S&P Global Market Intelligence, July 2023 release; S&P Capital IQ, July 2023 release; Consensus Economics, July 2023 release.

A.4.2 Costs

Capital and operating costs of each mine site are required to estimate the economic viability of each project. Where applicable, capital and operating cost data from the Office of the Chief Economist's *Economic Assessment of Mineral Resources within the Woomera Prohibited Area* (2018) are used and adjusted for inflation to 2023-dollar terms. For mine sites not included in the 2018 study cost data and other information are sourced from company reports (i.e., annual reports, scoping studies, feasibility studies, and ASX announcements). Operating costs for select mines included in the 2018 study are also updated using company reports, subject to data availability. Where there are data constraints, costs are approximated based on analogue sites with similar specifications in terms of location, size, depth and/or quality.

A.4.3 Production and resource life

To determine the NPV of known EDR, the remaining resource life has been derived by dividing the EDR by the average annual production rate. Annual production rates are based on Geoscience Australia 2018 values, or company reports where available. For polymetallic mines, the longest derived mine life was used, and the production rate for the other commodities was adjusted accordingly.

EDR is a collective term which includes the Joint Ore Reserve Committee (JORC) Code categories of: 'Measured Mineral Resources', 'Indicated Mineral Resources', 'Proved Ore Reserves' and 'Probable Ore Reserves'. These resources are regarded as geologically well understood and economically feasible to extract or produce with reasonable certainty.

A.4.4 Discount rate

The discount rate is applied to cash flows to determine the present value of future cash flows. The discount rate is used to account for the opportunity cost of investment and for the time value of money, that is, the preference for current consumption over consumption in the future. The discount rate used in this analysis to determine the NPV of resources is a real 7 per cent discount rate.

A.4.5 Other considerations

The NPV approach is subject to considerable uncertainty and possible revision in the future as more data and information becomes available. The uncertainty surrounding the estimates of NPVs means that the results should be viewed with some caution, and considered alongside accompanying commentary and geological assessment from DEM. There is also uncertainty regarding technological developments or further exploration activity which will occur during the life of the mine, which could reduce operating costs or increase resource life.

A.4.6 Results

The results of the NPV estimates are presented below. Appendix Table 16 provides a summary of the estimated NPV of EDRs by deposit. Appendix Table 17-19 provide a summary of the estimated NPVs of the low, best and high scenarios respectively.

Appendix Table 16: Net Present Value of Economic Demonstrated Resources by mine or deposit in the WPA

Deposit	Status	Commodity	EDR	Value ($ million)
Prominent Hill	Operating mine	Gold Silver Copper	140 t Au 435 t Ag 1,600 kt Cu	13,459
Challenger	Operating mine	Gold	2.04 t Au	108
Peculiar Knob	Operating mine	Iron	4.536 Mt Fe	-22
Hawks Nest	Operating Mine	Iron	210.23 Mt Fe	358
Cairn Hill	Operating mine	Gold Copper Iron	1.13 t Au 45,200 t Cu 5.643 Mt Fe	285

Notes: Values are in real 2023 dollars. Metal symbols in the 4th column indicate that the resource is measured in metal content terms. Economic Demonstrated Resource values current as at June 2023.
Source: Scyne Advisory and DEM analysis, 2023

Appendix Table 17 Net Present Value of Low scenario

Future mine	Commodity	Assumed total production over mine life	Net Present Value ($m 2023), discount rate 7 per cent
1 Prominent Hill (scaled to 110 Mt ore)	Copper Gold Silver Uranium	864 kt Cu 34 t Au 154 t Ag 17,100 t U	$2,351
1 Emmie Bluff (scaled to 7.7Mt ore)	Copper	70,000 t Cu 51 t Ag 2,800 t Co	$44
1 Buzzard	Iron	12.5 Mt Fe ore	$131
1 Jacinth-Ambrosia (scaled to 39 Mt ore)	Zircon Rutile Ilmenite	1,371 kt Zrn 142 kt Rt 605 kt Ilm	$241
1 Cassini (WA)	Nickel	35,300 t Ni	$267

Source: Scyne Advisory and DEM analysis, 2023

Appendix Table 18 Net Present Value of Best scenario

Future mine	Commodity	Assumed total production over mine life	Net Present Value ($m 2023), discount rate 7 per cent
1 Challenger	Gold Silver	37.5 t Au 1.5 t Ag	$479
1 Carrapateena	Copper Gold Silver	1,100 kt Cu 52 t Au 480 t Ag	$2,085
1 Prominent Hill	Copper Gold Silver Uranium	2,222 kt 88 t Au 396 t Ag 44 kt U	$6,049
1 Emmie Bluff	Copper Cobalt Silver	350 kt Cu 14 kt Co 254 t Ag	$253
1 Beverley	Uranium	30.1 kt U	$473
3 Buzzard	Iron	37.5 Mt Fe ore	$393

Future mine	Commodity	Assumed total production over mine life	Net Present Value ($m 2023), discount rate 7 per cent
1 Jacinth-Ambrosia	Zircon Rutile Ilmenite	5,082 kt Zrn 528 kt Rt 2,244 kt Ilm	$894
1 Nova-Bollinger (WA)	Nickel	266.8 kt Ni	$1,409

Source: DEM, Scyne Advisory and DEM analysis, 2023

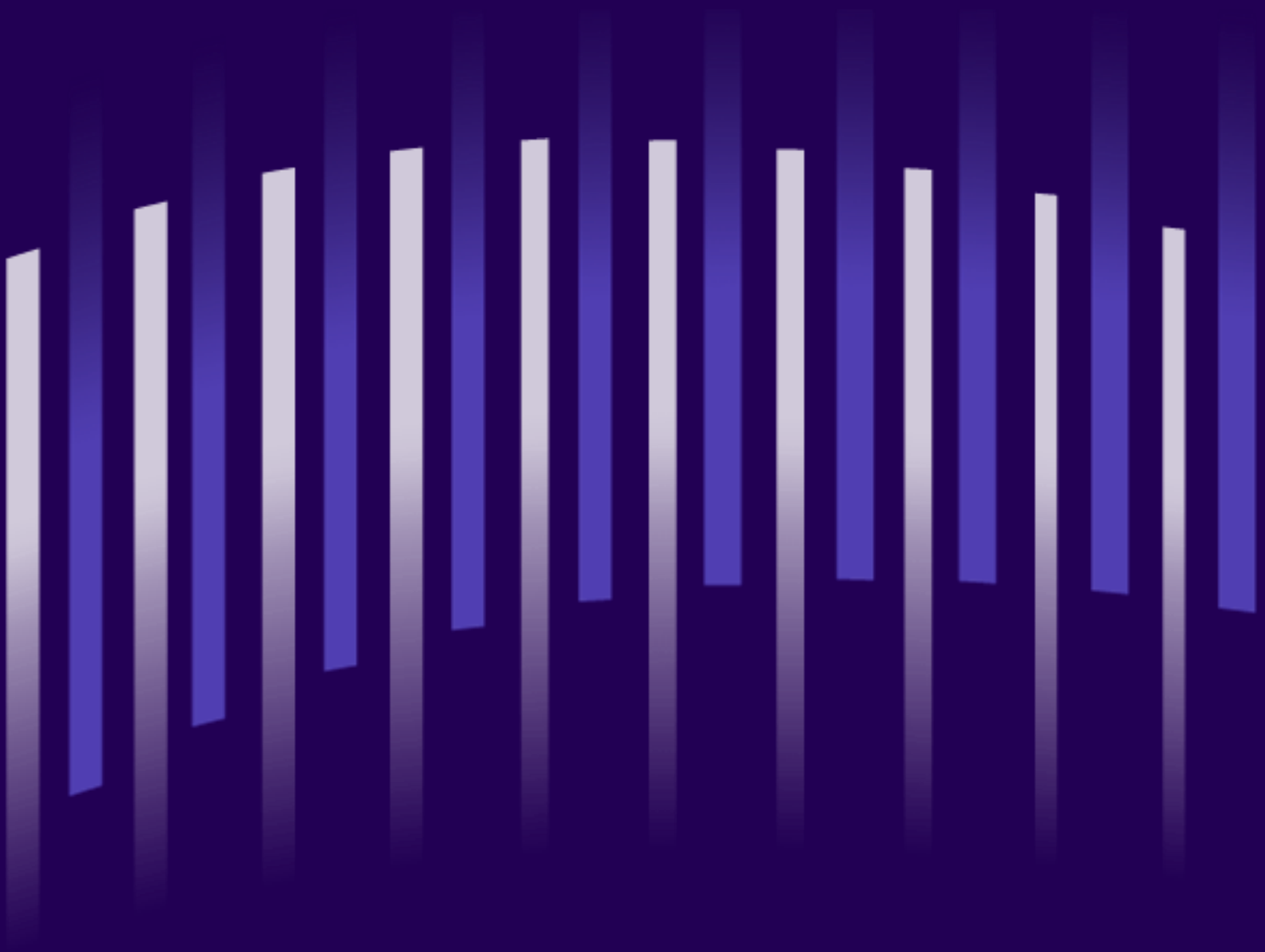
Appendix Table 19 Net Present Value of High scenario

Future mine	Commodity	Assumed total production over mine life	Net Present Value ($m 2023), discount rate 7 per cent
2 Challenger	Gold Silver	75 t Au 3 t Ag	$959
2 Carrapateena	Copper Gold Silver	2,200 kt Cu 104 t Au 960 t Ag	$4,171
2 Prominent Hill	Copper Gold Silver Uranium	4,444 kt 176 t Au 792 t Ag 88 kt U	$12,099
2 Emmie Bluff	Copper Cobalt Silver	700 kt Cu 28 kt Co 508 t Ag	$505
2 Beverley	Uranium	60.1 kt U	$946
3 Buzzard	Iron	37.5 Mt Fe ore	$393
1 Central Eyre Iron Project	Iron	537.5 Mt Fe ore	$986
2 Jacinth-Ambrosia	Zircon Rutile Ilmenite	10,164 kt Zrn 1,056 kt Rt 4,488 kt Ilm	$1,788
1 Nebo-Babel (WA)	Nickel	686.4 kt Ni	$872

Source: DEM, Scyne Advisory and DEM analysis, 2023

scyne ADVISORY

B Economic assessment technical appendix



B Economic assessment technical appendix

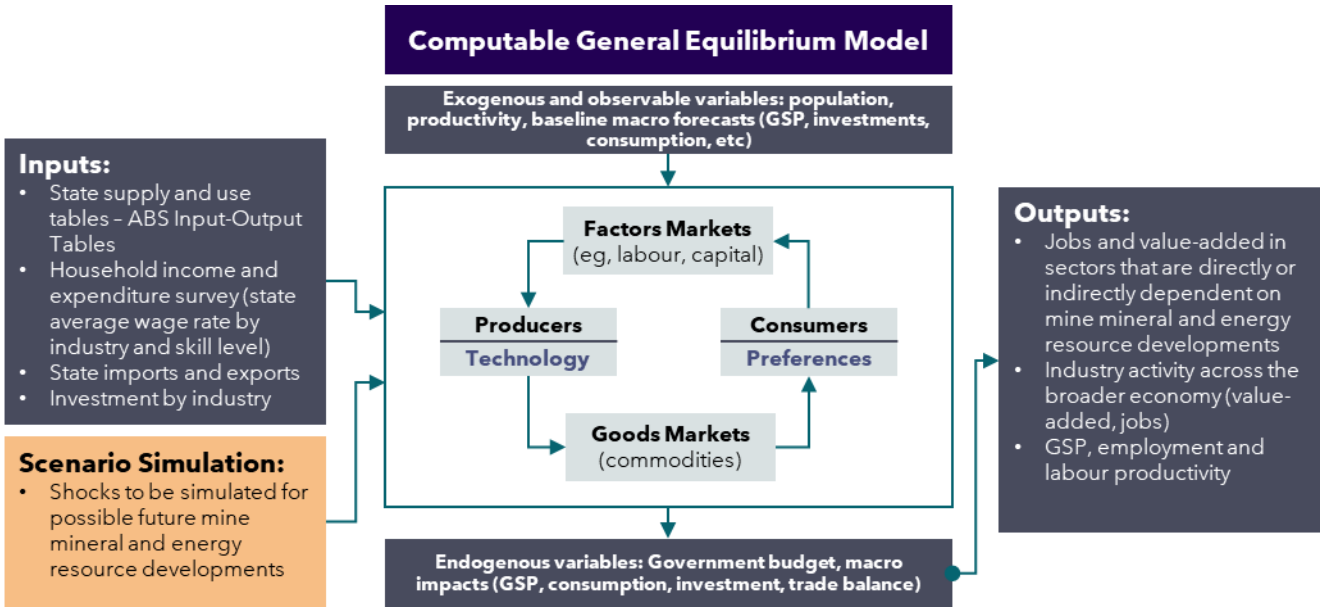
B.1 Appendix B: Modelling approach

B.1.1 CGE models

A CGE model is a mathematical model of an economy that is capable of capturing economy-wide impacts and inter-sectoral reallocation of resources that may result from a 'shock' to the economy. CGE models are generally designed for quantitative analysis of:

- resource allocation and technical efficiency issues
- government tax or expenditure policy related issues
- external events that can be represented as price or activity shocks.

Appendix Figure 3: Economic impact assessment approach



The core data of a CGE model is an input-output table, which is provided by the Australian Bureau of Statistics (ABS). An input-output table is a system of accounts which shows, in value terms, the supply and disposal of goods and services within the economy in a particular year. An input-output table captures sales of products to other industries for further processing (intermediate usage) or to the various categories of final demand. It also captures the inputs used in an industry's production, whether they are intermediate or primary inputs (such as labour and capital). The table is balanced such that total inputs to each industry are equal to total outputs from each industry. Essentially, an input-output table is a snapshot of an economy (whether it is a territory, state or country) in a particular year.

The database is combined with sophisticated economic and behavioural assumptions to capture:

- resource constraints and the responses of businesses and workers through the adjustment of prices and wages
- substitution between labour and capital (and other factors inputs) in response to changes in the price of labour relative to capital
- the behavioural responses of consumers, investors and foreigners to price changes
- the effects of technological change and shifts in consumer preferences.

These features of CGE models mean that they capture not only the direct (or first-round) effects of an activity, but also the indirect (or second- and third-round) effects.

A CGE model attempts to 'push forward' the base input-output table through time by utilising a set of equations that capture neoclassical microeconomic theory to determine behaviour of economic agents (such as households, governments, industries) when they are faced with changes in key economic variables, especially relative prices. The equations are solved simultaneously, where some variables are determined by the model (endogenous variables) and some are determined outside the model (exogenous variables). The classification of endogenous and exogenous variables is determined by the user, based on the set of assumptions derived for the specific modelling exercise.

B.1.2 Assessing economic impacts

This analysis focuses on the economic impacts to the SA and national economies of possible future mine mineral and energy resource developments in the WPA. While the direct economic impacts can be measured through the level of capital spending on possible future mine mineral and energy resource developments, any flow-on or second-round effects are identified and quantified using CGE modelling.

As noted above, the CGE model that has been used by Scyne Advisory in this analysis is Scyne's dynamic version of the Victoria University Regional Model (VURM). VURM is a regional CGE model that provides a highly disaggregated representation of the Australian economy. It distinguishes up to eight Australian regions (six States and two Territories) and, depending on the application, up to 84 commodities/industries. The model recognises:

- domestic producers classified by industry and domestic region
- investors similarly classified
- up to eight region-specific household sectors
- an aggregate foreign purchaser of the domestic economy's exports
- up to eight State and Territory Governments and the Federal government.

VURM has been widely applied in economic impact and policy analysis. VURM models the economy as a system of interrelated economic agents operating in competitive markets. Economic theory specifies the behaviour and market interactions of economic agents, including consumers, investors, producers and governments in domestic and foreign goods, capital and labour markets. The model gives a complete description of the transactions of domestic households, producing sectors, government and the rest of the world.

CGE models can be set up as either 'comparative static' or 'recursive dynamic', depending on the treatment of time in the modelling exercise, the presence of annual shocks and the degree to which it is desirable to represent underlying changes in the economy over time. This analysis has been run as recursive dynamic. Recursive dynamic modelling accounts for how the economy changes over time to move from one equilibrium position to another. This allows for:

- underlying changes in the economy over time, including accumulation relationships such as for investment, capital and debt
- how the shock might be disaggregated over a number of time periods and how it might play out through the directly affected industry, interrelated industries and the wider economy over time
- a lagged adjustment process in the labour market.

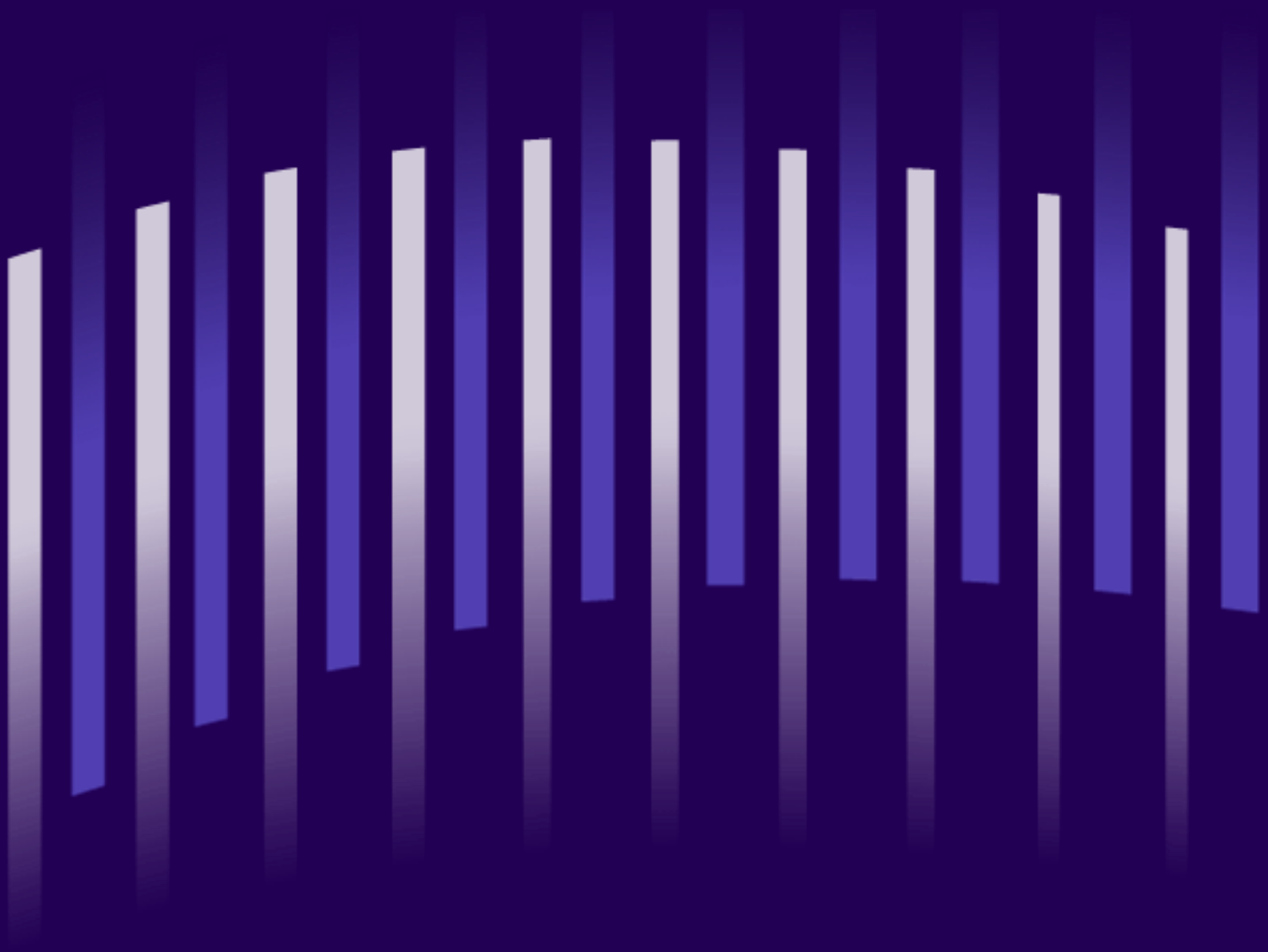
B.1.3 Royalties

Note that the royalties have been estimated using the change in capital stock in the economic modelling multiplied by the base case royalties payments. They have not been calculated on the basis of production level or commodity prices.

scyne ADVISORY

C

Study approach



C Appendix C: Study approach

C.1.1 Study approach detail

This study was undertaken through a collaborative approach across Scyne Advisory and DEM. The approach is outlined in the introduction to this report. The purpose of this supplementary appendix is to provide some key points of reference on specific actions and transition points between Scyne Advisory and DEM. This is to support future studies as they are developed.

Resource Prospectivity Analysis

In this first phase of work, DEM prepared and provided Scyne Advisory with a 'WPA Atlas 2023' data package, which included an ArcGIS project, a 'SpatialData' geodatabase and raster files relevant to the assessment in the WPA area. These datasets are publicly available on the South Australia Resources Information Gateway (SARIG) platform. The 2010 and 2018 prospectivity polygons as provided to DEM by Geoscience Australia, and the Global Solar Atlas and Global Wind Atlas GIS datasets were also provided by DEM. Additional data not initially provide was subsequently provided by DEM or downloaded by Scyne Advisory from SARIG.

At the commencement of the study, DEM provided a list of the commodities to be reviewed in the 2023 report, and the updated mineral deposit models, which included which dataset provided should be used for each input and any specific considerations for each input. Scyne Advisory generated the prospectivity maps using the deposit model and inputs as specified by DEM. When an interpretation of the prospectivity of an area was required, this interpretation was performed by Scyne Advisory and subsequently reviewed by DEM.

One of DEM's objectives for this report was to develop a more robust, quantitative approach to determining the undiscovered resource potential in the Woomera Prohibited Area (WPA). DEM provided Scyne Advisory with a quantitative assessment methodology[46] developed by Donald A. Singer, a prominent United States Geological Survey (USGS) geologist, known as the USGS three-part assessment system[47]. Scyne Advisory and DEM agreed to replicate the approach used by Singer and Kouda[48]. This three-part quantitative assessment system was further refined and developed in studies following Singer and Kouda by incorporating Monte Carlo simulation[49], but due to time constraints, this could not be performed in this study and is an opportunity for future improvement for the methodology.

For the evaluation of undiscovered future resource, Scyne Advisory and DEM agreed which commodities would be assessed using a quantitative method, which would be evaluated deterministically, and which commodities would not be assessed for their future volumetric potential.

Scyne Advisory developed the model to calculate undiscovered resource following Singer and Kouda. Scyne Advisory collated the grade and tonnage models for each deposit style with inputs from DEM, the SA Geodata MINDEP Database, peer reviewed studies, company reports and the PorterGeo Database, at the direction of DEM. These grade and tonnage models were then reviewed by DEM. Scyne Advisory also proposed a modification to the approach to include a 'confidence scalar' to represent the reduction in confidence that areas mapped lower than 'High' potential in the Resource Prospectivity Analysis met the definition of a 'permissive tract' as described by

---

46 Singer, D. A. (2010). Progress in integrated quantitative mineral resource assessments. *Ore Geology Reviews*, *38*(3), 242-250.

47 Porwal, A. K., & Kreuzer, O. P. (2010). Introduction to the special issue: mineral prospectivity analysis and quantitative resource estimation. *Ore Geology Reviews*, *38*(3), 121-127.

48 Singer, D. A., & Kouda, R. (2011). Probabilistic estimates of number of undiscovered deposits and their total tonnages in permissive tracts using deposit densities. *Natural Resources Research*, *20*, 89-93.

49 Singer, D. A., Jaireth, S., & Roach, I. (2018). A three-part quantitative assessment of undiscovered unconformity-related uranium deposits in the Pine Creek region of Australia. *Iaea Tecdoc Series*, 350.

Singer and Kouda, which DEM agreed to. DEM reviewed the outputs of the model for each commodity, which generated a P90 (Prediction Interval Lower), median and P10 (Prediction Interval Upper) estimate of undiscovered resource by commodity.

The analogue deposits for the mineral commodities evaluated deterministically were proposed by DEM. DEM provided Scyne Advisory with the Economic Demonstrated Resources (EDR) values for deposits and mines in the WPA.

Net Present Value Analysis

The 2018 approach to determining NPV was to use analogue mines to provide the life of mine, cost and production inputs for the NPV calculation. These mines were determined by a judgement by Geoscience Australia on *"the likely maximum number of deposits that could be discovered and developed within the WPA in the short to long term"* in a Conservative and Optimistic Scenario[9].

For this study, the combined Scyne Advisory and DEM team identified appropriate analogue mines for each deposit style, constrained by the outputs of the undiscovered resource potential analysis. Because the methodology for determining undiscovered resource produced a P90, median and P10 estimate of undiscovered resource, three scenarios of analogue mines, described as Low, Best and High, were developed.

A drawback of this approach to determine NPV is that the analysis will be representative of the cost performance and production performance of each individual mine. Capital costs associated with previous mine developments will not capture the installation of a renewable energy power supply that is likely to be present in future mining operations and future improvements to mine design and technologies could enhance production rates. Therefore, a further improvement to this approach would be to consider these potential cost changes and different production rates in the determination of NPV of future mine developments.

Scyne Advisory developed the discounted cash flow model for each analogue to compute individual NPVs for each mine, which were used to calculate a combined NPV for each scenario. Consistent with the 2018 study, the combined team agreed to apply a real 7 per cent discount rate to cash flows to determine the present value of future cash flows.

Commodity price forecasts and projections for the NPV calculation compiled using the March 2023 edition of the Resources and Energy Quarterly for the period to 2028. Select commodities covered in this report that were not included in the Resources and Energy Quarterly include silver, cobalt, and the heavy mineral sands of zinc, rutile and ilmenite. Silver and cobalt price forecasts were compiled from the July 2023 release of S&P Market Intelligence's Commodities Estimates. Heavy mineral sands price forecasts were compiled with data from global macroeconomic survey firm Consensus Economics' July 2023 release. The combined Scyne Advisory and DEM team agreed to assume static commodity prices in real dollar terms beyond 2028. Exceptions include Cobalt, where prices have been assumed to remain static beyond 2027, and beyond 2032 for silver and heavy mineral sands.

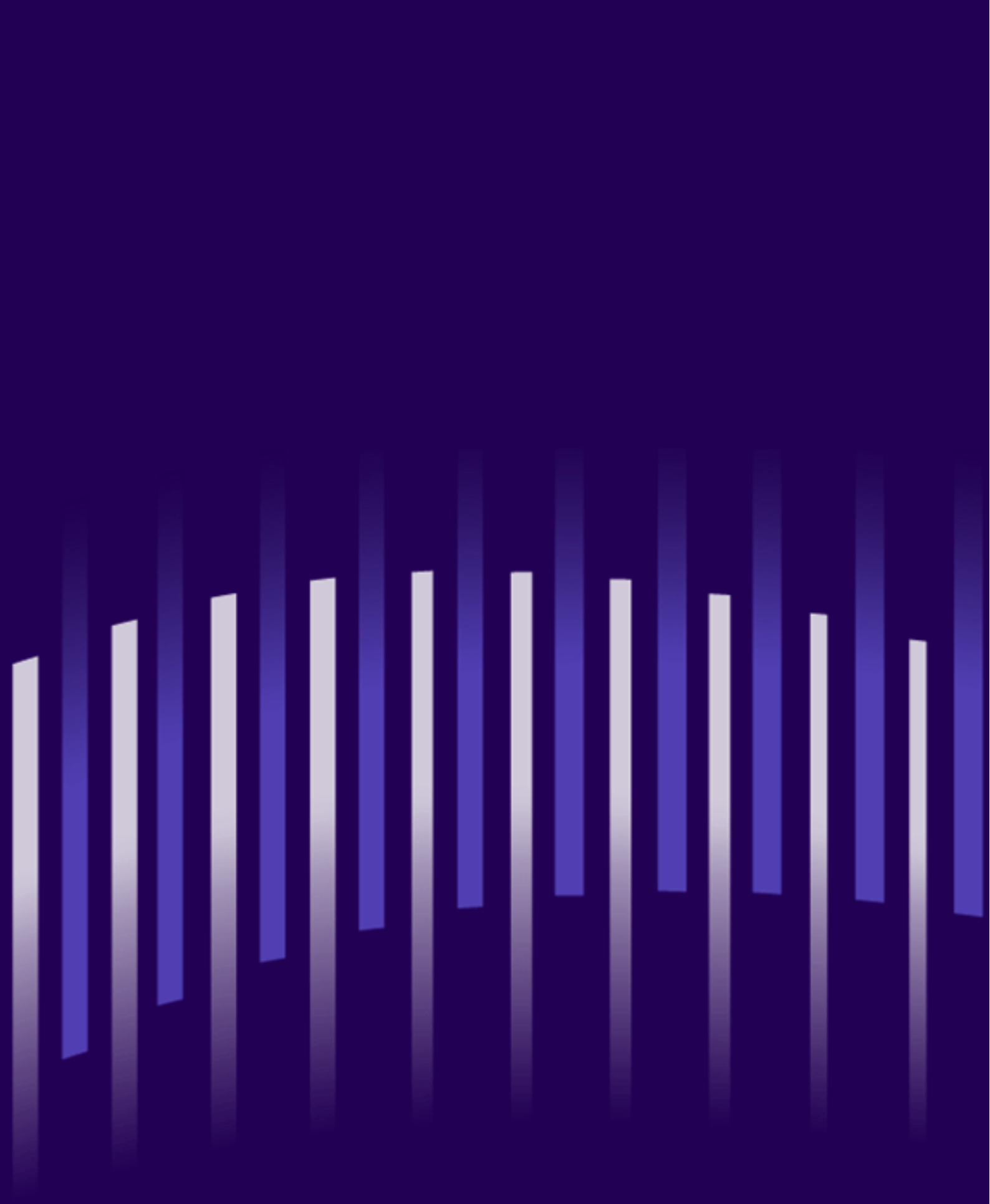
Capital and operating costs of each mine site were used to estimate the economic viability of each project. Scyne Advisory applied ABS Consumer Price Index10 to adjust capital and operating costs to real 2022-23 dollars in the NPV calculation.

Economic Impact Assessment

The 2018 study undertook an input-output modelling approach to estimate economic impacts of possible future mine developments in the WPA region. This study uses CGE modelling and analysis as the basis for the economic impact assessment which differs from the approach undertaken in the 2018 study. DEM and Scyne Advisory discussed the pros and cons of the modelling techniques (input-output model versus CGE model) for economic impact modelling and analysis of possible future mine developments in the WPA region and to develop a fit for purpose modelling approach. As this analysis focuses on the economic impacts to the SA and national economies of possible future mine mineral and energy resource developments in the WPA the combined team agreed to use a

dynamic version of the Victoria University Regional Model (VURM), which is a regional CGE model that provides a highly disaggregated representation of the Australian economy.

To estimate the benefits that will be generated in each of the scenarios modelled, three 'shocks' were applied that vary the CGE model from its base case. DEM and Scyne Advisory discussed and agreed to the set up of the model and key modelling assumptions. To support this process, the DEM team included economists, and as such there were key review points during this phase of work to test assumptions, inputs and results, and provide feedback to the Scyne Advisory team.



To: The Secretary
Woomera 'Prohibited' Area Review
Public Submission by Sarah Isaacs.

The Public Interest and Indigenous Rights in SA would be compromised by the imposition of AUKUS military high-level nuclear waste & nuclear weapons usable fissile material on the Woomera Area

I wish to draw your attention to the potentially severe negative impacts resulting from dumping high-level nuclear waste & nuclear weapons usable fissile material in the Woomera Area in South Australia (SA):

- on both human and environmental health
- Indigenous Rights and
- democratic processes.

For the reasons outlined below, I ask you to advise that the Woomera area is not suitable as a site for dumping nuclear waste – and to recommend the annulment of the AUKUS treaty.

Negative Impacts on both Human and Environmental Health
If the Woomera area were to be designated as a dump site, both the transport and dumping of the US origin military high-level nuclear wastes would present an unprecedented, untenable threat to the health, safety and welfare of Australians and the environment.

If accepted by Australia, the decommissioning of the second-hand Virginia US nuclear powered submarines would produce both high-level radioactive waste and weapons grade highly-enriched uranium.[1]

High-Level radioactive waste is highly toxic long-term and must be contained for over 10 000 years to minimise any risk to health and the environment. If the Romans had been foolish enough to produce nuclear waste, we would still be looking after it!

It is worth noting that, despite operating naval nuclear reactors for many decades, neither the US nor UK have solutions for managing high-level radioactive waste. Perhaps this is one of the attractions of the AUKUS deal to these countries, i.e. the opportunity to dispose of some of their high-level radioactive waste on the other side of the world.

This Review must seek a full explanation of how Defence Minister Marles would be able to manage the globally unprecedented task of siting and perpetual storage & disposal of intractable US origin high-level nuclear wastes from second-hand US Virginia N-Subs.

Just last year, half the country stopped when a highly radioactive device the size of a tic tac somehow fell off a truck in Western Australia. News reports[2] claim that the incident came as a shock to experts who said that handling of radioactive materials like Caesium-137 is highly regulated with strict protocols for its transport, storage and disposal.

Great on paper but not always in practice perhaps? It seems highly dubious that Australia can handle the nuclear waste of nuclear powered submarines when one small radioactive capsule

1https://www.mapw.org.au/updated-naval-nuclear-safety-brief/
2 https://edition.cnn.com/2023/02/01/australia/australia-radioactive-capsule-found-intl-hnk/index.html

couldn't be safely contained and managed. [3]

Proposed regulatory arrangements may generate risks to public health and safety. The proposed Australian Naval Nuclear Power Safety Regulator will report to the Defence Minister, not the Health Minister as is the case for existing nuclear safety regulation. This means the Minister responsible for operating naval nuclear reactors is also responsible for their regulation.

Insufficient independence of a regulator is known to be a factor in nuclear and radiation incidents, and does not comply with International Atomic Energy Agency (IAEA) governance standards. In the UK, where a similar regulatory arrangement exists, internal and secret reports have documented "a failure of safety culture", as reported by the Medical Association for the Prevention of War in March of this year in their briefing paper **Naval Nuclear Power: Key Health Issues.**[4]

- **Negative Impacts on Indigenous Rights**

According to the Australian Government defence website[5], 'The Woomera Prohibited Area (WPA) encompasses the traditional lands of six Aboriginal groups. Maralinga Tjarutja (MT) and Anangu Pitjantjatjara Yunkunytjatjara (APY) hold almost 30 per cent of the land in the west of the WPA as freehold title granted under South Australian legislation. Four other groups – Antakirinja Matu-Yankunytjatjara (AMY), Arabana, Gawler Ranges and Kokatha – hold native title over areas in the WPA.

'The history of these people and their deep ties to the land in the WPA date back over many thousands of years. The WPA contains sites of enduring significance to Aboriginal people, including stone arrangements associated with traditional ceremony and ritual, rock art sites, ceremonial sites, cultural sites manifested in topographical features such as watercourses, and archaeological sites that show how people lived in and used their environment.

'Aboriginal people continue their traditions by accessing the WPA for traditional ceremonies, hunting, heritage site protection, and cultural activities. A number of Aboriginal groups have been actively involved in commercial activity in and around the WPA, including in the resources and tourism sectors. Today, the traditional custodians of the WPA mostly live in cities, small towns and settlements around South Australia. They continue to have strong links to their land, an interest in preserving their history and culture in the WPA, and growing an economic and employment base for their communities.'

These Indigenous Peoples must be consulted and they have a UN recognised Human Right to Say No to AUKUS N-wastes. The Woomera Area Review must act in accordance with the Recommendations of a Federal Inquiry Report (Nov 2023) into the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), stating:
"the Commonwealth Government ensure its approach to developing legislation and policy on matters relating to Aboriginal and Torres Strait Islander people be consistent with the Articles outlined in the UNDRIP".

---

3 greenpeace.org.au/news/greenpeace-statement-on-AUKUS-nuclear-subs/
4https://www.mapw.org.au/updated-naval-nuclear-safety-brief/
5 https://www.defence.gov.au/bases-locations/sa/woomera/about/aboriginal-cultural-heritage

This Review must seek a commitment from the Federal Labor Government to respect and comply with the United Nations Declaration on the Rights of Indigenous Peoples Article 29 provision of Indigenous Peoples Rights to "Free, Prior and Informed Consent", as a Right to Say No, over storage or disposal of hazardous materials on their lands.[6]

- **Negative Impacts on Democratic processes.**

Lack of Transparency

Why has there been no serious public consultation about the decision to have nuclear powered submarines? .The high level security and lack of transparency needed to protect the nuclear facilities and dump sites undermines democracy.

According to David Noonan, an independent environment campaigner's briefing paper **Civil Society faces imposition of an AUKUS military High Level nuclear waste dump,** putting a nuclear waste dump in Woomera would conflict with both SA State Acts and also the ALP national Platform.

Conflict with State Acts

Imposing nuclear waste storage in South Australia(SA) would also involve Defence over-ride of two State Acts:

- the SA Environment Protection Act 1993 and
- the SA Aboriginal Heritage Act 1988.[7]

Conflict with ALP National Platform Commitment to oppose Overseas Waste

The Woomera Area Review must recognise the AUKUS Agreement's proposed importation of US origin military High-Level nuclear wastes, sourced in 10–12-year-old US Navy nuclear reactors in second hand US Virginia Class N-Subs, will require perpetual storage in Australia:

The Review should call on Minister Marles to explain the incompatibility between the AUKUS Agreement's transfer of second-hand US Virginia Class N-Sub nuclear wastes to Australia, effective importation of nuclear wastes sourced from the US, and the pre AUKUS Federal Labor Policy commitment in the ALP National Platform (2021, Uranium p.96-98) to oppose overseas waste.[8]

The vast sums of money needed for AUKUS and for caring for high-level nuclear waste for millennia come from taxpayer money that would be better used to help address the serious social and health problems our country faces, such as the crises in homelessness, domestic violence, climate change and biodiversity loss.

For all these reasons , I ask you to advise that the Woomera area is not suitable as a site for dumping high-level nuclear waste & nuclear weapons usable fissile material – and to recommend the annulment of the AUKUS treaty.

Sarah Isaacs 6 September 2024

6 Civil Society faces imposition of an AUKUS military High Level nuclear waste dump Updated Briefing by David Noonan, Independent Environment Campaigner 22 August 2024

7 Civil Society faces imposition of an AUKUS military High Level nuclear waste dump Updated Briefing by David Noonan, Independent Environment Campaigner 22 August 2024

8 Civil Society faces imposition of an AUKUS military High Level nuclear waste dump Updated Briefing by David Noonan, Independent Environment Campaigner 22 August 2024

Submission Woomera Prohibited Area Review
Email: woomera.review@defence.gov.au

From Michele Madigan
I forward my submission as a person who has been involved with Aboriginal Peoples in South Australia for several decades including with the people of Yalata and Oak Valley in the Maralinga Lands and peoples in Coober Pedy all adversely affected by the nuclear industry. Because of this involvement with the people themselves and the knowledge thus obtained including written research I have been involved in supporting various Aboriginal groups from 1998 to 2023 in campaigns in their concerns re radioactive waste

1 – Respecting the Declaration of the Rights of Indigenous Peoples. I quote from the Defence Department document: The Woomera Prohibited Area (WPA) encompasses the traditional lands of six Aboriginal groups. Maralinga Tjarutja (MT) and Anangu Pitjantjatjara Yankunytjatjara (APY) hold almost 30 per cent of the land in the west of the WPA as freehold title granted under South Australian legislation. Four other groups – Antakirinja Matu-Yankunytjatjara (AMY), Arabana, Gawler Ranges and Kokatha – hold native title over areas in the WPA...

Aboriginal people continue their traditions by accessing the WPA for traditional ceremonies, hunting, heritage site protection, and cultural activities. A number of Aboriginal groups have been actively involved in commercial activity in and around the WPA, including in the resources and tourism sectors. Today, the traditional custodians of the WPA mostly live in cities, small towns and settlements around South Australia. They continue to have strong links to their land, an interest in preserving their history and culture in the WPA, and growing an economic and employment base for their communities.'

The Defence Department simply cannot quote such knowledges in words as above in their document and at the same time continue to disregard the United Nations Declaration on the Rights of Indigenous Peoples Article 29 provision of Indigenous People's Rights to "Free, Prior and Informed Consent" over storage or disposal of hazardous materials on their lands.

This needs consultation to happen BEFORE the Woomera Prohibited Area (WPA) is declared for any further developments than already exist. This effect needs to come as a result of this Woomera Independent Review

2. South Australia, the lands, waters and citizens of succeeding generations has already had to endure the destruction of the British nuclear tests both in Emu and further south in the what has come to be known as the Maralinga lands through the Australian government bowing to an ally's desire to test of all things nuclear tests of the 1950s and 1960s including the so called minor trials which involved plutonium. Despite assurances to the contrary successive 'cleanups' have been largely unsuccessful.

As well from 1998 to 2023 South Australia has been the key target in 4 out of 5 attempts by the federal government to impose/ establish a federal nuclear waste dump for low level and intermediate long lived waste. None have been successful, the latest being the proposed imposition on Kimba defeated by the Barngarla Traditional Owners with the firm backing of many of the Kimba and Eyre Peninsula farmers and many South Australians

From 1998- 2004 indeed the federal government made unsuccessful efforts to impose the same level dump on various locations – Billa Kalina, Arcoona Station/Woomera region in SA's with 80% of the State's population against this in a concerted campaign which included the SA government's legislation banning such.
This *is the Nuclear Waste Storage (Prohibition) Act 2000). "The Objects of this Act are to protect the health, safety and welfare of the people of SouthAustralia and to protect the environment in which they live by prohibiting the establishment of certain nuclear waste storage facilities in this State."* The South Australian Government already has legislation in place to prohibit

the federal government from dumping nuclear waste in our state.South Australians, Many South Australian are concerned that we are facing a future where high-level radiation exposure will be an ever-present danger.

If the present Labor Government is absolutely intent on a high level nuclear waste dump It is time to direct attention elsewhere in the nation.

Other jurisdictions in the commonwealth of Australia need to take their turn.

3- The need for transparency. Federal Labor must fully and clearly state the AUKUS nuclear wastes to be stored in Australia. I see that The ALP National Platform (2021, Uranium p.96-98) makes a commitment to oppose overseas waste: *Labor will: 8. d. Remain strongly opposed to the importation and storage of nuclear waste that is sourced from overseas in Australia.*I offer to the Review just one out of many historic precedents on the lack of transparency by Australian federal governments re this vexed question of nuclear waste, including high level waste:

On the 17th June 1953, Professor L. H. Martin Scientific Advisor to the Defence Department wrote to the Rt Hon the Prime Minister in correspondence previously classified Top Secret. Regarding the site of the Emu Fields within the Woomera Prohibited Area:
...'On the basis of the information made available by Sir William Penney we are able to assure you that the isolation of the site of the redacted (Totem) trials precludes any possible damage to habitation or living beings by the "shock" wave, thermal radiation, gamma rays and neutrons.'
Further: '...It is possible for us to assure you that the time of firing will be chosen so that any risk to health due to radioactive contamination, or in fact of any human beings, is impossible.'
The consoling last paragraph immediately follows: 'To sum up, on the basis of the information before us, we are able to assure you, Sir, that no habitations or living beings will suffer injury to health from the effects of the atomic explosions proposed for the (redacted word clearly seen Totem) trials.'
History clearly belies every aspect.

In our modern times, August 2024 in a quote attributed to Defence Minister Marles regarding the Woomera Prohibited Area via media release:

"The *National Defence Strategy* made clear that in response to our strategic circumstances, we must accelerate capability development and acquisition, including long range strike, and investment in emerging technologies for the ADF ... Further-
"The Albanese Government is committed to ensuring these arrangements are in the interests of all users, including local indigenous communities and the economic and cultural opportunities in the region."

3A- Almost seven decades later it is discouraging to note the similar kind of optimism in the assurance that conflicting use – of destruction versus preservation – of the longest surviving culture in the world, **not to mention the pastoral industry, tourism and safety Australian citizens of the region and elsewhere is a right t**o in what government leaders would name as a democracy. I trust that the Woomera Review will call out these conflicting aims and offer concrete suggestions as to how any consequent call out of 'national interest' will genuinely be balanced by a non override in practice of Aboriginal and citizen interests

5. Preoccupation with war and warlike language. On assuming government the Labor government including through its Foreign Minister seemed to be making some diplomatic ground in our region compared with sometimes violent language of several of the previous governmental ministers.
However since then It is quite disturbing to witness on occasion the seeming eagerness of the Defence Minster to revert to such- the urgent language and the naming of long range strikes, seemingly not in an experimental mode as in the past but in actual warfare:cf
'Our strategic environment has shifted dramatically and we must ensure that we can develop, test and evaluate these capabilities in a fit for purpose environment.'
The rather more veiled language means the same thing as the more direct language of the now Opposition. The intention seems the same – to draw our nation into another war in subject to Australia's allied. This is surely not why many, perhaps most, Australians voted in a Labor government and why as citizens we are being subjected to

6. In a relevant point It is extremely disturbing that while the government is keen to list other achievements for the good of all its citizens – the overwhelming attention seems to be on jobs for warfare-
as at 5 SEPTEMBER 2024 media release: 'The Albanese Government is further accelerating Australia's long-range strike capability through the acquisition of the Joint Strike Missile (JSM) from 2025.
The Government and Norwegian company Kongsberg Defence & Aerospace have signed a $142 million contract to deliver the JSM for use by the Australian Defence Force...
Kongsberg's new South Australian facility will have the capacity to employ up to 150 workers and will assemble launchers for the Naval Strike Missile (NSM) using mostly Australian-manufactured components, creating 20 new local jobs.'

Here is further evidence of a disregard by government especially the case when it is recognised that, because of the rising cost of living, large numbers of Australian families are falling into poverty. Too many Australian children are going to bed hungry. At the same time there is an acute housing shortage with record numbers of people homeless and charitable organisations that support the impoverished and homeless are stretched beyond capacity. Therefore many Australian citizens decry the enormous expenditure as a reflection

of misguided priorities and doubtful realisations. It is hardly enough for government members to look sympathetic voicing platitudes – 'we know some are doing it tough' while the substantial funding and seemingly government interest goes

7. Makes the Woomera region a target for terrorism and war attacks to join in further in an increasing alienation of Australian soil and loss of sovereignty. It opens up SA to join the places listed below as a key target for terrorist and war attacks.cf Gareth Evans: 'The price now being demanded by the US for giving us access to its nuclear propulsion technology is, it is now becoming ever more clear, extraordinarily high. Not only the now open-ended expansion of Tindal as a US B52 base; not only the conversion of Stirling into a major base for a US Indian Ocean fleet, making Perth now join Pine Gap and the North West Cape – and increasingly likely, Tindal – as a nuclear target...'

8 Hence no doubt the trigger for this Inquiry - what happens when a nuclear-powered submarine is decommissioned? This waste will be. What plans have been established to dispose of this waste?
No country in the world including the AUKUS partners have yet successfully dealt with their high level radioactive waste which needs to be shielded from human and other contact for an impossible to fathom 100,000 years. Finland indeed is an exception having built its deep underground depository at enormous cost but it needs to be said after years of careful community consultation. 'Remote' it is to be remembered is only remote from those who live elsewhere.

8.It is of utmost concern to me that our nation is at risk at also becoming the dumping ground for high level waste from other countries – that is for the UK and /or US submarine navies. Both the UK and the US have generated decades of high nuclear waste which have yet to be housed satisfactorily. I welcome the very recent announcement by the Defence Minister (August 9th 2024) that Australia will not accept this. However, as Dave Sweeney of the Australian Conservation Foundation rightly points out, the above possibility has been confirmed previously by a Senate Inquiry and also by the Department of Defence. In fact there is legislation now before the Australian parliament which would make it possible. This legislation has not yet been passed. I agree strongly that it is up to the Minister 'to close the loophole,' by ensuring the legislation, which will make it impossible for us to take foreign nuclear waste products, is passed.

As Dave Sweeney further warns in his interview on August 9th with ABC Channel 24: Minister Marles needs to take this opportunity to act by changing the legislation to ensure that Australia will not become a dumping ground for high level international nuclear waste. It is already of such concern that the AUKUS deal is set to involve Australia with it own high-level radio-active waste with a shelf-life of at least 100,000 years. **This is a key concern directly connected to this present inquiry regarding the Woomera Protection Area and upon which I trust the Independent leader of the Inquiry will make strong recommendation**

9. Finally – the extremely important concern of underground water contamination. SA is the driest state in the driest continent and so artesian/underground water safety is of the essence.

Conclusion It is to be hoped that Australian government take notice of the independent inquiry it has commissioned and to which a number of its citizens including myself are taking the time and effort to make submissions to. It is the hope of many Australian citizens – those who know about this inquiry and the vast majority who do not- that the wellbeing of the nation's land, waters, citizens and 'all sentient beings" that the usual 'national interest ' clause will not override the actual interest of all except those intent on the promotion of which the Independent Commissioner has been appointed to examine.

Thank you for receiving my submission

Michele Madigan

[redacted]

Woomera Prohibited Area Co-existence Framework Review

Submission: Julie Marlow, Wollongong

I thank the Department of Defence (DOD) for the opportunity to comment on the Woomera Prohibited Area Review (WPA Review).

The lack of independence of the WPA Review is disappointing. With sincere due respect to Ms Rebecca Skinner, she has been appointed by Government and will have the guidance of Defence. She herself has an impressive history as a senior Defence public service and undoubtedly has the required knowledge of the Government's current national security position to be equipped to meet the review's very restrictive terms of reference.

The Review's terms of reference make clear that reviewers' recommendations must serve and enhance the military uses of the WPA, including the WPA's potential to increase Defence revenue. If the military potential of the WPA requires stronger prohibitions on other users, stronger prohibitions will be recommended. All the review can do for 'third party' users'—pastoralists, miners, Aboriginal groups with native title and cultural heritage interests, tourism operators and scientific researchers— is make regulations less burdensome if possible. "In making [its] recommendations, the review should acknowledge the precedence of Defence's use to advance strategic priorities and capability development to protect our national security, and opportunities to minimise regulatory burden and costs for third-party users".

Terms of reference indicate that the Government has keen interest in further exploiting the economic potential of the WPA thus swelling Defence coffers. The Review is to assess opportunities to increase the usefulness of the WPA expensive services to military allies. This promises more international entities among WPA users, such as the big international arms corporations, who will be more privileged than the non-defence 'third party' users. It would seem that miners seeking minerals essential for the 'emerging' armament technologies will also be privileged.

I am not a WPA user. In calling for submissions, Defence is clearly wishing to attract WPA users. It appears that non-user members of the general public are not considered to be appropriate stakeholders. However, as an Australian, I am a stakeholder. All residents and citizens of Australia are stakeholders in the WPA and its activities. The area, as described by Defence, is "a critical Defence site used for the testing of advanced and emerging Defence capabilities". Any such site has critical public interests invested in it and its management must be accountable to the public.

The theme for my submission is the governance of the WPA's co-existence framework.

First Nations' sovereignty

My major concern relates to First Nations' sovereign rights to WPA lands. The Review appears to restrict its understanding of Indigenous rights to 'native title and 'cultural heritage'—this is an inadequate understanding. In the *Uluru Statement from the Heart*, an eloquent and concise description of First Nations' concept of sovereignty is given: "*Our Aboriginal and Torres Strait Islander tribes were the first sovereign Nations of the Australian continent and its adjacent islands, and possessed it under our own laws and customs. … This sovereignty is a spiritual notion: the ancestral tie between the land, or 'mother nature', and the Aboriginal and Torres Strait Islander peoples who were born therefrom, remain attached thereto, and must one day return thither to be united with their ancestors. This link is the basis of the ownership of the soil, or better, of sovereignty. It has never been ceded or*

extinguished, and co-exists with the sovereignty of the Crown." It is imperative that reviewers ensure their recommendations to Government do not allow regulation of the WPA to encroach on Indigenous sovereignty and over-ride Indigenous cultural rights. Meaningful consultation with all the six (or more?) First Nations whose lands comprise the WPA must be acheived. Advice should also be sought from Indigenous public figures who have in-depth general knowledge of First Nations' people and their customs and law, and who, through their contributions to academe, have tried so hard to enlighten non-indigenous Australia about how co-existence can work and, indeed, benefit us all.

I urge reviewers to strongly recommend that WPA regulations incorporate the UN consent tool for Indigenous peoples, known as the Free, Informed and Prior Consent: "FPIC is a principle protected by international human rights standards that state, 'all peoples have the right to self-determination' and – linked to the right to self-determination – 'all peoples have the right to freely pursue their economic, social and cultural development'. Backing FPIC are the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), the Convention on Biological Diversity and the International Labour Organization Convention 169, which are the most powerful and comprehensive international instruments that recognize the plights of Indigenous Peoples and defend their rights."
https://www.un.org/development/desa/indigenouspeoples/publications/2016/10/free-prior-and-informed-consent-an-indigenous-peoples-right-and-a-good-practice-for-local-communities-fao/

I also ask that the review remind the Government that Australia has endorsed the UNDRIP but has yet to fully incorporate it into laws and practices. It follows that Australia should also ratify the International Labour Organisation (Indigenous and Tribal Peoples) Convention 169.

Environmental protection

We are in a time of climate and biodiversity crises—these are our greatest national security risks. It is extraordinary that the Review terms to not require reviewers to seek opportunities for improved environmental protection. WPA Rule 2024 allows the co-existence framework to include environmental researchers only, whose activities of course are secondary to Defence activities. The WPA is undoubtedly a hotspot of environmental assault: from military activities, including nuclear weapons testing, from mining and pastoralist operations.

The WPA must be among the ADF's highest sources of CO2-e emissions (worthy of note is the fact that the world's militaries, including Australia's, are under no obligation to report and reduce their CO2 emissions). Evaluation of the contribution of rocket technologies to global CO2-e emissions is in its early days but indicate that it is considerable. Researchers into black carbon (BC) emissions of rocket launches confirm this. Their key points are:
--The increased stratospheric BC burden from rocket launches warms the stratosphere;
--Stratospheric BC-induced heating causes shifts in stratospheric dynamics, year-round NH ozone loss, and a stronger Antarctic ozone hole;
--The climate response scales in a near linear fashion with increasing rocket launch emissions.
(Maloney, CM, Portman, RW, Ross, M, Rosenlof, KH; The Climate and Ozone Impacts of Black Carbon Emissions From Global Rocket Launches; Journal of Geophysical Research: Atmospheres Vol 127, issue 12, June 2022 **https://doi.org/10.1029/2021JD036373**

I ask reviewers to recommend a genuinely independent and comprehensive assessment of WPA's natural environment and the risks posed by its Defence uses.

AUKUS Pillar 2

It is clear that the a major motive behind the WPA Review is the facilitation of the highly controversial AUKUS agreement. From Government perspective, the WPA, the largest land based test range in the world, must be fit-for-purpose as a means to (borrowing words from the Review's consultation page) " accelerate capability development and acquisition, including of long range strike, and investment in emerging technologies", that is, Pillar 2 of AUKUS. The 'emerging technologies' that Government wants to help develop and/or purchase include missile systems and unmanned systems involving poorly understood, arms-race provoking technologies, such as AI and hypersonics. Such dangerous developments have nothing to do with preserving peace. On the contrary, their acquisition risks compromising our relations with China and other regional states.

Australia's acquisition of these weapons hold high stakes for the general public. ***I ask the reviewers to recommend an open and independent risk assessment of these military technologies and greater involvement by Australia in establishing international law regarding their development and uses.***

AUKUS Pillar 1

What is equally alarming is the probability that WPA will also be used to facilitate AUKUS Pillar 1 in that it is considered the favoured site for the disposal of high-level nuclear waste made necessary by the future decommissioning of US and UK nuclear reactors purchased by Australia. Minister for Defence Marles announced March 2023 that the Government has committed to Australia being responsible for disposal of naval nuclear reactors; he promised to reveal where disposal site/s would be within twelve months of his announcement, but has yet to do so.

Globally, no safe permanent solution for high-level waste has been found. After 60 years of building and decommissioning nuclear powered ships, US and UK have arrived at no satisfactory solution for their immense accumulation of waste.

Within a few years, Australia will need to be equipped to manage and store low- and intermediate waste from operational UK and US nuclear submarines soon to be based and maintained at HMAS Stirling (SRF_W). Will this waste be eventually transported from temporary facilities at Stirling onto WPA?

Historically, the Australian population has been opposed to nuclear power and concerns about nuclear waste has been a significant part of what informed that opposition.

The AUKUS agreement and its implementation has proceeded without proper scrutiny, not even parliamentary debate. Decisions of the foremost consequence for the public are justified by Government with claims based on opinion, not sound evidence. Such justifications are under credible challenge from reputable and informed critics. The Government has failed to respond constructively to the criticism and concerns about AUKUS that have been voiced by both civil society, military strategists and researchers, nuclear scientists, international law academics and others.

I ask the reviewers to recommend to Government full and open re-assessment of the AUKUS agreement.

Defence Secrecy

And that brings me to the vexed matter of DOD's and the whole defence sector's notorious lack of transparency and accountability. Australian defence is reputed to be the most secretive among OECD countries. Journalists and other researchers seeking information on local defence matters have more success with US government sources than sources of the

Australian Government. Rarely is anything substantial gained through our FOI system. This secrecy is appalling and a serious undermining of our democracy.

Journalist and former Canberra Times editor, Jack Waterford, in his ‘Australia’s secretive defence establishment: the real enemies of truth and freedom’ (Pearls & Irritations 19 Sept. 2024) gives good evidence for his claim that, “*There is a serious problem with foreign propaganda and discerning the truth in the modern world. But the biggest part of the problem, and the starting point for considering what we may do about it, is the public’s incapacity to know, understand or believe anything much that the Australian government, and the Australian Defence Force, puts out about defence matters. It is rather more difficult to sort truth from fiction supposedly coming from the enemy when one has no idea about the reliability of what we are being told by our own. And not much reason to believe anything much they say either. …. Whether as an armed force, or as a military bureaucracy, it {the defence department] is more compulsively secretive than any of Australia’s allies, including Britain, the United States, and NATO. Other defence organisations train and trust their agencies and officials to engage with the general population, and to participate in debates on policy and strategy.”*

The lack of transparency and accountability that surrounds AUKUS is undermining of the credibility of the WPA Review. It is unacceptable that the WPA Review is to proceed without the Government making clear what its ambitions for the WPA are and an open evaluation of what the cultural, social, strategic, economic risks might be. How can public consultation be credible when the public is not informed? We are being kept on the wrong side of a very dark curtain.

Reviewers must expect and demand greater transparency and accountability of Defence for the sake of their own credibility as well as for our democracy.

5 September 2024

Review of the Woomera Prohibited Area Coexistence Framework
C/- Strategic Policy
R1-1-A098
PO Box 7901
Canberra BC ACT 2610
Email: woomera.review@defence.gov.au

Dear Sir/Madam

Exploration Licence Holder submission for the Woomera Prohibited Area Coexistence Framework Review

Background

The following submission is made on behalf of Marmota Limited and its wholly owned subsidiaries Marmosa Pty Ltd and Half Moon Pty Ltd which hold exploration licences within the Woomera Prohibited Area ('WPA'). Marmota including its subsidiary Half Moon Pty Ltd are Managers of the Golden Moon Joint Venture and Manager of the Western Gawler Craton Joint Venture, which also reside within the 'WPA'. Marmota (including its subsidiaries and Joint Venture rights) has 10,776 km^2 of exploration tenure within the WPA and has a multitude of prospective gold and advanced exploration projects which are spread across the AMBER 2 ZONE and GREEN ZONES within the WPA.

Submission Key Points:

1. ***Access: impact of existing access zones and exclusion periods on your activities and interests.***
    a. A number of our exploration licences overlap both the GREEN ZONE and AMBER 2 ZONE. Sometimes, we are asked to keep out of green zone areas even though the green zone is NOT closing, when they are close to amber zone areas that are closing ... even though they are not in the amber zone ... and should be open ... creating delays to our exploration programs and imposing unnecessary costs and denial of access to our tenements, which are costing us funds to run. One such case is at our Aurora Tank Gold Deposit which sits within EL 6470: the current drilling and deposit itself is within the GREEN ZONE.

    b. The closure zones have been impacting on Marmota's exploration programs, creating delays to our exploration programs and imposing costs in operating tenements which we do not have access to during the closure periods. Or worse, potentially we have to start drilling, then send the driller away, and either stop the program, or incur all the mobilisation costs of bringing the driller and our team back on site after the closure period ends.

c. Sometimes, closures (and particularly the issues raised in point 1a) have been communicated with very little notice, again imposing costs on us.

2. ***Management: What processes and practices are currently working well, and which could be streamlined or updated to reduce red tape?***
    a. We have recently completed Notification of a Variation in Permit (W010) which included 2 different subsidiaries and 2 joint ventures. We received multiple conflicting information from 3 different WPA officers for the information required for the Resource Exploration Permit (W001) and the process was too confusing for the WPA Personnel who may not be familiar with mineral Joint Ventures and exploration tenement holdings. This caused a number of emails, calls and back forward to explain the structure of joint ventures and subsidiaries, which is generally a simple structure for a junior explorer such as Marmota.
    b. The current Approved Person Status (W003) and Escorted Persons (W004) forms are difficult for contractors and personnel to complete. In some cases, personnel and contractors are unsure which sections to complete which results in delays in the personnel to complete or multiple attempts by Marmota as a company to fix before are able to send onto Woomera. Even when submitted, Woomera may then require further information. Generally, we work with remote workers such as DRILL COMPANIES where access to computers, printers, scanners and regular internet can become a problematic in completing such forms and causing multiple attempts to correct which results in delays in gathering all the required paperwork.
    c. Access Request (W007) forms. We have had issues over the years with access request forms being emailed to Woomera enquiries but not received. We have been informed that this due to the incoming emails being blocked, leading to delays in review and approval of the access requests, and subsequent personnel movement into the WPA.
    d. Timeframes for Approvals. In the past we have had problems with long delays in approved persons applications being processed, often beyond the stated timeline. We are pleased to note that this issue seems to have been resolved and hope that the timely turnaround of applications continues.

Regards,

Aaron Brown (Director of Exploration) on behalf of Marmota Limited and its wholly owned subsidiaries Marmosa Pty Ltd and Half Moon Pty Ltd.

Submission: Review of the Woomera Prohibited Area Coexistence Arrangements.

From the 2018 Review - "Recognizing the complexity of the WPA environment and the rapid pace of contemporary change, a further complete Review of the WPA arrangements is recommended by 2025."

It is now seen that the matters to be considered are far more complex and far-reaching than what might have been apparant in 2018. The "Timeframe" of this 2024 Review which "...should be finalised by the end of Q1 2025..." and the determination that the "Interim findings related to re-making the Rule should be presented by December 2024", puts great emphasis on making this Review an expedient process that within the current context cannot give due consideration to the matters in hand, or allow for a sufficiently broad, open and transparent Public Consulation Process.

I contend that the "Timeframe" is inadequate and must of necessity be refelective of the importance of the matters to be considered. I also request a detailed outline be produced of all prospective determination processes that are now planned in order to facilitate the unprecedented and unevaluated proposals that are now clearly on the table: ie. High Level U.S. Nuclear Waste Disposal within the WPA, facilitation of weapons testing at a greater intensity and increased military use of potentially high risk technological installations.

The assertion by the Hon. Richard Marles MP that given "The National Defence Strategy made clear that in response to our strategic circumstances, we must accelerate capability development and acquisition, including long range strike, and investment in emerging technologies for the A.D.F.", indicates a far greater potential development of the WPA than is expressed within the framework of this Review. (quote from dpm.media@defence.gov.au)

The Commonwealth Department of Defence and the ADF must show honesty to the People of Australia in truthfully outlining what is being proposed for the Woomera 'Prohibited' Area. It is, after all, Traditional Country and a vital Environment that requires the same due diligence in Assessment, Evaluation and Public Awareness of the proposals that the Commonwealth Government and the Military have for this area.

Despite claims by the Government that it can ensure "that the arrangements are in the interests of all users" (dpm.media@defence.gov.au), the potential impacts of now far greater developments both in the facilitation of weapons testing, siting of weapons? siting of a High Level Nuclear Waste Repository? take the WPA into a much larger realm of assessment of the 'Arrangements' than for other previous Reviews.

The manner in which this Review is being conducted would indicate a state of 'business as usual' in the WPA, but, the now commonly used phrase "fit for Purpose" in conjunction with the statement of the"Key Tasks" in the "Terms of Reference" that:

5. The Review should make qualitative and quantitative assessments of the balance of national interests over the short and medium (10year) term, including but not limited to:

b. anticipated future Defence needs in the WPA, in particular any potential changes in frequency and scope of activity"

indicates possible substantial changes that potentially require greater oversight.

The South Australian Nuclear Waste Storage Facility (Prohibition)Act 2000 specifically prohibits the development of Nuclear Waste infrastructure in S.A.
For the past 30+ years South Australians have opposed efforts from many sources to impose Nuclear Waste Disposal on S.A. This is the Public Position.

High Level Nuclear Waste Disposal is a massive undertaking that should necessarily be the responsibility of the Country producing the material, in this case the United States. Movement of such materials is fraught with considerable unacceptable hazards and risks as is the storage of such materials for the unimaginably long period that is required. No Government or Defence body can ensure safe disposal and maintenance of storage of High Level Nuclear Waste well beyond the foreseeable or even imaginable future.

" 3. Objects of Act. (Nuclear Waste Storage (Prohibition)Act. 2000)
The objects of this Act are to protect the health, safety and welfare of the people of South Australia and to protect the environment in which they live by prohibiting the establishment of certain Waste Storage Facilities in this State.

9. Prohibition against importation or transportation of nuclear waste for delivery to nuclear waste storage facilitity
A person must not -
(a) bring nuclear waste into the State, or
(b) transport nuclear waste within the State.

14. Public inquiry into environmental and socio-economic impact of nuclear waste storage facility.
If a licence, exemption or other authority to construct or operate a nuclear waste storage facility in this State is granted under a law of the Commonwealth, the Environment, Resources and Development Committee of Parliament must inquire into, consider and report on the likely impact of that facility on the environment and socio-economic wellbeing of this State."

From the 2018 Review:
"Analysis of new data in 2018 also identified additional areas with piotential for groundwater resources in the WPA."
Refer to Map - Water 2018 Review. This Map indicates that the Great Artesian Basin underlies the Woomera 'Prohibited' Area. Any notion of storing High Level Nuclear Waste is unthinkable.

Impacts of higher grade weapons testing, any siting of weapons or military technologies that attract active engagement all have potential for implications for the People, the Land and animals of the immediate vicinity and the wider South Australian Environment.

All consideration must be given to any proposals at this time with thorough and comprehensive investigation through Public Input.

The Objective at this time and in this Age is one of Peace and Co-Operation in our Region and in the World. There is great necessity to apply every effort in this regard. Honesty with the Australian People is imperative and ultimate respect and regard for the Lands and People of Woomera and its Environs vital to the future of us all.

Annie McGovern OAM. 6.8.24.

To: The Secretary

Woomera 'Prohibited' Area Review

Public Input by Mr David J. Noonan B.Sc., M.Env.St.

Independent Environment Campaigner and ABN Sole Trader Consultant

05 September 2024

Re: The Public Interest and Indigenous Rights in SA must not be compromised by an untenable Defence imposition of AUKUS military High-Level nuclear waste & nuclear weapons usable fissile material on the Woomera Area

Contents:

To: The Secretary

Woomera 'Prohibited' Area Review

Public Submission by Mr David Noonan B.Sc., M.Env.St.

Re: The Public Interest and Indigenous Rights in SA must not be compromised by an untenable Defence imposition of AUKUS military High-Level nuclear waste & nuclear weapons usable fissile material on the Woomera Area

Dear Secretary

An array of Public Interest and Indigenous Rights & Interests are at stake in South Australia facing an ongoing Defence siting assessment for imposed storage of AUKUS nuclear wastes.

The Woomera Area Review must require Defence to become transparent on these matters.

Please consider this input and the Recommendations provided (see p.9-10). I also request an opportunity to give Evidence as a Witness in a Hearing (see my Relevant Background, p.12).

This public input focuses on serious Defence "nuclear risks" and impacts that threaten the Woomera Area in SA and warrant full transparency and public interest disclosures by Defence.

The powers, imprimatur and pathway the AUKUS Agreement (Washington, 04 August 2024) drives a federal Labor agenda to impose nuclear powered submarine (N-Subs), "nuclear risks", and military High-Level nuclear reactor wastes & nuclear weapons usable fissile materials, with consequence for the Rights and Interests of Civil Society and Indigenous People in Australia.

The Review is an opportunity for the public to formally engage and scrutinise Defence plans for the future of the Woomera Area in context of the unfolding federal AUKUS agenda and Defence intention to over-ride State Laws and impose AUKUS N-Sub nuclear wastes on community.

Integrity, transparency, and accountability are key to public confidence in governance in Australia. This Review must face up to the fact the unfolding dangerous and undemocratic federal agenda to impose N-Sub's untenable High-Level nuclear wastes (N-wastes) undermines public confidence and is harming trust in governance in Australia.

The Review must take account of looming "nuclear risks" caused by the AUKUS Agreement in an uncosted liability of High-Level nuclear wastes to be imposed on all future generations.

The Safety, Health and Welfare, and Rights & Interests of targeted Australian communities and Indigenous Peoples are at stake, along with protection of the Environment in which they live.

Defence nuclear risks confront SA & NT as primary targets for intended N-waste Storage sites.

This Review must urgently inform SA community on "nuclear risks" they may face at Woomera.

The 'Review' of the Woomera Prohibited Area was announced by Defence Minister Marles MP: *"to ensure it remains fit for purpose and meets Australia's national security requirements"* – read AUKUS requirements. For transparency, the Review should Report pre the federal election.

The public has a 'Right to Know' who is targeted for imposed storage of AUKUS N- wastes.

Minister Marles MP has still not made a promised 'announcement', said to be by early 2024, on a process to manage High-Level nuclear waste and to site a waste disposal facility, he saying "*obviously that facility will be remote from populations*" (ABC News 15 March 2023).

The national press (11 August 2023) reports the Woomera rocket range is understood to be the 'favoured location' for storage and disposal of submarine nuclear waste ("Woomera looms as national nuclear waste dump site including for AUKUS submarine high-level waste afr.com).

Political leaders in WA, Qld and Vic have already rejected a High-Level nuclear waste disposal site. SA's Premier has so far only said it should go to a 'remote' location in the national interest.

This Review must respect the SA public and Traditional Owners rights to full disclosure of potential nuclear risks and impacts *in advance* of any decisions, legislation and process to impose AUKUS N-waste onto community in the Woomera Area or anywhere else in SA.

Defence can-not claim to have a '***social license***' to operate in the Woomera Area while failing to inform affected community of the AUKUS nuclear risks, the cultural and environmental impacts, and socio-economic impacts they may face through siting for AUKUS nuclear waste storage.

Defence has so far denied South Australians their '**Right to Know**' the nuclear risks they face.

AUKUS N-wastes are a threat to the Rights of the People of SA to decide their own Future.

The Woomera Area Review must understand that South Australians will not accept federal Labor and Defence undemocratic imposition of AUKUS nuclear wastes in our State.

If federal Labor go ahead with storage of AUKUS nuclear wastes in SA, it will have to over-ride State Law to impose the dump. AUKUS N-wastes are a threat to the Safety of the People of SA.

Storage and disposal of nuclear wastes compromises the Safety and Welfare of the people of South Australia, that is why it is *prohibited* by the *Nuclear Waste Storage (Prohibition) Act 2000*.

The Reforming Defence Legislation Review also proposes to take on Defence Act powers to override State legislation to 'provide certainty' to Defence roles, operations and facilities. My input and Recommendations to the Defence Review called for transparency on these issues:

> *Defence should become transparent over proposed Navy High-Level nuclear waste disposal, policy, siting process, rights and legal issues. Defence must declare whether the SA Nuclear Waste Storage (Prohibition) Act 2000 will be respected OR is intended to be over-ridden to impose a Navy High-Level nuclear waste storage or disposal site on 'remote' lands and unwilling community in South Australia.* (April 2023, p.7 & Rec 6-7)

I refer the Review's consideration to "**The Politics of Nuclear Waste Disposal: Lessons from Australia**", a Report by Dr Jim Green and Dimity Hawkins AM, Published by the Asia-Pacific Leadership Network (January 2024). The Defence AUKUS agenda needs to learn these lessons.

There is an onus on this Woomera Area Review to see it doesn't add to a sad history of nuclear disrespect for Indigenous Human Rights and Interests in our State.

Civil Society faces imposition of an AUKUS military High-Level nuclear waste dump:

The Federal ALP belatedly disclosed a secret pre-condition in AUKUS plans to buy second-hand US nuclear subs: for Australia to have to keep US origin military High-Level nuclear waste forever…

In a breach of trust the ALP is seeking to 'normalise' High-Level nuclear waste in Australia. Claims of 'nuclear stewardship' in taking on US N-Subs and in retaining untenable US N-Sub wastes are a farce.

Disposal of High-Level nuclear waste is globally unprecedented, with our AUKUS partners the US & UK having proven unable to do so in over 65 years since first putting nuclear powered subs to sea.

Minister for Defence Richard Marles MP has still not made a promised 'announcement', said to be by early 2024, on a process to manage High-Level nuclear waste and to site a waste disposal facility, he saying "*obviously that facility will be remote from populations*" (ABC News 15 March 2023).

Defence is already working to identify potential nuclear waste storage and disposal sites, is assessing existing Defence lands, and appraising potential regions with areas to compulsorily acquire a site.

The public has a right to know who is already being targeted for imposed AUKUS N- waste Storage.

Political leaders in WA, Qld and Vic have already rejected a High-Level nuclear waste disposal site.

The SA Labor Premier has so far only said it should go to a 'remote' location in the national interest.

AUKUS compromises public confidence in Gov and sets up a serious clash with civil society:

This Woomera Area Review must require Defence to become transparent and to be made accountable over rights and interests that are at stake in AUKUS intended military High-Level nuclear waste storage and federal Labor's still secretive N-waste siting process. For instance:

- Federal Labor must commit to comply with the United Nations Declaration on the Rights of Indigenous Peoples Article 29 provision of Indigenous People's Rights to "Free, Prior and Informed Consent" over storage or disposal of hazardous materials on their lands.

- Defence must declare their intension to over-ride the SA *Nuclear Waste Storage (Prohibition) Act 2000* to impose an AUKUS nuclear dump on outback lands and unwilling community in SA.

- Federal Labor must fully set out the array of AUKUS nuclear wastes to be stored in Australia.

The ALP National Platform (2021, Uranium p.96-98) makes a commitment to oppose overseas waste:

- *Labor will: 8. d. Remain strongly opposed to the importation and storage of nuclear waste that is sourced from overseas in Australia.*

In contrast, AUKUS aims Australia buy existing US military nuclear reactors in second-hand N-Subs that are to be up to 10-12 years old, loaded with intractable US origin High-Level nuclear wastes that are also weapons usage fissile materials – and remain as Bomb Fuel long after decommissioning.

Further, in an affront to public trust Labor's AUKUS Bill has been written to provide a federal legal power to take existing US and UK N-Sub nuclear reactor wastes for storage and disposal in Australia.

Federal Labor claims that it is not their 'policy' to do so – but it is their proposed Federal Law!

Defence is already targeting the Woomera Area as a potential region to site an imposed AUKUS military High-Level nuclear waste dump:

The Labor AUKUS Bill assumes a power and a right to over-ride State laws by naming State laws in Regulations that are to be made in 2025. Section 135 "Operation of State and Territory laws", states:

> *If a law of a State or Territory, or one or more provisions of such a law, is prescribed by the regulations, that law or provision does not apply in relation to a regulated activity.*

The AUKUS Bill provides for regulated activities in 'nuclear waste management, storage and disposal' at AUKUS facilities in future Nuclear Zones, which are to be authorised in part under Sec.135.

The national press has reported the Woomera rocket range is understood to be the 'favoured location' for storage and disposal of submarine nuclear waste ("Woomera looms as national nuclear waste dump site including for AUKUS submarine high-level waste afr.com 11 August 2023).

Defence will aim to compulsorily acquire and declare a High-Level nuclear waste dump site, with over-ride of State laws through this Bill, long before the buying a second-hand US N-Sub in 2032.

It was left up to a US Vice Adm. Bill Houston to reveal proposed sales of in-service Virginia-class subs will be in 2032 and in 2035, with a claimed first new N-Sub in 2038 (US Breaking Defence 8/11/23).

If Federal Labor decide to locate an AUKUS nuclear waste dump in SA, it will have to over-ride State Law to impose the dump. This AUKUS Agreement is a threat to the Safety of the People of SA.

Storage and disposal of nuclear wastes compromises the Safety and Welfare of the people of South Australia, that is why it is *prohibited* by the SA *Nuclear Waste Storage (Prohibition) Act 2000*.

Labor Premier Mike Rann strengthened these laws in 2002. Now Federal Labor may over-ride them.

The *Objects* of the Act cover public interest issues at stake, to protect our Health, Safety and Welfare:

> *"The Objects of this Act are to protect the health, safety and welfare of the people of South Australia and to protect the environment in which they live by prohibiting the establishment of certain nuclear waste storage facilities in this State."*

The import, transport storage and disposal of High-Level nuclear reactor waste is *prohibited* in SA. However, federal Labor are taking up legal powers to impose a dangerous AUKUS nuclear dump on SA or on the NT, through an undemocratic override of State laws and compulsory land acquisition.

The 2023 Reforming Defence Legislation Review proposed to take on Defence Act powers to override State legislation to 'provide certainty' to Defence roles, operations and facilities. My input and Recommendations to the Defence Review called for transparency on those issues.

The AUKUS Bill Senate Inquiry at "***Overrides other laws***" (p.66) states: "This issue has been noted by local communities and environmental groups including David J Noonan who stated in his submission:

The Bill is undemocratic and disrespectful to the people of SA in a proposed power under Section 135 "Operation of State and Territory laws" to over-ride any SA Laws or provisions of our Laws effectively by decree, a fiat of unaccountable federal agents to annul our Laws by naming then in Regulations."

This Woomera Area Review must respect South Australian's Democratic Right to decide their own Future and to Say No to Defence imposition of an AUKUS nuclear waste dump.

Indigenous People have a UN recognised Human Right to Say No to AUKUS N-wastes:

The AUKUS Agreement triggers the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, adopted by United Nations, Sept 2007) in Indigenous People's Article 29 Rights to "Free, Prior and Informed Consent" over storage or disposal of hazardous materials on their lands. AUKUS military High-Level nuclear wastes and fissile materials are absolutely 'hazardous materials'.

This Woomera Review must act in accordance with the Recommendations of the federal Inquiry Report (Nov 2023) into the UN Declaration on the Rights of Indigenous Peoples and respect Chair of the Inquiry, Indigenous Labor Senator Patrick Dodson's clear views on the matter, stating:

> *"the Commonwealth Government ensure its approach to developing legislation and policy on matters relating to Aboriginal and Torres Strait Islander people be consistent with the Articles outlined in the UNDRIP".*

It is concerning Labor has so far failed to act on key Rec. No.6 of this UNDRIP Inquiry, which states:

> "*The Committee recommends that the Human Rights (Parliamentary Scrutiny) Act 2011 (Cth) be amended to include the UNDRIP in the definition of 'human rights', so that it be formally considered when scrutinising legislation."*

This Review must call on the federal Labor and Defence to become transparent on whether or not they support the Rights of Indigenous Australians under the UNDRIP Article 29 to "Free, Prior and Informed Consent" - as a Human Right to Say No - over Storage of AUKUS military High-Level nuclear waste on their lands. **Transparency is a minimum standard to expect from this Woomera Review.**

The AUKUS Agreement builds on unacceptable steps to date. For instance, the "Statement of Compatibility with Human Rights" (Explanatory Memorandum to the current AUKUS Bill, p.97-102) misleadingly claims the Bills are compatible with Human Rights while excluding the UNDRIP.

I raised these issues of Indigenous Rights in my public input Recommendations to the 2023 Defence Review and to a Senate Inquiry into the current AUKUS Bill before Parliament - without response.

My input and Recommendations to the Defence Review called for transparency on these issues:

> *Defence should become transparent over proposed Navy High-Level nuclear waste disposal, policy, siting process, rights and legal issues. Defence should commit to respect and to comply with the United Nations Declaration on the Rights of Indigenous Peoples Article 29 provision of Indigenous People's rights to "Free, Prior and Informed Consent" over storage or disposal of hazardous materials on their lands.*

Traditional owners Human Right to Say No to the imposition of nuclear wastes must be respected. See "AUKUS nuclear waste dump must be subject to Indigenous veto" (By Michelle Fahy May 2023):

> "*Bipartisan secrecy and Defence's poor record with Indigenous groups at Woomera are red flags for consultations over an AUKUS nuclear waste dump. Human rights experts say government must establish an Indigenous veto right."*

Question: Will Defence respect OR disregard Indigenous Peoples UN recognised Right to Say No?

Is US origin military High-Level nuclear waste from US N-Subs to be dumped at Woomera?

The Federal ALP belatedly disclosed a AUKUS pre-condition to Australia's purchase of second-hand US nuclear submarines: for Australia to keep the US origin N-Subs military High-Level nuclear waste.

This was kept secret in the federal election and only revealed to the Australian public in March 2023.

The ALP is seeking to 'normalise' High-Level nuclear waste in Australia with simplistic claims of 'nuclear stewardship' in taking on untenable liabilities to retain US origin N-Subs N-wastes forever.

Disposal of High-Level nuclear waste is unprecedented at a global scale, with the US and UK having proven unable to do so in over 65 years since first putting nuclear powered submarines to sea.

In Defence seeking to claim 'nuclear stewardship' over nuclear waste it can be anticipated that a final site for an AUKUS military High-Level nuclear waste storage or disposal facility will be acquired and declared before a first purchase of a second hand US nuclear powered submarine, due in 2032.

The current AUKUS Bill Section 10 provides powers to declare a Designated Zone to impose a nuclear waste Storage site and Section 135 provides powers to over-ride State laws that protect public safety.

AUKUS aims Australia buy existing US military nuclear reactors in second-hand N-Subs that can be up to 10-12 years old, loaded with intractable US origin weapons grade High-Level nuclear wastes.

This is 'flag swapping' an Australian flag onto existing US N-Sub High-Level nuclear reactor wastes.

It has been reported the second-hand US nuclear subs for purchase by Australia will allow approx. 20 years of nuclear reactor operations to be left out of a cited 33-year reactor period.

US Vice Adm. Bill Houston revealed sales of in-service Virginia-class N-Subs will be in 2032 and 2035, with a first new Virginia N-Sub said to be sold to Australia in 2038 (US Breaking Defence 08 Nov).

This Review must seek a full explanation of how Defence claims to manage and perpetually store intractable US origin High-Level nuclear wastes from two second-hand US Virginia N-Subs.

AUKUS claims of 'nuclear stewardship' in taking over US N-Subs and in retaining the US origin High-Level nuclear wastes are a farce. The US has been unable to dispose of any High-Level N-wastes.

AUKUS touted production of a future British N-Sub design in the 2040's, claimed to be built at an Osborne Dedicated Nuclear Zone, may never be realised - but this US origin N-waste threat is real.

This Review must consider and accept that it is undemocratic for Civil Society and Indigenous People in SA to have to face the serious risks and impacts in required perpetual Storage of intractable US origin military High-Level nuclear wastes and weapons usable fissile materials.

These US origin military High-Level nuclear wastes present an unprecedented, untenable threat to the Health, Safety and Welfare of the People of SA and to the Environment in which they live.

The import, transport storage and disposal of these AUKUS US origin nuclear wastes is against the Law in SA and must remain *prohibited* in our State to protect the Safety of the People of SA.

Multi-billion $ N-waste Costs are ignored while the US gets Indemnity over nuclear risks:

Under threat of Defence imposition of AUKUS N-wastes in the Woomera Area this Review must require a full public exposition on the array of "nuclear risks" South Australia is exposed to by the AUKUS Agreement, and the consequences of an intended grant of Indemnify to the US.

The National Interest Analysis [2024] ATNIA 14 to the AUKUS Agreement is written by the proponent of N-Subs the Australian Submarine Agency (ASA) and is clearly not fit for purpose.

The NIA is without regard to Australia's interests in the Agreement bringing "nuclear risks" here.

The NIA gives uncritical support to the Agreement granting a wide-ranging *Indemnity* to the US for "nuclear risks" in second-hand Virginia N-Subs and associated US origin nuclear materials:

> ***Indemnity*** *22. The Agreement requires Australia to indemnify the UK and the US against any liability, loss, costs, damage, or injury (including third party claims) arising out of, related to, or resulting from nuclear risks (risks attributable to the radioactive, toxic, explosive or other hazardous properties of materials) … transferred pursuant to the Agreement (Article IV(E)). …*

The NIA 23 further supports "*the management of nuclear risks to be indemnified by Australia*" to be subject to an unstated role for the US to determine arrangements and "*visibility of activities"*.

This reads as a 'secrecy clause' to preference US interests over Australian interests. To limit the 'visibility' (and public reporting?) of "nuclear risks" and of required response arrangements.

To even attempt to address the serious array of "nuclear risks" imposed by the Agreement would require *unfettered* 'management and arrangements' and must be in our National Interests alone.

These matters require a full exposition re the "nuclear risks" we face in proposed US Indemnity.

Further, the NIA entirely ignores the **$ Cost to Australia** of storing and disposing of US origin High-Level nuclear wastes and weapons usable fissile materials from the first two second-hand 10- to 12-year-old US Virginia Class N-Subs to be 'Australian flagged' in 2032 and in 2035.

There is an onus on this Review to require public $ Costings and an evidentiary basis from the federal Gov for AUKUS nuclear waste storage on the Woomera Area, on:

- the liability $ Cost consequent to this AUKUS Agreement in required capability and facilities for *in perpetuity* High-Level nuclear waste storage and geological disposal;
- whether the $ Cost of High-Level nuclear waste storage and claimed geological disposal is included in - OR is additional to - the public Cost of AUKUS at approx. A$368 billion.

These Costs must be in the order of at least 10's of billions of dollars, yet this is entirely ignored throughout the AUKUS agenda, with only flippancy from proponent ASA's claim at NIA Costs 46:

> *"No regulatory costs associated with this treaty action are anticipated and each Party will bear its own incidental costs…"*

Recommendations:

These Recommendations No.1-5 comprise public interest disclosures that must be required from Defence to facilitate an informed public Review of the future of the Woomera Area:

1. Civil Society faces imposition of an AUKUS military High-Level nuclear waste dump

This Review must respect affected Communities and Indigenous People's '**Right to Know**' the Defence imposed nuclear risks they face in intended High-Level nuclear waste & nuclear weapons usable fissile material storage and disposal facilities.

1.1 The Review must call on Defence to publicly disclose which Australian regions and Indigenous Peoples are currently under threat of imposed siting and compulsory land acquisition for an AUKUS High-Level nuclear waste dump, and which - if any - existing Defence lands are included in the regional short list that is currently being prepared.

1.2 The Review must make Defence become accountable over the future and fate of the Woomera Area, understood in national media to be a 'favoured location' for storage and disposal of submarine nuclear waste ("Woomera looms as national nuclear waste dump site including for AUKUS submarine high-level waste afr.com AFR 11 August 2023). Noting the Woomera Area is currently subject to a Defence 'Review': *"to ensure it remains fit for purpose and meets Australia's national security requirements"* – read AUKUS requirements.

1.3 Defence must become publicly accountable and declare its intension to over-ride the SA *Nuclear Waste Storage (Prohibition) Act 2000* through powers in an AUKUS Bill now before Parliament (Sec.135 "*Operation of State and Territory laws*"): to impose an AUKUS nuclear waste dump on outback lands and unwilling community in SA, by decree in federal Regulations.

This Defence agenda to impose nuclear waste storage in SA also involves Defence over-ride of the SA ***Environment Protection Act 1993*** and over-ride of the SA ***Aboriginal Heritage Act 1988***.

2. Indigenous People have a UN recognised Human Right to Say No to AUKUS N-wastes

The Woomera Area Review must respect the clear views of Indigenous Labor Senator Patrick Dodson and act in accordance with the Recommendations of a Federal Inquiry Report (Nov 2023) into the UN Declaration on the Rights of Indigenous Peoples, stating:

> *"the Commonwealth Government ensure its approach to developing legislation and policy on matters relating to Aboriginal and Torres Strait Islander people be consistent with the Articles outlined in the UNDRIP".*

2.1 This Review must seek an explanation from the federal Labor Gov as to whether they will commit to respect and comply with the United Nations Declaration on the Rights of Indigenous Peoples Article 29 provision of Indigenous Peoples Rights to "Free, Prior and Informed Consent", as a Right to Say No, over storage or disposal of hazardous materials on their lands;

OR if Federal Labor intends to claim a sanction to over-ride UNDRIP and to impose a hazardous AUKUS nuclear waste dump against the potential express wishes of Traditional Owners.

3. US origin military High-Level nuclear waste from US N-Subs to be dumped at Woomera?

The Woomera Area Review must recognise the AUKUS Agreement's proposed importation of US origin military High-Level nuclear wastes sourced in 10–12-year-old US Navy nuclear reactors in second hand US Virginia Class N-Subs that will require perpetual storage in Australia:

This Review must seek a full explanation of how Defence Minister Marles claims to be able to manage a globally unprecedented task in siting and perpetual storage & disposal of intractable US origin High-Level nuclear wastes from second-hand US Virginia N-Subs.

It is not credible for the Review to overly rely on claims by AUKUS proponent Minister Marles.

3.1 The Review should call on Minister Marles to explain the incompatibility between the AUKUS Agreement's transfer of US origin Virginia Class N-Sub nuclear wastes to Australia, effective importation of nuclear wastes sourced from the US, and the pre AUKUS Federal Labor Policy commitment in the ALP National Platform (2021, Uranium p.96-98) to oppose overseas waste:

- *Labor will: 8. d. Remain strongly opposed to the importation and storage of nuclear waste that is sourced from overseas in Australia*.

4. Multi-billion $ N-waste Costs are ignored while the US gets Indemnity over nuclear risks

There is an onus on this Review to require public $ Costings and an evidentiary basis on:

- the liability $ Cost consequent in required capability and facilities for *in perpetuity* High-Level nuclear waste storage and geological waste disposal at the Woomera Area;
- whether the $ Cost of High-Level nuclear waste storage and claimed geological disposal is included in - OR is additional to - the public Cost of AUKUS at approx. A$368 billion.

These unstated, kept secret, liability $ Costs must be in the order of at least A$10's of billions.

4.1 In the public interest the Review must require a full exposition on the array of nuclear waste risks the AUKUS Agreement exposes the Woomera Area to and grants the US Indemnity over.

> *"**Indemnity** 22. The Agreement requires Australia to indemnify the UK and the US against any liability, loss, costs, damage, or injury (including third party claims) arising out of, related to, or resulting from nuclear risks (risks attributable to the radioactive, toxic, explosive or other hazardous properties of materials) … transferred pursuant to the Agreement (Article IV(E))."* (In the National Interest Analysis [2024] ATNIA 14)

5. The Review must be transparent on Defence's roles for Woomera in AUKUS and in war

Our survival is at stake, ex-Ambassador to China, Ross Garnaut has stated (20 August 2024):

> *"America would be damaged by war with China over the status of Taiwan, but, short of a major nuclear exchange debilitating both great powers, its sovereignty would not be at risk. Australia's would be. **Indeed, I doubt that Australia could survive as a sovereign entity** the isolation from most of Asia that would be likely to follow anything other than a decisive and quick US victory in a war in which our military was engaged."*

Discussion:

Defence imposed AUKUS military High-Level nuclear waste & nuclear weapons usable fissile material on all future generations of Australians is untenable and will be opposed at Woomera.

This Review must at least be able to facilitate informed public consideration of the future of the Woomera Area through required full disclosures from Defence to the set of pre-requisite public interest Recommendations No.1-5 presented in this public input.

Australian regional communities and Indigenous groups have a '**Right to Know**' who is being currently targeted for siting and assessment of an AUKUS nuclear waste storage / dump.

The Review must realise an answer from federal Labor over whether the UNDRIP championed by Senator Patrick Dodson will be complied with OR over-ridden to impose AUKUS N-wastes.

Three years into AUKUS the failure to respect affected communities 'Right to Know' is evidence Defence is on a seriously wrong track and is undermining trust in governance in Australia.

There is an onus is on this Review to investigate the array of serious nuclear waste risks to be imposed on Woomera through AUKUS and subject to an Indemnity to favour US interests.

The Review must be transparent on Defence roles for Woomera in AUKUS and in war.

It is arguable that AUKUS and N-Subs bring Australia closer to a devastating **war** between the US and China, including likely strikes on Australia with a real risk of nuclear weapons strikes.

For instance, the Review should consider "AUKUS: The worst defence and foreign policy decision our country has made" by ex-Foreign Affairs Minister Gareth Evans (17 August 2024):

> *"... Four, the price now being demanded by the US for giving us access to its nuclear propulsion technology is, it is now becoming ever more clear, extraordinarily high. Not only the now open-ended expansion of Tindal as a US B52 base; not only the conversion of Stirling into a major base for a US Indian Ocean fleet, making Perth now join Pine Gap and the North West Cape – and increasingly likely, Tindal – as* ***a nuclear target*** *...*
>
> ***Australia's no-holds-barred embrace of AUKUS is more likely than not to prove one of the worst defence and foreign policy decisions our country has made****, not only putting at profound risk our sovereign independence, but* ***generating more risk than reward for the very national security it promises to protect****."*

Australia's survival is at stake. Ross Garnaut ("When an experienced ambassador to China speaks on AUKUS, we should listen" 20 August 2024) is reported as stating:

> *"America would be damaged by war with China over the status of Taiwan, but, short of a major nuclear exchange debilitating both great powers, its sovereignty would not be at risk. Australia's would be.* ***Indeed, I doubt that Australia could survive as a sovereign entity*** *the isolation from most of Asia that would be likely to follow anything other than a decisive and quick US victory in a war in which our military was engaged."*

It is not credible for this Review to overly rely on claims by AUKUS proponent Minister Marles.

As to my Relevant Background: In 30 years' experience scrutinising environment and nuclear public interest issues. I have provided public input and Recommendations relevant to matters now before this Review to AUKUS Federal Parliamentary and Defence processes held over the last 3 years:

- The JSCT Inquiry into the AUKUS Agreement, public input 2 Sept 2024, Rec's p.10-12;
- The Inquiry into *the Australian Naval Nuclear Power Safety Bill 2023*, by the Senate Foreign Affairs, Defence and Trade Legislation Committee, Submission No.8 Jan 2024, Rec's at p.11;
- The Reforming Defence Legislation Review, Submission No.34, Recommendations 6-7 at p.3 and discussion at p.7, 20 April 2023;
- An earlier AUKUS Inquiry by the Senate Foreign Affairs, Defence and Trade Legislation Committee held on the *Defence Legislation Amendment (Naval Nuclear Propulsion) Bill 2023 [Provisions]*, see Submission No.46, Recommendations 1-5 at p.2, 26 May 2023;
- The Defence Strategic Review, my public input is recorded but was not released by that process;
- The "Exchange of Naval Nuclear Propulsion Information Agreement" (ENNPIA) Inquiry by the Treaties Committee, Submission No.40 (27 p), Recommendations at p.12, 25 Nov 2021.

I served for sixteen years as an Australian Conservation Foundation (ACF) environment campaigner 1996-2011 with primary roles on public interest nuclear issues.

Including as lead author of ACF nuclear issues public input to Joint Standing Committee on Treaties Inquiries and as an ACF witness in JSCT Hearings on uranium sales issues with China & with Russia.

As an individual, I later gave evidence as a witness before the JSCT Inquiry on UAE uranium sales, provided input to the JSCT Inquiry on Ukraine uranium sales, and am quoted in both JSCT Reports.

Roles as an ACF campaigner included over 5 years on a prior federal attempt to impose a nuclear waste dump in SA - 1998 through 2004 – another flawed process that had to be abandoned.

I have been an invited Witness as an individual involved on nuclear waste issues at a 2016 Hearing of the SA Parliament Joint Committee Inquiry on the Findings of the SA Nuclear Royal Commission.

As an Independent Environment Campaigner, I have provided public interest Briefing and Public Submissions throughout the National Radioactive Waste Management Facility process 2015-23.

For instance see a Brief "Nuclear Waste Store siting at Napandee also targets the Port of Whyalla" (Feb 2020, 2 p), and a formal Public Comment: "Input to the CEO of ARPANSA on Alternative Storage of ANSTO ILW at Lucas Heights" (Nov 2021, 26 p).

As illustrative of some of the public interest issues in nuclear waste siting processes I refer you to my public input to the Federal Environment Department on Guidelines for an Environmental Impact Statement process on the then proposed nuclear waste facility at Kimba (March 2023, 11 p).

I have a role in media comment on public interest nuclear issues, for instance see an article: "***Alarm on nuclear waste transport***" (By Clare Peddie, SA Sunday Mail Rural Edition, 31 July 2022).

Yours sincerely

Mr David J Noonan B.Sc., M.Env.St.

Independent Environment Campaigner and ABN Sole Trader Consultant

Seaview Downs SA

Review of the Woomera Prohibited Area Coexistence Framework

Nova Systems Submission

6 September 2024

A Submission to the Review of the Woomera Prohibited Area Coexistence Framework by Nova Systems.

Designated contact:

Peter La Franchi

Executive General Manager Future Business.

peter.lafranchi@novasystems.com

T: +61 2 9043 2512

15 Lancaster Place, Majura Park, Canberra, 2609

novasystems.com

Summary

Australia's changed strategic circumstances requires an accelerated approach to Australian Defence Force (ADF) capability generation, sustainment, and operational preparedness.

The Woomera Protected Area (WPA) hosts the nation's premier Defence Test and Evaluation (T&E) facility. This critical facility is essential to the objective of rapid capability uplift of ADF capabilities, particularly the focus on rapid fielding of Minimum Viable Capabilities (MVC). WPA is likewise a direct enabler of Australia's contribution to Pillar Two of the common AUKUS security framework with the United Kingdom and United States.

More is needed from WPA by Defence and defence industry between 2024 and 2030. Longer term ADF and AUKUS needs will increasingly elevate those needs over the period 2030-2040. New approaches are required to allow increased rates of usage in support of defence capability test and evaluation as soon as possible.

This submission identifies the current Coexistence Framework as representing a pre-established enabler of increased defence industry usage of Woomera in support of the ADF and the AUKUS alliance.

This forward leaning and highly relevant framework can directly enable increased range usage where Defence and the Commonwealth elect to:

- Progress the WPA Coexistence Framework first through a focus on integrating forward access and use arrangements with Defence's own strategic planning for enhanced, whole of enterprise T&E requirements.
- Advance a WPA range evolution roadmap as a fundamental building block of the forward Coexistence Framework.
- Progress forward planning and usage approvals for the WPA on the basis of a dynamic, whole of range perspective, and enable this with a whole of range geospatial digital twin.
- Create new range complexes within WPA to support expanded Defence and defence industry T&E activities.
- Develop and implement a whole of WPA electromagnetic spectrum mapping and management system.
- Allow defence industry to meaningfully engage in, and shape, the enhanced capabilities of WPA to meet Defence T&E needs. This includes capacity for industry to invest in T&E capabilities and infrastructure within WPA and operate this commercially for users which include allied nations.

Test and Evaluation as a Cornerstone of Australia's Defence Strategy

Australia's Defence Strategic Review (DSR) of 2023 identifies the pursuit of Minium Viable Capability (MVC) as a significant enabler of rapid capability generation to underpin Australia's response to changed security conditions across the Indo-Pacific region. As a concept, MVC seeks to ensure that the Australian Defence Force (ADF) can achieve a threshold capability effect quickly, rather than waiting for the perfect solution. This approach allows the ADF to respond more rapidly to emerging threats and adapt to changing strategic environments.

The key aspects of MVC include:

- Delivering essential capabilities that meet immediate defence needs.
- Allowing for further development and enhancement over time.
- Incorporating all fundamental inputs of capability, including materiel and sustainment components.

This strategy is part of a broader shift towards prioritising readiness, speed to capability, and the ability to integrate new technologies swiftly. By focusing on MVC, Australia aims to maintain a robust and flexible Defence posture, capable of addressing current and future security challenges swiftly and effectively.

Test and Evaluation (T&E) plays a pivotal role in ensuring the effectiveness, safety, and reliability of Defence capabilities, and is therefore a direct enabler of its ability to advance MVC in the shortest possible time. T&E's role across the ADF and the Department of Defence (DoD)is multi-faceted. At a fundamental level it enables capability risk management by providing objective evidence to support risk-based decisions, ensuring that new technologies, concepts, and capabilities are safe and operationally viable before they are deployed, and then across the full in-service lifecycle. This process helps to identify and mitigate potential risks early, reducing the likelihood of costly failures or operational issues. Throughout the entire life cycle of a system, from concept and acquisition to in-service use and disposal, T&E confirms whether risks are contained within acceptable boundaries. This continuous assessment ensures that the capabilities remain effective and reliable under various conditions. T&E is not a once-off requirement or process.

The Defence Industry Development Strategy (DIDS) of 2024, and, in particular, its associated Sovereign Defence Industrial Priority Number Seven (SDIP7), T&E, Certification and Systems Assurance (T&ECSA), identifies that achieving MVC in the shortest possible time requires a significant uplift in sovereign T&E capability and capacity in the broad. It identifies the need to focus on testing early during the development process to rectify any deficiencies before they manifest themselves in production. SDIP 7 also calls for defence

industry's innovative use of currently available T&E infrastructure, to the greatest extent possible, to test, assure, and where necessary certify, enhanced capabilities. To effectively support Defence in this mission, defence industry must have a greater level of access to existing T&E infrastructure.

This industry call-to-action is clearly articulated by the DIDS as a near-term Defence objective. It reflects the vital role industry plays in ensuring Defence T&E enterprise capability and infrastructure is sufficient and relevant to the technologies and products it delivers, and its ability to enable MVC in the shortest possible time.

The DIDS policy framework, as focussed by SDIP 7, therefore represents fundamental guidance to the current review of the WPA Coexistence Framework. Meeting SDIP7 objectives necessitates active thinking as to how this policy objective will be met in a constructive and forward-leaning approach.

The Woomera Prohibited Area: A Sovereign Security Asset

The WPA is a vast and significant military testing range located in South Australia, approximately 450 kilometres northwest of Adelaide. Spanning around 122,000 square kilometres, it is one of the largest land-based test ranges in the Western world.

The WPA plays a crucial and multifaceted role in ADF T&E. At a high level these can be characterised as:

- Providing a secure testing environment. The WPA provides a secure and controlled environment for the ADF to conduct tests on advanced military technologies and systems. Its vast and remote location ensures testing can be carried out safely, with minimal risk to civilian populations.
- Enabling testing of advanced systems and capabilities. The WPA is used to test a wide range of defence systems, including missiles, rockets, and other advanced weaponry. This includes both current technologies and emerging capabilities that are critical for maintaining and enhancing Australia's defence readiness.
- Enabling space and advanced aerospace testing. In addition to traditional military testing, the WPA is a significant site for space and advanced aerospace capability trials. This includes testing of satellites, space launch vehicles, and other aerospace technologies. The WPA's unique environment makes it ideal for these high-tech evaluations.
- Enabling collaboration and innovation. The WPA facilitates collaboration between the ADF, defence industry, and academic institutions. This collaborative environment fosters innovation and ensures that the ADF can leverage the latest technological advancements to maintain a competitive edge.

The WPA is considered a significant national security asset and is integral to the ADF's capability development. It supports the development and testing of capabilities that are essential for Australia's national defence strategy. This includes long-range strike capabilities and other advanced systems that are crucial for responding to contemporary strategic challenges.

Coexistence in the Woomera Prohibited Area

Due to its isolation, and its vastness, the WPA is a sought-after and well-utilised facility even when considering its application as a military test asset alone. The "Coexistence Framework", which consists of the Woomera Prohibited Area Rule 2014 and a Memorandum of Understanding between the Commonwealth of Australia, South Australian Government, and the WPA Advisory Board, aims to ensure that Defence activities can proceed without undue interference while allowing other stakeholders to access and use the land. This framework includes specific access zones and exclusion periods to manage the different uses of the area. For example, certain zones may be restricted during Defence operations but open for other activities at different times.

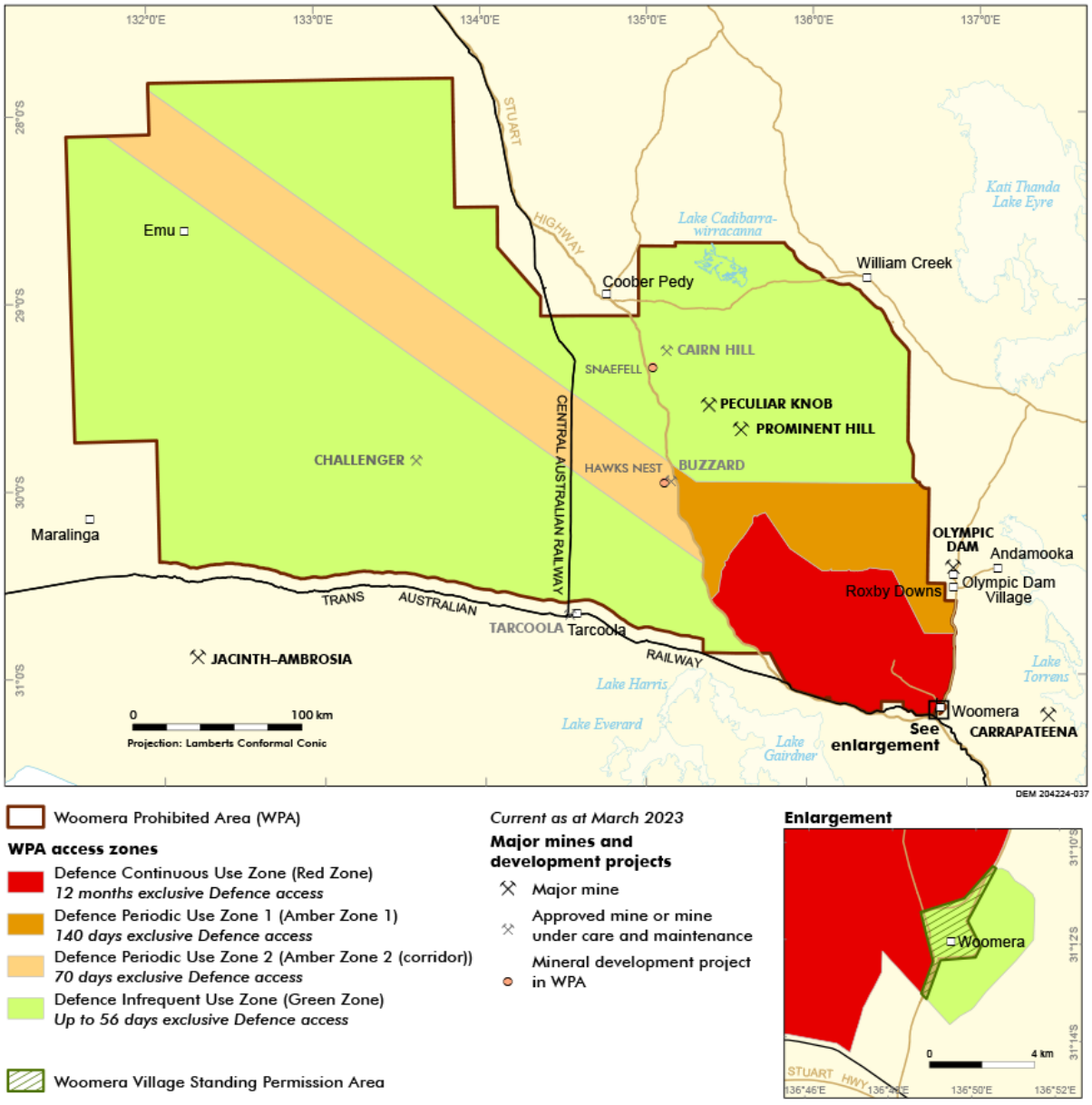
The Framework represents a Defence and Commonwealth policy commitment to commercial usage of the range. This framework:

- Provides the mechanisms by which applications will be considered and approved.
- Defines the enabling mechanisms for commercial access, and
- Sets out the requisite control and security mechanisms required to protect ADF and Commonwealth interests.

Various non-Defence activities already coexist in the WPA under this framework, including pastoralism, mining, Aboriginal cultural heritage, tourism, and scientific research.

Despite being divided into four separate zones, each with specific access levels and exclusion periods, the WPA can often be inaccessible to the wider defence industry due to long backlogs of large, long-running test programs. In some cases, these programs require the use of the full WPA footprint, however in most cases, large expanses of the WPA remain underutilised, with opportunities for multiple parallel test activities to occur.

The current approach to supporting such parallel test activities is managed case by case, rather than from an integrated, whole of WPA perspective. Optimising the efficient use of this sovereign strategic asset, and maximising Defence's and defence industry's access to the facility serves to mitigate Australia's T&E capability and capacity shortfall and meet Australia's strategic need for MVC in the shortest possible time.



Source: https://www.defence.gov.au/bases-locations/sa/woomera/about/maps

Expansion of Defence Industry Access to the Woomera Prohibited Area Under the Coexistence Framework

The 2018 Review of the WPA Coexistence Framework foreshadowed increased Defence use requirements as a result of ongoing ADF capability uplift plans. In response, that review proposed an enhanced WPA management environment which leveraged a combination of 'grid' analysis, particularly of the Green Zone, and a common range management digital platform. This approach sought to increase the granularity of awareness of how particular parts of the range were already being utilised, and better understand potential forward use cases. As proposed, the digital platform would host usage data and provide a mechanism for enhanced communications with all range users.

The 2018 review also highlighted the continuing need for non-Defence users of the range to accept that the range is first and foremost a military T&E environment, and all other use cases secondary even if commercially significant. That emphasis on defence T&E was supported by acknowledgement that technical equipment deployed within the range area may have an impact on Defence and defence industry activities, and that non-Defence usage may have security implications.

The findings of the 2018 Review remain valid in the broad. However, to meet current and forward Defence and defence industry T&E needs, key steps are now required.

First, the current review of the WPA Coexistence Framework must first focus on integrating forward access and use arrangements with Defence's own strategic planning for enhanced, whole of enterprise T&E requirements, as first reflected in the 2021 Defence T&E Strategy.

Second, as a planning principle, forward planning and usage approvals for the Woomera Protected Area should be based on a dynamic, whole of range perspective, rather than a case-by-case model.

Case-by-case management deals with a specific circumstance rather than an integrated assessment. Compounding case by case decisions and authorisations can directly result in the effective close out of range areas for significant time periods.

A capacity to assess whole of range impacts requires whole of range planning and management tools and systems. There is an immediate need for a highly detailed geospatial twin of the WPA, implemented on a progressive basis which begins in the Red Zone, then advances into the southeastern Green Zone, followed by the northeastern Green Zone and Amber Zone. A geospatial digital twin would in turn provide the foundation layer for a whole of range digital management platform.

Third, a specific WPA range evolution roadmap is required as a fundamental building block of the forward Coexistence Framework.

The WPA is a unique asset in western military terms, but more is needed from it. The scale down of the range and its capabilities from the 1960s onwards has resulted in a limited set of facilities and focal areas. There is now a need to identify and reserve internal areas where new range complexes can be developed in the immediate as well as longer terms.

Predicated on the SDIP7 objective of enhanced defence industry access to ADF ranges, and reflecting both ADF capability plans and AUKUS Pillar Two collaborative activities, these new WPA range complexes should include multiple areas dedicated to electromagnetic spectrum operations, through air cyber operations, counter remote and autonomous weapon system operations, and directed energy weapon operations.

A comprehensive geospatial twin of WPA will allow for highly detailed whole of range assessments to identify candidate sites for such complexes relative to the current and anticipated future technical capabilities of such systems. The geospatial digital twin would

likewise inform and enhance decision making relative to the environmental attributes each new range complex would display and present, and the planning and location of enabling, support and access infrastructure.

Fourth, a whole of WPA electromagnetic spectrum mapping and management system is required.

Defence systems are inherently dependent on access to and control of vast segments of spectrum. Electronic warfare, cyber and directed energy systems inherently shape and impact electromagnetic spectrum in specific ways to achieve effects. Defence systems T&E is inherently data intensive, and access and control of the electromagnetic environment is a critical factor.

A whole of WPA electromagnetic spectrum mapping and management system would commence with a whole of range survey, then implementation of standing, real time monitoring nodes for the existing Red Zone, and then any new range complexes within the Green Zone. Integrated with a whole of WPA geospatial digital twin, this capability would facilitate rapid identification of cross-range electromagnetic spectrum impacts and issues, allow for meaningful whole of range electromagnetic spectrum application choices by Defence and defence industry, implementation of designated silent zones, guide and inform non-Defence users at an early stage as to the consistency and appropriateness of their technical equipment selections on primary WPA range operations. Such a system would also directly contribute to WPA security by allowing for location and identification of unexpected spectrum usage events.

Fifth, a formalised process is required to allow defence industry to meaningfully engage in, and shape, the enhanced capabilities of WPA to meet Defence T&E needs.

The existing Defence standing contract for management of WPA is due to expire in June 2026. Rather than again contract for a single provider around a singular range hub model, there is a strong opportunity for Defence to increase the overall level of industry participation in supporting its overarching T&E needs by application of new models for defence industry access to, and investment in WPA, this including increased usage by AUKUS, allied and western alliance security partners.

Opportunities for greater access, and usage of WPA will enable defence industry to amortise their investments in T&E tools and range infrastructure over an increased number of commercial activities. Linked with the opening-up of multiple new range complexes within the WPA, such an approach would directly enable the Government's SDIP7 objectives.

Annex: About Nova Systems

Nova Systems is a 100% Australian owned and controlled engineering services and technology solutions company, partnering with our clients to keep our nation and people safe and secure. We deliver specialist systems engineering advisory and management services alongside advanced digital technology, software, and systems integration solutions.

There are few recent complex major projects of national safety and security we haven't been involved with. Team Nova is the only 100% Australian-owned and controlled Major Service Provider (MSP) to Defence's Capability Acquisition and Sustainment Group (CASG).

For more than two decades we have been a sovereign leader in T&E partnering with industry and academia to contribute to Australia's sovereignty, security, and safety. Nova Systems was founded on delivering these critical capabilities to the ADF.

We are proud of our economic contribution to Australia and the local jobs we have created. We are committed to building a sustainable and enduring sovereign defence industrial capability based here in Australia, under Australian control. As a sovereign leader, we uniquely understand how to grow, strengthen, and sustain Defence T&E capability as a critical enabler of the full spectrum of ADF capability.

We are the sovereign smarts behind the solution.

Paupiyala Tjarutja
Aboriginal Corporation

Ilkurlka Community
PMB 8002
Kalgoorlie
WA 6433
Phone: 08 9037 1147
Fax: 08 9037 1157
ilkurlka@spinifex.org.au
www.ilkurlka.org.au
ABN 20 304 504 408

ilkurlka

Spinifex Country

Woomera Prohibited Area submission 2 September 2024

Organisation:

Paupiyala Tjarutja Aboriginal Corporation

On behalf of Ilkurlka roadhouse

Introduction

Ilkurlka is managed by Paupiyala Tjarutja Aboriginal Corporation which is based in Tjuntjuntjara.

The reason for the existence of Ilkurlka is that it sits in the heart of the Spinifex native title area. As such, its location is in a culturally significant area and its establishment reflects the aspirations of the community.

From a traveller's perspective, Ilkurlka provides the only service point between Coober Pedy and Laverton and between Tjuntjuntjara and the northern communities. As well as a fuel resupply point Ilkurlka functions as a safety and emergency location. An airstrip is maintained and can be used for medivacs and each year about half a dozen rescues are performed, generally in conjunction with the Blackstone police located about 350km to the north. An RFDS emergency medical chest is on site and in conjunction with a phone consultation with the RFDS doctor medication and first aid treatment can be given pending a possible medivac by plane.

Ilkurlka was set up in part with the compensation money received after the nuclear testing. The roadhouse is owned by the Spinifex people in Tjuntjuntjara – these people were adversely impacted by the nuclear testing program in the same way as the people of Maralinga Tjarutja were.

The community has always recognised that Ilkurlka was a social enterprise rather than a commercial one. By siting Ilkurlka on a tourist route the expectation was that this traffic would subsidise the costs of running Ilkurlka. Ilkurlka has a short tourist season from April to September. Any closures in the Woomera Prohibited Area during this time severely diminishes traffic and revenue as can be seen from the spreadsheet which we have sent.

Ilkurlka relies on revenue in this period to maintain some sort of viability. As a direct result of these closures Ilkurlka has had to run at a larger than expected loss. These losses require a subsidy from Paupiyala Tjarutja Aboriginal Corporation to cover the financial impacts caused by closures of the Anne Beadell Highway in Amber Zone 2 during April to September.

The community members of Tjuntjuntjara are directly and adversely impacted by the Department's actions. The increased subsidy required from Paupiyala Tjarutja Aboriginal Corporation to cover

periods of road closures is covered by discretionary spending which results in other programs receiving less funding (for example: youth, sport, family and community advocacy).

As a direct result of road closures by WPACO during the height of our tourist season, Ilkurlka and the community have been unable to develop the 4x4 tourist market using road access to Ilkurlka along the Anne Beadell Highway. This has resulted in a loss of economic and employment opportunities for the community. It has been difficult to set up a cultural tourism market when closures preclude tourism activity.

Going forward, we note that in the 2018 Coexistance in the Woomera Prohibited Area report it was recommended that a review of the Woomera closure system would be made. One of the anticipated outcomes was the use of a graticular system of closures rather than the current zone system which is in place. This would minimise or eliminate closures of the Anne Beadell Highway which would in turn avoid further losses.

To date, there appears to have been no progression in advancing this option. This has been frustrating.

Recommendations from the 2018 Coexistance in the Woomera Prohibited Area report

Pages 41 and 42

The requirement to exclude people from an entire zone, rather than just part of it, can result in unnecessary inconvenience.

The Review has consulted WPA users on a proposal for a grid-based approach to managing the green zone. It is the largest portion of the WPA at 92,276 square kilometres or 86 per cent of the range. Under this proposal the existing amber corridor (amber zone 2) would be folded into an even larger green zone which would then be managed as a series of 15-nautical-mile grid squares. Defence would then exclude people from only those squares that were required for a test, rather than the entire area.

Responses to a concept paper on the grid-based green zone proposal were overwhelmingly positive. Among the benefits identified were the ability to more frequently avoid closing roads such as the Anne Beadell Highway, resulting in fewer disruptions to tourist traffic (an issue raised specifically with the Review).

Specific comments

Restrictions on non-defence use of the WPA only affect Ilkurlka insofar as amber zone 2 closures are concerned (green zone closures are infrequent).

Ilkurlka only receives tourists along the Anne Beadell Highway from April to September. All closures announced during this period have a dramatic impact on economic sustainability to the community and indigenous training and employment. This also applies to closures which are cancelled at short notice as tourists decide on travel plans at least one month in advance.

Existing access arrangements for amber zone 2 could be improved by:

1. avoiding all closures between April and September (tourist season)
2. or the use of a graticular system of closures which avoids the need for the closure of the whole zone when only a portion of that zone is required for defence purposes
3. or by removing a short section of the Anne Beadell Highway from amber zone 2

4. or by creating a standing permission for the Anne Beadell Highway where it passes through amber zone 2 (but retaining existing access arrangements outside this section)
5. or by providing escorts to those non-defence users traversing a short section of the Anne Beadell Highway as it passes through amber zone 2.

Ilkurlka has incurred significant losses during announced closures of amber zone 2 between April and September whether or not these closures have been rescinded or not. Documentation is supplied as an attachment to this submission.

We note with alarm that Amber Zone 2 is forecast for closure in June 2025, the peak of our tourist season. If this closure proceeds, we are likely to lose around $40,000 of turnover or about 15% of tourist revenue.

Long term planning and development are difficult whilst the current system of closures of a short stretch of the Anne Beadell Highway in amber zone 2 occurs during the period between April and September. Traffic flow is massively disrupted during announced closure periods.

Often preannounced closure periods are rescinded but at short notice (see attached documentation). We find that tourists plan at least one month in advance so a rescinded closure often has the same impact as a closure which actually goes ahead.

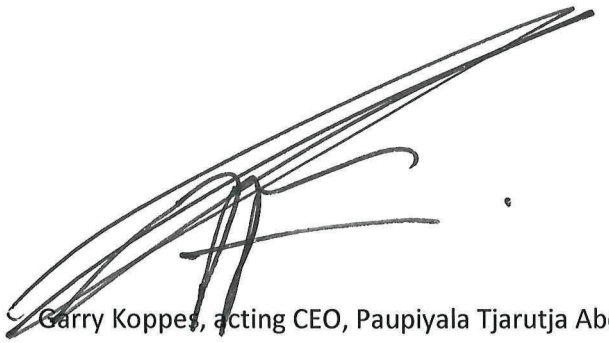
We believe that this problem would be diminished and would have little impact on Defence activities if a move was made to a graticular system of exclusion zones (as forecast at a meeting between traditional owners and the Department of Defence in Tjuntjuntjara in February 2016).

Another option would be to remove a short section of the Anne Beadell Highway from amber zone 2 possibly by way creating a standing permission for this section.

We note also that prior to one meeting in February 2016 with WPACO (held at the request of Pila Nguru and Paupiyala Tjarutja) there had been no consultation whatsoever regarding the operation of the Woomera Prohibited Area and nor has there been since then. This contrasts with the consultations held on a regular basis with Maralinga Tjarutja.

This seems unjust as all Aboriginal organisations concerned share a similar history with regards to defence activities starting from the time of the nuclear testing in the fifties.

We hope that you will view this submission favourably.



Garry Koppes, acting CEO, Paupiyala Tjarutja Aboriginal Corporation

Attachments:

Pages 4 to 6:

WPACO closures financial impacts on Ilkurlka

Page 7, 8:

2017 Request for compensation of financial losses to Paupiyala Tjarutja Aboriginal Corporation

Page 9:

Laverton shire support letter

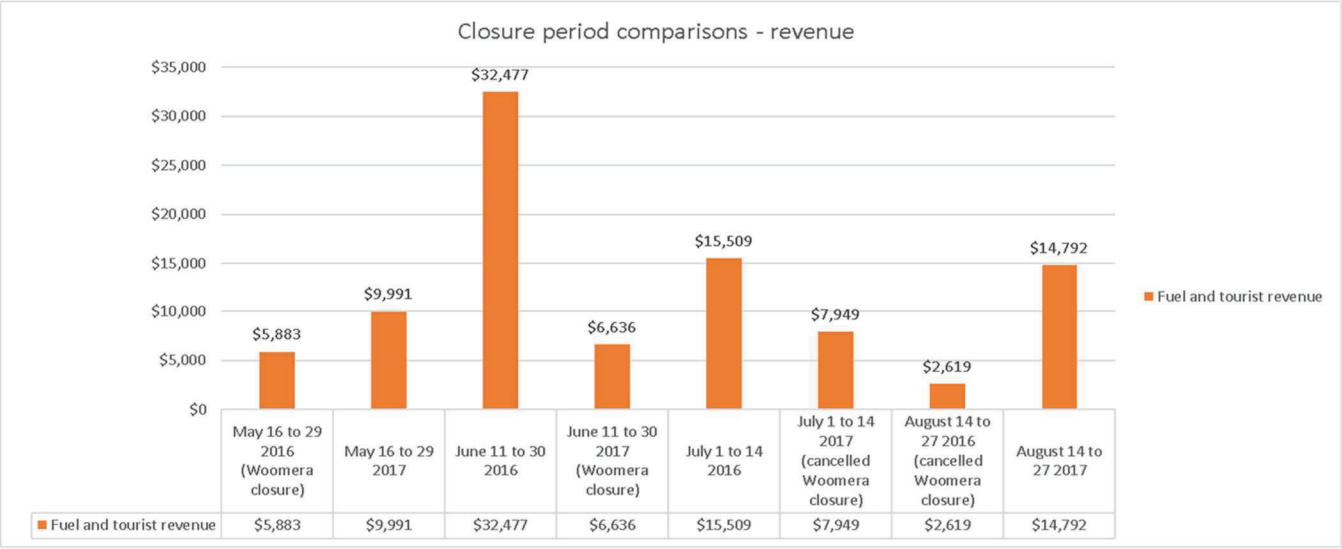
Pages 10 to 13:

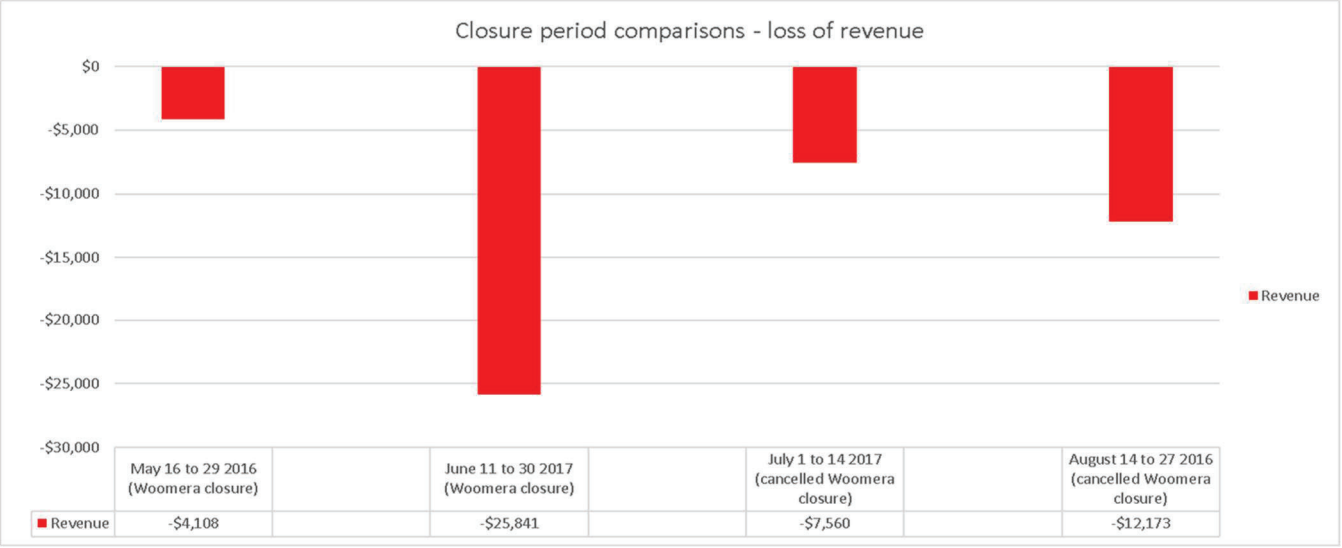
Record of meeting in Tjuntjuntjara 22 February 2017 with Department of Defence

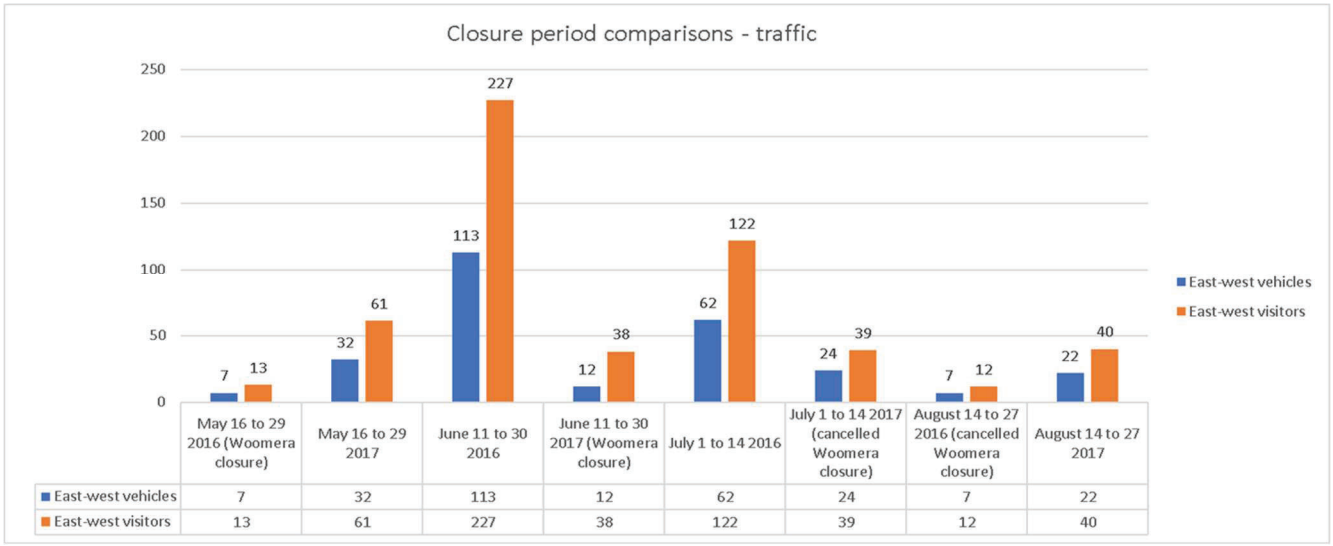
Woomera Amber Zone 2 closures							
Date from	Date to	Closure days	Cancelation date	Days notice of cancelation	Notes		Total days
13/05/2013	2/06/2013	21			Peak season	High impact	21
12/08/2013	25/08/2013	14	15/07/2013	28	Peak season	Low impact	
28/10/2013	10/11/2013	14	19/09/2013	39			
3/03/2014	23/03/2014	21	4/02/2014	27			
19/05/2014	8/06/2014	21	28/03/2014	52	Peak season	No impact	70
17/11/2014	30/11/2014	14					
2/03/2015	15/03/2015	14	17/12/2014	75			
18/05/2015	28/06/2015	42	20/02/2015	87	Peak season	No impact	70
20/07/2015	2/08/2015	14	18/06/2015	32	Peak season	Low impact	
2/11/2015	29/11/2015	28	13/10/2015	20			
29/02/2016	13/03/2016	14	9/03/2016	-9			
16/05/2016	29/05/2016	14			Peak season	High impact	70
14/08/2016	27/08/2016	14	19/07/2016	26	Peak season	High impact	
30/10/2016	19/11/2016	21	23/09/2016	37			
26/02/2017	11/03/2017	14	6/12/2016	82			
11/06/2017	30/06/2017	20			Peak season	High impact	69
1/07/2017	14/07/2017	14	1/07/2017	0	Peak season	High impact	
12/11/2017	9/12/2017	28	4/10/2017	39			
3/06/2018	30/06/2018	28	10/05/2018	24	Peak season	Low impact	70
1/10/2018	10/11/2018	41					
1/04/2019	29/04/2019	29	5/02/2019	55	Start of season	No impact	70
2/09/2019	29/09/2019	28			Peak season	High impact	
26/11/2019	9/12/2019	14	19/11/2019	7			
3/03/2020	30/03/2020	28			Start of season	COVID19 - no impact caused by closure	70
20/07/2020	16/08/2020	28	19/05/2020	62	Peak season	COVID19 - no impact caused by closure	
19/11/2020	9/12/2020	21	6/11/2020	13		Closure period changed 3 to 9/12/20	
22/03/2021	11/04/2021	21	16/02/2021	34	Start of season	No impact	70
3/07/2021	16/07/2021	14	8/06/2021	25	Peak season	Low impact	
4/10/2021	7/11/2021	35			End of season		
21/03/2022	10/04/2022	21	4/03/2022	17	Start of season	High impact	70
16/10/2022	5/11/2022	21			End of season		
20/02/2023	12/03/2023	21	31/01/2023	20	Start of season	Likely cancellation flagged 27/01/23	
3/06/2023	30/06/2023	28	26/05/2023	8	Peak season	High impact	70
13/11/2023	17/12/2023	35	3/11/2023	10		Likely cancellation flagged 20/10/23	
6/05/2024	9/06/2024	35			Peak season	Road closures because of March rainfall	70
21/11/2024	18/12/2024	28					
17/02/2025	2/03/2025	14					
3/06/2025	30/06/2025	28			Peak season	Likely to be high impact	70

Impacts of Anne Beadell Highway closures in amber zone 2 on Ilkurlka revenue and traffic

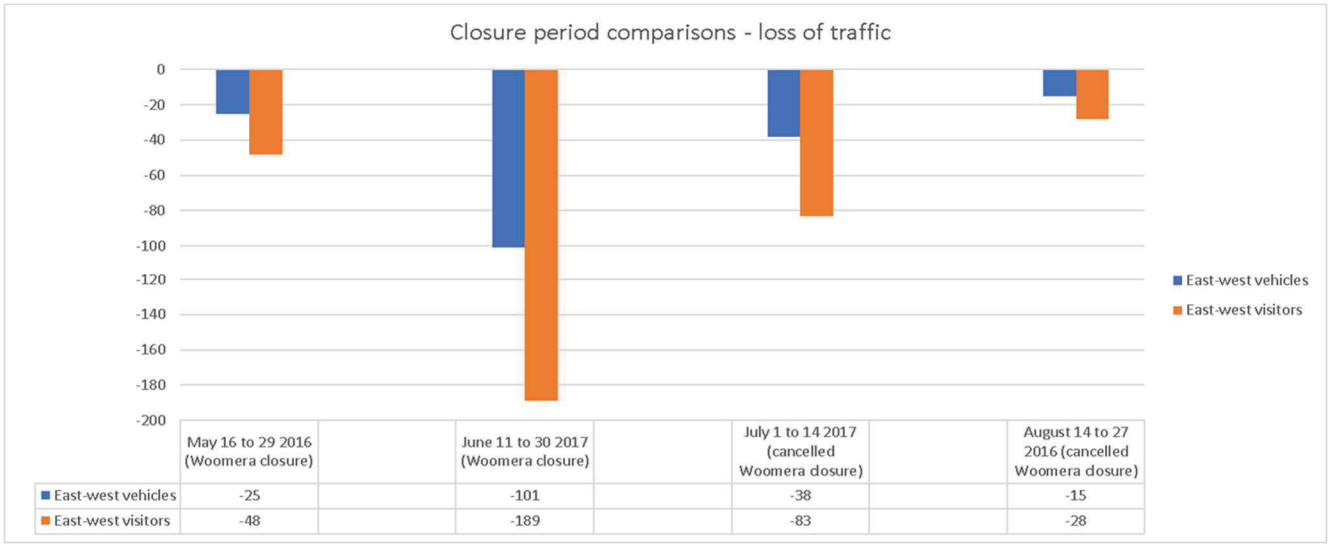
Closure periods comparisons 2016 and 2017							Gain/loss		
Period	Notes	East-west vehicles	East-west visitors	Fuel sales	Tourist item sales	Sales totals	East west vehicles	East-west visitors	Sales totals
May 16 to 29 2016 (Woomera closure)	Closure	7	13	$5,205	$678	$5,883	-25	-48	-$4,108
May 16 to 29 2017		32	61	$7,830	$2,161	$9,991			
June 11 to 30 2016		113	227	$27,789	$4,688	$32,477			
June 11 to 30 2017 (Woomera closure)	Closure	12	38	$2,391	$4,245	$6,636	-101	-189	-$25,841
July 1 to 14 2016		62	122	$12,507	$3,002	$15,509			
July 1 to 14 2017 (cancelled Woomera closure)	Closure lifted July 1, 2017	24	39	$6,624	$1,325	$7,949	-38	-83	-$7,560
August 14 to 27 2016 (cancelled Woomera closure)	Closure lifted July 19, 2016	7	12	$1,834	$785	$2,619	-15	-28	-$12,173
August 14 to 27 2017		22	40	$11,992	$2,800	$14,792			
Differences		**-179**	**-348**	**-$44,064**	**-$5,618**	**-$49,682**			







	May 16 to 29 2016 (Woomera closure)	May 16 to 29 2017	June 11 to 30 2016	June 11 to 30 2017 (Woomera closure)	July 1 to 14 2016	July 1 to 14 2017 (cancelled Woomera closure)	August 14 to 27 2016 (cancelled Woomera closure)	August 14 to 27 2017
East-west vehicles	7	32	113	12	62	24	7	22
East-west visitors	13	61	227	38	122	39	12	40



	May 16 to 29 2016 (Woomera closure)		June 11 to 30 2017 (Woomera closure)		July 1 to 14 2017 (cancelled Woomera dosure)		August 14 to 27 2016 (cancelled Woomera dosure)
East-west vehicles	-25		-101		-38		-15
East-west visitors	-48		-189		-83		-28

Paupiyala Tjarutja
Aboriginal Corporation

Ilkurlka Community
PMB 8002
Kalgoorlie
WA 6433
Phone: 08 9037 1147
Fax: 08 9037 1157
Email:
manager@ilkurlka.org.au
ceo@spinifex.org.au

Ilkurlka

Spinifex Country

13 December 2017

Request for compensation of financial losses to Paupiyala Tjarutja and Pila Nguru Aboriginal Corporations caused by the closures of the Anne Beadell Highway by the Department of Defence

Please find attached historical figures (financial and visitor numbers) for Ilkurlka as requested at the meeting between Pila Nguru and Paupiyala Tjarutja Aboriginal Corporations and the Airforce Compliance Monitoring Flight in Tjuntjuntjara on 22 February 2017.

We wish to lodge a claim for financial compensation of the losses which will be caused to Ilkurlka by the Department of Defence in June and July this year. We are aware that a compensation scheme exists for organisations suffering adverse impacts and that this covers South Australia only. It is our belief that this arrangement is based on an historical anomaly which failed to consider the on-going impacts felt by the people of Tjuntjuntjara who are deprived of significant income when defence activities occur during the tourist season.

We wish to gain an initial response from the Department of Defence by the end of the month as a decision must be made in April concerning the future viability of Ilkurlka in view of the large financial losses which will be incurred by the activities of the Department of Defence.

Financial data is limited prior to July 2012 and no categorized data is available prior to January 2015. The reason for this relates to a changed management structure which took effect from July 2015.

We believe that the data presented shows clearly that June and July are by far our busiest months for tourism and likely account for 40% of our income for the year. This income is generated from high value tourists. Last year was the first time we started to promote Ilkurlka and we had plans to do this again in 2017. From the figures presented, tourists will travel in June or July but are less likely to travel outside this period – there is a build-up in April and May with a decline in August and September. This has several implications:

1. There is only a short window of opportunity in June and July to generate significant income
2. If tourists cannot traverse the length of the Anne Beadell Highway in June and July, then they will quite simply not travel at all
3. The publicity campaign carried out in 2016 was very successful in generating income in June and July, even though winter rains during those months likely did impact adversely on visitor numbers
4. Promotion of Ilkurlka has been placed on hold given that three weeks in June and a period in July will be closed off to Ilkurlka insofar as tourist revenue is concerned. There is little point in wasting limited resources on promoting Ilkurlka outside the peak season timeframe as there is unlikely to be an impact on tourist numbers
5. This will impact on local employment (there was to have been a continuation of the Vocational Education and Training program at Ilkurlka for Anangu tour guides)
6. There will also be an impact on the Spinifex Arts Project in terms of reduced sales of artwork produced by community members in Tjuntjuntjara (which will harm their income)
7. Paupiyala Tjarutja and Pila Nguru Aboriginal Corporations will be faced with the problem of sourcing around $40K to $60K to cover lost income at Ilkurlka caused by the Woomera Prohibited Area closures. If this money cannot be found, then the future of Ilkurlka will have to be reconsidered
8. If the Department of Defence does effectively force the closure of Ilkurlka there will be no safety or supply point for tourists travelling on the Anne Beadell Highway or members of the community travelling on the Business Road from Tjuntjuntjara to the northern communities. This is likely to result in fatalities given that rescues are done routinely from Ilkurlka
9. Land management activities will be curtailed with a resulting loss of employment
10. Aboriginal people will be unable to maintain a connection to country if Ilkurlka is closed

We note the support which has been given by the department to Maralinga Tjarutja for a tourism venture and would hope that you would see fit to give support to Ilkurlka given the close ties and shared histories of the traditional owners in Oak Valley and Tjuntjuntjara.

At the meeting held in Tjuntjuntjara we were surprised that the cultural and historical ties between the people of Maralinga Tjarutja and Pila Nguru had not been recognised previously especially given that the displacement of people caused by nuclear testing affects people in both Oak Valley and Tjuntjuntjara.

We urge the Department of Defence to act promptly by rescinding the closures of the Anne Beadell Highway in June and July this year. This would need to be done immediately if there is to be minimised impact on tourism (tourists generally plan two to three months in advance).

If the department is unwilling to cancel the impending closures with immediate effect, then we request that a claim for compensation be considered based on the forecast loss in earnings caused by the closure of the Anne Beadell Highway in June and July this year.

Letter from the Shire of Laverton to the Woomera Prohibited Area Coordination Office (February 2017)

SHIRE OF
LAVERTON

SHIRE OF LAVERTON

9 MacPherson Place
PO Box 42
Laverton WA 6440
P (08) 9031 1202 F (08) 9031 1340 www.laverton.wa.gov.au

The Shire notes that you are planning a closure of Amber Zone 2 from 1 1 June to 30 June 2017. We also note that you have not yet released details of proposed closures after 30 June 2017.

This closure will have the effect of curtailing completely all tourist traffic between Coober Pedy and Laverton. According to figures supplied by Ilkurlka Roadhouse, last June saw 150 tourist vehicles and 300 tourists traveling on the Anne Beadell last June. In addition, the Shire's tourism centre in Laverton, the Great Beyond Visitor's Centre, reported that during the 2015/16 year, 10% of those tourists who visited the Great Beyond travelled to Laverton via the Anne Beadell Highway.

The loss of this trade at the height of the tourist season is severe: these tourists are consumers of accommodation, fuel, groceries and sundry services. They also add to the tourism industry in Laverton.

We are also advised by Ilkurlka (an indigenous business operating in the Shire of Laverton) that June and July are by far the busiest months of the tourist season and that without the income generated in June the viability of that business is threatened.

We are aware that some tour groups are considering the use of the Anne Beadell Highway this season. Ilkurlka has been advised that one or two tour groups may have to cancel their plans as a consequence of the proposed closures.

We believe that the Anne Beadell Highway offers an important tourism revenue stream and that this only occurs during the winter months which is more conducive to travelling in these regions. We also note that the Department of Defence has frequently cancelled winter closures of Amber Zone 2 but has not done so until the last minute. Given that tourists make their plans several months in advance the reversal of these closures at a late stage still has a great impact on tourism in our region.

We urge the Department of Defence to consult with all stakeholders involved with tourism along the Anne Beadell Highway prior to closing Amber Zone 2 during winter months.

Please do not hesitate to contact me should you wish to discuss this further.

Yours sincerely

Steven Deckert, Chief Executive Officer

Paupiyala Tjarutja
Aboriginal Corporation

Ilkurlka Community
PMB 8002
Kalgoorlie
WA 6433
Phone: 08 9037 1147
Fax: 08 9037 1157
Email: *ilkurlka@spinifex.org*
Facebook:
www.facebook.com/ilkurlka

Ilkurlka
Spinifex Country

Record of meeting in Tjuntjuntjara 22 February 2017

Attending:

Ethan Hanson (Paupiyala Tjarutja chairperson, Pila Nguru land management)

Ian Baird (Pila Nguru general manager)

Neil Smithies (Paupiyala Tjarutja CEO)

Philip Merry (manager, Ilkurlka)

Squadron Leader Darren Shorter (Officer in Charge Compliance Management Flight)

Mr Trevor Seebohm (Access Administration and Compliance Officer Woomera Test Range)

WOFF Allan Nobrega (Compliance Monitoring Team)

CPL Shane Robbie (Compliance Monitoring Team)

CPL Adele McCallum (Compliance Monitoring Team)

CPL Ernest Warrior (Compliance Monitoring Team)

Discussion:

The Compliance Management Flight (CMF) manages non-Defence access into the WPA in conjunction with the Woomera Prohibited Area Coordination Office (WPACO). The CMF supports trials by providing of security effects. CMF monitors and enforces compliance with access conditions in accordance with the statutory authority. The WPA is governed by the Defence Act 1903 (Cth), the Woomera Prohibited Area Rule 2014 (Cth) and Defence Force Regulations 1952 (Cth). Any changes to the Rule require the agreement of both Ministers of Defence and Industry. A Rule review is scheduled for 2018.

The Compliance Team is part of Woomera Test Range Air Warfare Centre. WPACO is part of strategic policy Air Force Headquarters. The Advisory Board is the vessel for Non-Defence stakeholder submissions.

The Woomera team considers it important to work with local communities which are connected with traditional lands associated with the WPA. Tjuntjuntjara has not been previously engaged by the team and the team are here to open lines of communication so as to better understand the challengers and potential impacts that the community faces when the Anne Beadell is closed in support of Defence activities.

Tjuntjuntjara has been seen in a different light to Oak Valley and the CMF team were unsure of the ties between Tjuntjuntjara and the South Australian side. The close link between the traditional owners living in Tjuntjuntjara and the Maralinga testing area was explained and it was noted that the Piling Trust was set up as compensation not only for Maralinga Tjarutja but also for Pila Nguru.

The department had previously been unaware of the wider impacts of closures on Pila Nguru and tourism in Laverton (support letter attached).

Ilkurlka was established in 2003/04 by funding from the Maralinga Piling Trust (which is apportioned to both South Australia and Western Australia). It is part of the link to the northern lands and tourism is being developed there. At one point, it was going to be the main community.

Ilkurlka is the only supply point along both the Anne Beadell Highway and the Business Road from Tjuntjuntjara to the northern lands. It hosts land management activities and community cultural events. It is the only rescue point in the area and conducts rescues on a regular basis and RFDS medivacs as required from its airstrip.

Culturally Ilkurlka is very important and it is also used for land management. Ilkurlka roadhouse provides the only income – closures of the Anne Beadell highway mean a loss of income. Ilkurlka runs at a loss which needs compensation. Currently Paupiyala Tjarutja makes up that loss whilst Pila Nguru owns the infrastructure.

Ilkurlka plays a part in seasonal tourism (high-value spend, support for jobs and training, tours, the Spinifex Arts Project). Tourism is sharply seasonal with June and July being the busiest months. Figures from last year show marked impacts on tourist numbers of the closures of the Anne Beadell Highway during the season.

However, as the data only shows the impact for one year, the CMF considers that it is insufficient to support any historical trend analysis. The data needs to be captured over a longer period, and then cross referenced with notified closure, actual closure and cancelled closure periods to be able to provide sufficient fidelity on the business impacts experienced.

The Defence department provides sufficient notice of closures but where these are later lifted there is usually only very short notice. Most tourists plan their trip several months in advance so Ilkurlka loses their business. CMF requests that this needs to be part of the broader analysis as referenced above.

The compliance team stated that is not possible to give greater notice of closure cancelations and this year an announcement is imminent on a closure of Amber Zone 2 in July as well as the existing announced closure in June.

This will adversely impact Ilkurlka as June and July are the two peak months for tourism. Average spends per person were given: $147 per person for tourism, $67 per person for community. Tourists provide 70% of turnover and make up about 50% of visitor numbers primarily because tourists make fuel and arts purchases whilst community members typically buy groceries.

The Department of Defence will analyse the historical Ilkurlka data when it is presented by CMF and CMF will initiate a discussion with the department but cannot promise any compensation.

The financial deficit incurred by Ilkurlka is met by Paupiyala Tjarutja which is an entirely grant-funded organisation. To date Ilkurlka is carrying a deficit of $41K which may blow out to $100K by the end of the financial year depending on tourist activity in the coming winter peak season. Efforts are being made to turn the financial situation around by encouraging tourism.

There are two scenarios: close Ilkurlka, but this is not a realistic option. The community will not accept this and there are vital reasons to keep Ilkurlka open: culture, health and safety, airstrip, fuel and supplies for travellers. The other scenario is to fund the deficit but this will impact on the financial abilities of the community.

There has been mention of army assistance for the community under the AACAP program in the past with respect to community roads and building programs but this is not within the remit of the compliance team. SQNLDR Shorter mentioned that he had been made aware of discussions regarding Air Force engineering capabilities with respect to possibly supporting remote communities, however due to the operational tempo the possibility was not progressed. However, he would raise the issue with the relevant chain of command to ascertain the status of the concept.

There is no external funding available to maintain the Business Road.

There have been discussions regarding the grading of part of the Anne Beadell highway in South Australia. Some funding was provided by SA Government to Maralinga Tjarutja with a small amount of works completed ad hoc. However regardless of condition of the highway, Defence maintains authority to affect closures in support of testing activities as required.

Standing permissions for the Anne Beadell Highway within the WPA have been considered and some consultation conducted. To make the Anne Beadell a standing permission would potentially provide less notice to travellers and would likely impact safety of persons in the area. Standing permissions for the Anne Beadell were opposed in the past by Maralinga Tjarutja.

The current permit system allows Defence to monitor and control access and provide important safety and security input to trials activities. Any changes to Standing Permissions would require non-Defence Stakeholder engagement and ministerial agreement. Changing the Anne Beadell would not necessarily be practical in this case as tourists may be held at checkpoints for protracted periods with little or no notice.

Advance notice of closures are promulgated under the Woomera Prohibited Rule 2014, Green Zone as it relates to tourists and other users and is provided no later than 21 days, with Amber Zones promulgated by last day of March for the next financial year.

The current Zone Management system was discussed and trials planning nuances explained in general terms. It was highlighted that the current system is problematic as it requires notification of an entire zone.

A review of the current arrangements will be held in 2018 and submissions will be sought from stakeholders. A possible solution would be set up the zone management regime on a grid-based system based whereby specific grids squares could be identified for closure rather than complete zones coupled with modified notification regimes. This could potentially provide greater certainty to non-Defence users of the WPA and specifically the Anne Beadell Highway. This may be something that could be examined during the 2018 review if there was sufficient Industry and non-Defence Stakeholder support.

Action items:

Darren Shorter to advise Chain of Command of the discussion points above and seek further guidance so as to further engage Tjuntjuntjara, in particular with regards to possible compensation based on an analysis of historical trading figures.

Phil Merry to collate historical monthly income figures for Ilkurlka and assess the correlation between notified and cancelled closure periods to accurately assess impact to the Ilkurlka operations as a basis for submission to Advisory Board regarding questions of compensation for loss of income resulting from closure of the Anne Beadell highway by Defence.

Neil Smithies CEO will consider raising a submission to the Advisory Board regarding alternative views to zone management for the 2018 review.

Trevor Seebohm to provide JOSS POC as provided to MT during the recent flood event.

CMF will provide contact details for the advisory board.

Documents presented at meeting

Woomera meeting agenda

Tjuntjuntjara 22 February 2017

1. **Welcome to country**
2. **Introduction by WPACO (Trevor Seebohm)**
   a. **Roles and responsibilities**
   b. **Employment opportunities**
3. **Ilkurlka and the community (Ian Baird)**
   a. **The history of Ilkurlka and the Maralinga Piling Trust**
   b. **Cultural continuity and community aspirations**
   c. **Land management**
4. **Ilkurlka's current role (Phil Merry)**
   a. **Tourism**
   b. **Community travel**
   c. **Rescue**
   d. **Employment and training**
5. **Issues facing the community in running Ilkurlka (Neil Smithies)**
   a. **Subsidy required by PTAC to keep Ilkurlka open in line with community desires**
   b. **Economic prospects for 2017**
6. **Ways forward (all)**

South Australian Chamber Of Mines & Energy

20 September 2024

Review of the Woomera Prohibited Area Coexistence Framework
C/- Strategic Policy
R1-1-A098
PO Box 7901
Canberra BC ACT 2610

Via email: woomera.review@defence.gov.au

Commercial-In-Confidence

2024 Review of the Woomera Prohibited Area Coexistence Framework

The South Australian Chamber of Mines & Energy (SACOME) is the leading industry association representing resource and energy companies with interests in the South Australian resources sector, including minerals, energy, extractives and petroleum.

SACOME welcomes the opportunity to make this submission to the Department of Defence's review of the Woomera Prohibited Area (WPA) Coexistence Framework, recognising that a significant number of its member companies undertake activity in the WPA via the Coexistence Framework.

Consistent with its 2018 submission to the WPA Coexistence Framework Review, SACOME strongly supports the Coexistence Framework and welcomes Defence's commitment to continued coexistence with other stakeholders.

SACOME acknowledges that the 2024 Coexistence Framework Review follows major reforms to regulatory frameworks governing the operation of the Australian Defence Force prompted by signing of the tri-lateral AUKUS pact between Australia, the United States of America and Great Britain.

We recognise that these reforms reflect a changing geopolitical and military-strategic environment which will likely see an increase in use of the WPA for the foreseeable future, meaning greater use by Defence and its allies of the WPA for testing purposes and associated operational impacts for non-Defence users.

We further acknowledge this is likely to result in a higher level of scrutiny attached to access by non-Defence users and equipment being brought into the WPA.

South Australian Chamber Of Mines & Energy

As a general statement of policy, SACOME submits that balancing Defence's national security interests with South Australia's economic objectives should continue to be a central principle of the Coexistence Framework.

We further submit that these economic objectives are underpinned by the economic contribution made by the State's resources sector which amounted to $10.7 billion in direct and indirect spending across the South Australian economy in 2021-22.

We note that the Scope of the Review (per the Terms of Reference):

> *(W)ill assess the current WPA coexistence framework to determine whether it remains fit for purpose in the current strategic environment.*
>
> *It will consider national security, economic and cultural perspectives, and make recommendations to balance competing views in the national interest, including to:*
>
> > *a. inform remaking of the WPA Rule before it sunsets on 1 October 2026; and*
> >
> > *b. update coexistence governance arrangements.*

We further note the 'Key Tasks' for the Review process set out in section 5 of the Terms of Reference, with the following having particular relevance to the South Australian resources sector:

- *c. current and future potential economic value of mineral deposits and other economic activities in the WPA, including potential impacts on employment and government revenues, and use of emerging technologies;*

- *d. the extent to which mining and economic activity is compatible with Defence use of the WPA, and any inherent limits to future coexistence, including issues posed by foreign ownership or control; and*

- *e. appropriate coexistence governance arrangements, including the ongoing role of the WPA Advisory Board, and the Memorandum of Understanding between the Commonwealth of Australia and South Australian Government.*

South Australian Chamber Of Mines & Energy

We acknowledge that Defence seeks feedback to inform the Review process across four broad themes, namely Access, Management, Communication, and Governance, and SACOME's submission makes comments against these themes accordingly.

SACOME member companies with mineral production tenements, mineral exploration licences or mineral/petroleum exploration licence applications in the WPA are:

- BHP
- Rio Tinto
- Fortescue
- Iluka
- Peak Iron Mines
- Magnetite Mines
- H2EX

Comment against key review themes is informed by consultation with these member companies and provided below.

1. Access

1.1 WPA Flexible Green Zone Framework

The *WPA Flexible Green Zone Update* paper released in September 2022 proposed changes to the WPA Flexible Framework, noting the following changes to access zones:

- Absorb Amber Zone 2 into the Green Zone to reduce the impact on WPA stakeholders who have interests located within that zone by 14 days per fiscal year.

- Adopt individual grids across the WPA – set at 15 minutes (15') longitude x 15' latitude.

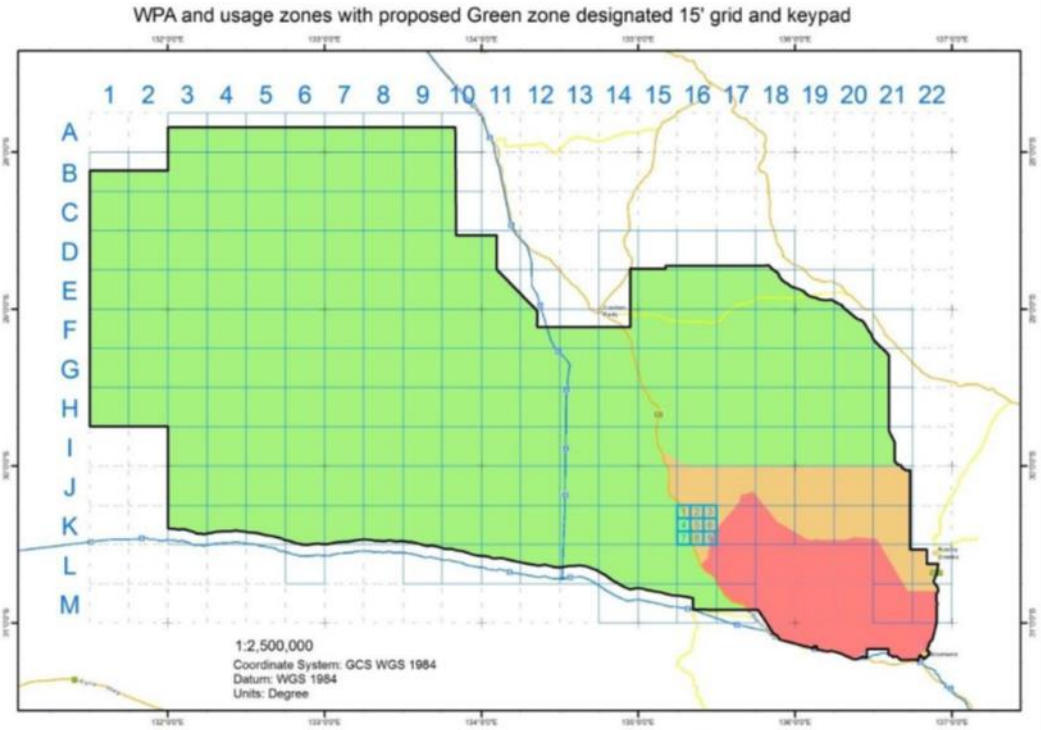
- Individual grid squares will be allocated 56 days for exclusive Defence use.

- Keypad mechanism to manage the activation of a single grid square to mitigate impacts to WPA stakeholders. It will be applied on a case-by-case basis depending on whether there is an impact to a stakeholder that could be mitigated and whether safety considerations allow for it.

South Australian Chamber Of Mines & Energy

- Addressing concerns about cumulative effect with those who have interests across the WPA, where resource production permit holders hold interests in multiple grid squares, a single day of exclusion in one square would automatically apply to other grid squares.

- Managing cumulative effect will be limited to resource production permit holders due to their ongoing and significant presence in the WPA.



Acknowledging that Defence has indicated it intends to increase its use of the Green Zone, SACOME members have expressed a strong interest in understanding what the future frequency of closure directions are expected to be compared to the existing Green/Amber 1/Amber 2/Red Zone framework.

SACOME respectfully submits that, in moving to the Flexible Green Zone Framework, effort should be made to consolidate areas not critical to Defence requirements so as to best ensure appropriate balance between the operational interests of resources sector stakeholders and those of Defence.

Recognising that a mine comprises both the mine and its enabling logistical infrastructure, operators have expressed a desire to understand the impact of closure

requirements in circumstances where a part of the mine is captured in part of the keypad.

As a general statement of principle, a greater frequency of closure directions is highly likely to impact project profitability given its impact on mine production and the association costs of shutting down and restarting critical equipment

Greater granularity in WPA Zone management is supported, however, SACOME and its member companies seek to better understand how the proposed grid and keypad mechanism is intended to operate with regard to a mine's overall operational footprint.

1.2 Interconnectivity between WPA and non-WPA Operations – Copper South Australia

BHPs acquisition of OZ Minerals (A$9.6bn), sees BHP Copper South Australia bringing together the globally significant Olympic Dam mine and Carrapateena and Prominent Hill Mines, and a potential fourth mine at Oak Dam, to create multi mine copper province with regionalised smelting and refining at its heart.

At its recent full year results BHP announced plans to increase production from its Copper SA assets, from 322 kilotonnes (kt) of refined copper cathode in FY24 to more than 500ktpa by the early 2030s and up to 650ktpa by the mid-2030s.

This significant increase in Australia's onshore production of refined copper would support the global energy transition and represents a significant opportunity for the national economy and the state of South Australia.

Delivered in two stages, the ambition for Copper SA is to upgrade of surface processing capacity by shifting from single stage to two-stage smelting to enable the first stage of growth to more than 500,000 tonnes of copper cathode (equivalent to 1.1mt – 1.4mt copper concentrate).

The construction of a two-stage smelting process would better suit the mineralogy of Olympic Dam and accommodate a potential expansion of the Olympic Dam Southern Mining Area, along with production growth from the Prominent Hill and Carrapateena mines.

The second stage of growth would involve further expansion of Olympic Dam's smelting and refining capacity to match potential production from a new mine at Oak Dam along

with further production increase at Olympic Dam, taking total output up to 650,000 tonnes of copper cathode (1.7mt concentrate).

Expanded domestic smelting and refinery capacity in South Australia demonstrates the ongoing opportunity for a globally significant ore-to-metal copper province in South Australia producing copper cathode for domestic and international market.

This ambition further reinforces the importance of South Australia's strategic metals capacity. SACOME notes that copper is not listed on the national Critical Minerals or Strategic Materials lists despite its importance to a range of national policy objectives.

SACOME submits that the Coexistence Framework should consider broader connectivity across the region, with the potential for mining operations within the WPA being interconnected to a regional smelting and refining hub outside it.

This interconnectivity highlights the need to consider impacts on mine operations and how they overlay and impact associated operations.

1.3 Deeds of Access

Some member companies have expresses strong support for the continued operation of Deeds of Access which pre-date the *Woomera Prohibited Area Rule 2014*, now the standard framework governing access to the WPA for non-Defence users.

While we acknowledge Defence's preference for all non-Defence users of the WPA to operate under the WPA Rule 2014 given it would standardise the administration of access arrangements, member companies hold the view that Deeds of Access should continue to operate in the WPA alongside the Coexistence Framework.

2. Management & Communication

Feedback from SACOME members has been generally positive with regard to management and communication arrangements under the Coexistence Framework.

2.1 Woomera Prohibited Area Coordination Office

SACOME members have highlighted the importance of WPACO to coexistence arrangements. We submit that the likely increased use of the WPA as a result of recent

Defence reforms further reinforces the importance of WPACO as the key manager of access arrangements in the WPA; and as the 'day-to-day' point of communication between resources sector stakeholders and Defence.

Members have generally advised that Notice of Entry arrangements work well and that they have excellent relationships with the Woomera Prohibited Area Coordination Office (WPACO).

WPACO staff are consistently praised by operators for their excellent communications and the timely nature in which they provide advice to operators about closure periods.

SACOME notes comment made by some operators about the turnover of WPACO staff and its associated impact on understanding of the WPA and its complexities, along with relationship building. The resources sector similarly experiences staff turnover which also impacts continuity of relationships.

SACOME submits that this could be mitigated through structured communications when personnel change occurs, as well as through ongoing quarterly meetings between WPACO/Defence and the resources sector.

2.2 Approved Person Status

Member companies have suggested changes to 'Approved Person' arrangements, noting that personnel accessing sites in the WPA people must have Approved Person status as a condition of access, with this status only applicable to a specific permit.

Operators advise that contractors who are delivering to multiple permit sites held by a company must have Approved Person status for each different permit, meaning that an application must be made to secure approval on a permit by permit basis.

Operators have suggested simplifying administrative arrangements so that once an individual has been granted Approved Person status (noting it is valid for up to two years), that it then applies to all other permits held by that company within the WPA.

This would allow 'Approved Persons' to then access all of an operators permit sits without having to go through the assessment process each time, reducing administration for both operators and Defence.

South Australian Chamber Of Mines & Energy

3. Governance

3.1 Importance of the WPA Advisory Board

Given the increase in Defence activity prompted by the current geopolitical and military strategic environment; and in resources sector activity in and around the WPA, SACOME submits that there is a critical need for governance arrangements as provided via the WPA Advisory Board.

We note the key responsibilities of the WPA Advisory Board are to:

- monitor and report on the balance of national security and economic interests in the WPA
- oversee the implementation of the coexistence policy arrangements
- foster strategic relationships between Defence and non-defence users of the WPA

Both Defence and the resources sector have important roles to play in supporting delivery of national strategic priorities.

SACOME and its member companies submit that the Coexistence Framework must continue to be underpinned by collaborative engagement through this important governance body.

Yours sincerely

Rebecca Knol
Chief Executive Officer
South Australian Chamber of Mines and Energy