SNAPPER MINE

Northern Extension Modification

Modification Report

TRONOX



SNAPPER MINE
NORTHERN EXTENSION MODIFICATION

MODIFICATION REPORT



NOVEMBER 2019
Project No. CMA-19-08
Document No. 1004900

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres north-east of Wentworth and approximately 170 kilometres south-east of Broken Hill in western New South Wales (NSW).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act 1979* (Project Approval [06_0168]) in 2007.

This Modification Report is a Statement of Environmental Effects that has been prepared by Tronox to support a request to modify Project Approval (06_0168) under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

ES.2 OVERVIEW OF THE MODIFICATION

The Snapper Mine integrates with the following Tronox mineral sands mining and processing operations located in western NSW:

- Broken Hill Mineral Separation Plant (MSP).
- Ginkgo Mineral Sands Mine (the Ginkgo Mine).
- Atlas-Campaspe Mineral Sands Project (Atlas-Campaspe Mine).

Mineral concentrates produced at the Snapper and Ginkgo Mines are currently processed at the MSP.

Production from the approved Atlas-Campaspe Mine (once operational) will progressively replace Snapper and Ginkgo Mine production as the feed material for the MSP. Construction activities at the Atlas-Campaspe Mine commenced in 2018, and production is scheduled to commence in late 2021.

Production at the approved Snapper Mine is currently scheduled to conclude in mid-2020. The Snapper Mine workforce is then planned to transition to the Atlas-Campaspe Mine.

Based on current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine Northern Extension Modification (the Modification) would minimise the risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around Mining Lease Application 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

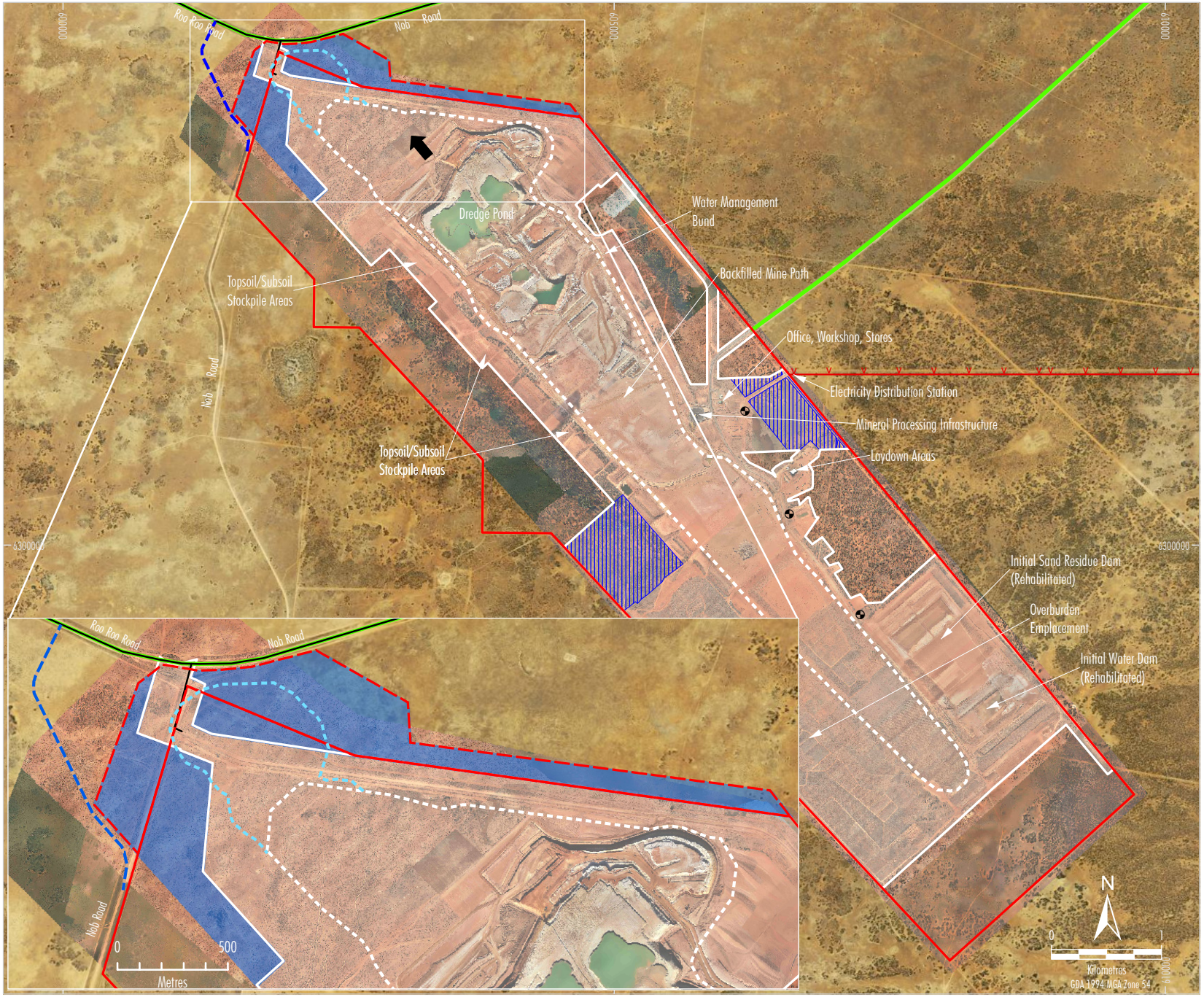
The indicative general arrangement of the modified Snapper Mine is shown on Figure ES-1.

The additional surface development areas and Nob Road realignment (Figure ES-1) are herein referred to as the Modification area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

Table ES-1 provides a comparative summary of the existing/approved and modified Snapper Mine.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure ES-1

CMA-19-08_SNE_ES_201B

Table ES-1
Comparison of the Existing/Approved and Modified Snapper Mine

Snapper Mine Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Life	• Mining operations until 10 July 2026.	• No change.
Tenement	• Mining Lease 1621.	• New Mining Lease Mining Lease Application 1.
Surface Development Area	• Approximately 1681 hectares.	• Overall net reduction in surface development area of approximately 3 hectares.
Mining	• Dredge mining producing approximately 14 million tonnes per annum of ore. • Conventional mining (dozers and/or scrapers) for ore unable to be dredge mined.	• No change.
Mineral Concentration and Mineral Concentrate Transport	• Mineral concentrate production up to 621,000 tonnes per annum. • Mineral concentrate transport from the Snapper and Ginkgo Mines combined to the MSP up to 975,000 tonnes per annum. • Ore concentrated in the primary gravity concentration unit (comprising a screen, surge bin and wet concentrator) to produce heavy mineral concentrate. • Heavy mineral concentrate washed in the salt washing facility prior to processing in the wet high intensity magnetic separation circuit to produce ilmenite-rich, leucoxene-rich and non-magnetic (containing rutile-rich and zircon-rich) mineral concentrates.	• No change.
Overburden Management	• Overburden removal ahead of ore extraction areas using conventional truck and shovel methods (e.g. excavators and haul trucks). • A conveyor system and/or haul trucks are approved to transport the overburden to either the mine void behind the advancing dredge pond or in the overburden emplacement.	• No change. • Additional temporary off-path overburden emplacements.
Sand Residue and Coarse Reject Management	• Sand residues and coarse rejects placed in either an initial sand residue dam or dredge pond behind the advancing ore extraction area.	• No change.
MSP Process Waste Management	• MSP process waste placed behind the advancing ore extraction areas at either the Ginkgo Mine, Snapper Mine or Atlas-Campaspe Mine. • MSP process waste transport up to 300,000 tonnes per annum to the Snapper and Ginkgo Mines.	• No change.
Water Supply	• Water requirements supplied by the Snapper Mine borefield.	• No change.
Electricity Supply	• Electricity supplied by distribution station connected to grid.	• No change.
Site Access	• Access to the Snapper Mine via the Highway Access Road. • Eastern and northern (not constructed) access roads connect the Snapper Mine to the Highway Access Road.	• No change. • Northern access road would not be constructed.
Employment	• Up to approximately 200 personnel during operations.	• No change.
Rehabilitation Works	• Progressive rehabilitation undertaken as mining advances. • Two final depressions associated with the final dredge pond and water disposal dam, respectively.	• No change to rehabilitation strategy. • Reduction in the number of final depressions from two to one. • Increased size of the remaining final depression.

In accordance with Clause 3BA(6) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the consent authority is required to satisfy itself that any consent as modified would result in the Snapper Mine remaining substantially the same development as was last modified under Section 75W of the EP&A Act (i.e. Modification 5, February 2015 which is the existing/approved Snapper Mine), inclusive of consideration of the changes arising from previously approved modifications.

Based on a review of the proposed changes, Tronox considers that the modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.

ES.3 STAKEHOLDER ENGAGEMENT OVERVIEW

Tronox has consulted with a number of stakeholders during the development of the Modification, including:

- Department of Planning, Industry and Environment;
- other relevant NSW Government agencies;
- Wentworth Shire Council;
- Aboriginal stakeholders; and
- relevant leaseholders.

The outcomes of engagement with these stakeholders has informed the development of the scope of the Modification and Tronox's preparation of the Modification Report.

ES.4 ENVIRONMENTAL REVIEW

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment. The key environmental issues identified are summarised in Table ES-2 below.

ES.5 EVALUATION OF MERITS

Approval of the Modification is considered to be justified given that:

- The modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.
- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine.
- The Modification would allow Tronox to continue to supply its downstream operations (including the MSP) and other customers mineral concentrate until the commencement of production from the Atlas-Campaspe Mine avoiding disruption to existing supply chains.
- The Modification would promote the efficient and economic recovery of additional mineral sands resources while maximising the use of Tronox's established facilities and associated returns on existing financial investment.
- The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy and other measures.
- The WSC and relevant leaseholders have provided in-principle support for the Modification.

In weighing up the main environmental impacts (costs and benefits) and socio-economic benefits associated with the Modification as assessed and described in this Modification Report, the Modification is on balance, considered to have merit.

Table ES-2
Key Outcomes of Environmental Review for the Modified Snapper Mine

Environmental Aspect	Summary of Key Environmental Review Conclusions
Biodiversity	• The Modification would not increase impacts on biodiversity values. Instead, it would result in a net positive outcome for biodiversity values in the local area. • As the Modification would not increase impacts on biodiversity values, it is considered that a Biodiversity Development Assessment Report is not required.
Aboriginal Cultural Heritage	• No known Aboriginal cultural heritage sites are present within the Modification area.
Historic Heritage	• No historic heritage sites are present within the Modification area.
Land and Agricultural Resources	• The Modification would result in a net reduction in surface development area, therefore there is expected to be no additional impact on potential land and agricultural resources.
Air Quality	• Potential air quality impacts associated with the Modification would not contribute to any exceedances of the relevant air quality criteria at the closest sensitive receivers.
Noise	• Noise emissions due to the Modification would not result in any material increase in noise levels, and relevant noise criteria are predicted to be achieved at the closest sensitive receivers, during the day, evening and night, under neutral and adverse meteorological conditions.
Road Transport	• A portion of Nob Road would be realigned in consultation with the WSC. • The Modification would have acceptable impacts on the capacity, efficiency and safety of the road network surrounding the Snapper Mine.
Groundwater Resources	• The Modification is not expected to have any measurable effect at leaseholder bores given the negligible groundwater drawdown effects expected. • The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River). • The Modification would have “minimal impact” as defined in the *Aquifer Interference Policy*. • Tronox holds sufficient entitlements (21,442 share components [units or million litres]) under the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011.*
Surface Water Resources	• Potential surface water impacts associated with the Modification would be minimal with the implementation of existing surface water management measures.
Social and Economic	• The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine. • The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the in the regional economy would continue as a result of the Modification. • The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would however avoid potential negative social impacts associated with the loss of employment opportunities at Tronox’s operations.
Visual	• The potential visual impact associated with views of the modified Snapper Mine operations along a short section of the highway access road would be low given the very low number of road users on the highway access road.
Greenhouse Gas	• The total greenhouse gas emissions from the Snapper Mine (over the whole mine life) would not change significantly as a result of the Modification.
Hazards and Risks	• As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.
Community Infrastructure	• As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved social and community infrastructure impacts is expected.

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1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (Project Approval [06_0168]) (Attachment 1) in 2007.

This Modification Report is a Statement of Environmental Effects that has been prepared by Tronox to support a request to modify Project Approval (06_0168) under Section 4.55(2) of the EP&A Act.

The Snapper Mine Northern Extension Modification (the Modification) includes an extension to the existing/approved mine path to extend operations at the Snapper Mine within the approved mine life and without increasing the size of the approved surface development area.[1]

1.1 DESCRIPTION OF THE EXISTING/APPROVED SNAPPER MINE

1.1.1 Development History

The Snapper Mine integrates with the following Tronox mineral sands mining and processing operations located in western NSW (Figure 1):

- Broken Hill Mineral Separation Plant (MSP).
- Ginkgo Mineral Sands Mine (the Ginkgo Mine).
- Atlas-Campaspe Mineral Sands Project (Atlas-Campaspe Mine).

Construction of the Snapper Mine commenced in August 2008, and mining operations commenced in December 2009.

Project Approval (06_0168) has been modified on six occasions since the commencement of construction at the Snapper Mine (Attachment 1):

- June 2009 – to modify the approved offset area for the offset of environmental impacts associated with the Snapper Mine.
- December 2009 – to allow for the road transport of ore to the Ginkgo Mine for processing.
- October 2010 – to increase the total ore mined at the Snapper deposit, increase the maximum annual production of mineral concentrates, reduce the life of mine and transport high grade ore from the Snapper Mine to the Ginkgo Mine.
- October 2014 – to integrate the Atlas-Campaspe Mine into the existing Tronox mineral sands mining and processing operations located in western NSW (i.e. the Snapper and Ginkgo Mines, and the MSP).
- December 2014 – to increase the ore extraction rate and mineral concentrate transport limits.
- February 2015 – to increase the maximum annual ore extraction rate to maintain the approved maximum mineral concentrate production rate.

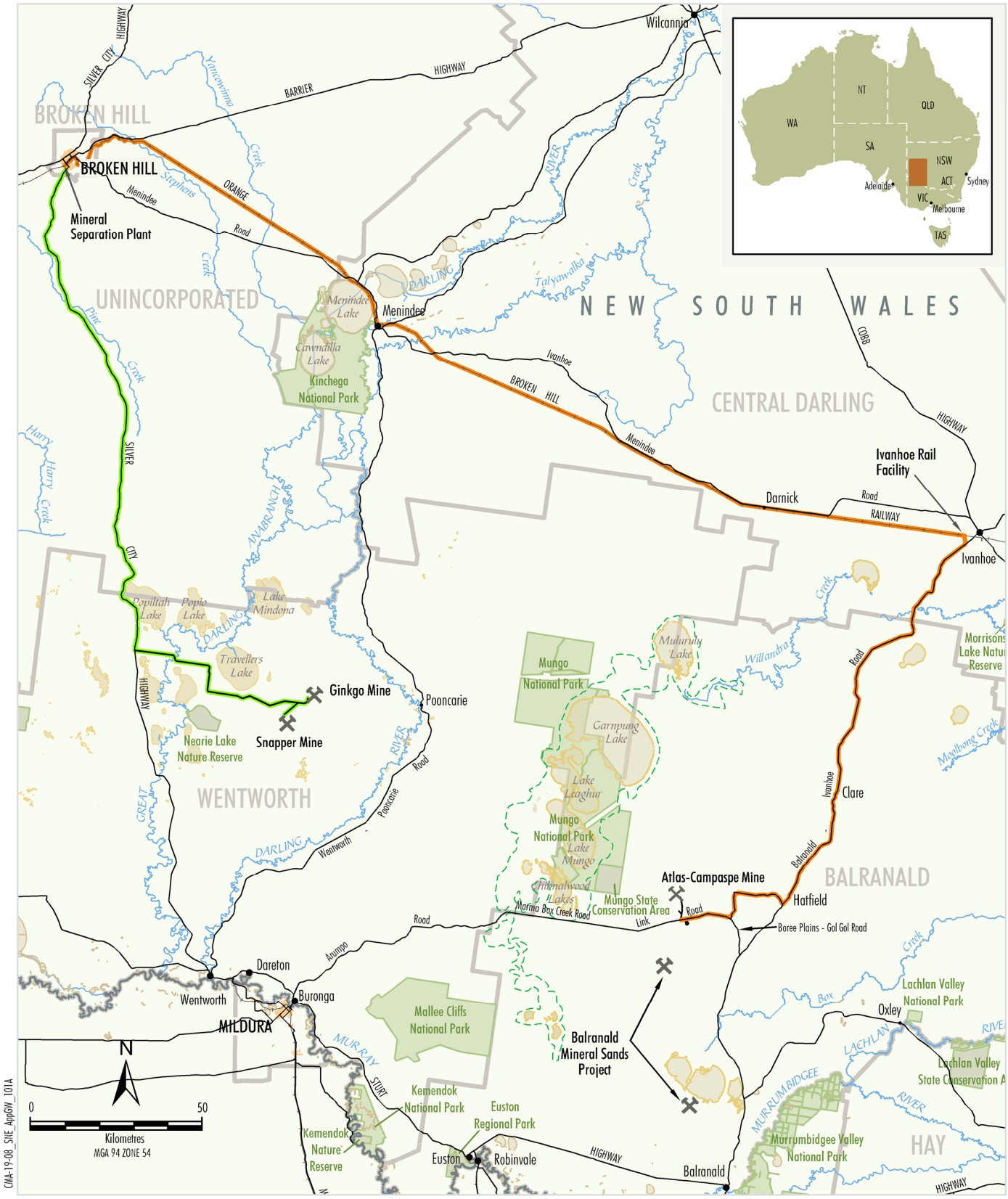
1.1.2 Snapper Mine Operations

The Snapper Mine is currently approved to extract up to 14 million tonnes per annum (Mtpa) of mineral sands ore, producing a maximum 621,000 tonnes per annum (tpa) of mineral concentrate for processing at the MSP (Figure 1). The Snapper Mine is also approved to receive MSP process waste for designated stockpiling, prior to depositing on the sand residue beach and/or with overburden.

The existing/approved Snapper Mine is comprised of the following major site components:

- dredge pond (including a primary and secondary (mini) dredge, primary gravity concentration unit and associated equipment);
- overburden conveyor system (not constructed to date);
- overburden emplacement;
- sand residue dam;
- mineral processing infrastructure including:
  - heavy mineral concentrate (HMC) treatment facility including a reverse osmosis plant, salt washing facility and a wet high intensity magnetic separation (WHIMS) circuit (not constructed to date);
  - towers and stackers for stockpiling mineral concentrates/HMC;
- mineral concentrate/HMC stockpiles;
- office, workshop and store buildings and car parking facilities;

[1] Considering the mine path extension and the area of currently approved surface development area being relinquished (Section 2.2).


BROKEN HILL
BROKEN HILL
Mineral Separation Plant
UNINCORPORATED
NEW SOUTH WALES
CENTRAL DARLING
BALRANALD
WENTWORTH
MILDURA
Wilcannia
Menindee
Menindee Lake
Cawndilla Lake
Kinchega National Park
Ivanhoe
Ivanhoe Rail Facility
Darnick
Ginkgo Mine
Snapper Mine
Pooncarie
Nearie Lake Nature Reserve
Papiltah Lake
Popio Lake
Lake Mindona
Travellers Lake
Mungo National Park
Mutundy Lake
Garnpung Lake
Lake Leaghur
Lake Mungo
Chinnalwood Lakes
Atlas-Campaspe Mine
Mungo State Conservation Area
Hatfield
Clare
Dareton
Wentworth
Buronga
Mallee Cliffs National Park
Balranald Mineral Sands Project
Kemendok National Park
Kemendok Nature Reserve
Euston Regional Park
Euston
Robinvale
Balranald
Lachlan Valley National Park
Oxley
Murrumbidgee Valley National Park
Morrisons Lake Nature Reserve
Barrier Highway
Silver City Highway
Ivanhoe
Menindee
Broken Hill
Darnick
Railway
Cobb Highway
Ivanhoe
Balranald
Boree Plains - Gol Gol Road
Morma Box Creek Road
Link Road
Wentworth
Pooncarie
Road
Anumpo
Road
Darling River
Murray River
Lachlan River
Murrumbidgee River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Yancowinna Creek
Stephens Creek
Menindee Road
Orange
Pine Creek
Harry Harry Creek
Talyawalka Creek
Box Creek
Silver City Highway
Barrier Highway
Cobb Highway
Darling River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Lachlan River
Murrumbidgee River
Sturt Highway
Sturt Highway
Sturt Highway

- fuel and consumables storage facilities;
- water supply bores and associated pumps and pipeline systems;
- wastewater (including sewage) treatment plant;
- water disposal dam (not constructed to date);
- laydown areas;
- highway access route (HAR), internal access roads and haul roads;
- electricity transmission line (ETL), electricity distribution station and associated internal ETLs; and
- other associated minor infrastructure, plant, equipment and activities.

Mining of the approved mine path is scheduled to be completed in mid-2020 (i.e. before the end of the approved mine life) as mining progression to date has been faster than planned.

The general arrangement of the existing/approved Snapper Mine is shown on Figure 2.

1.1.3 Environmental Monitoring and Management

An Environmental Management Strategy (GHD, 2016a) has been developed to minimise environmental impacts by providing the strategic context for environmental management at the Snapper Mine.

Management and monitoring plans and control strategies have been developed in consultation with relevant agencies as part of the Environmental Management Strategy. These monitoring programs and control strategies include the following:

- Water Management Plan (GHD, 2016b);
- Transport Management Plan (GHD, 2015a);
- Flora and Fauna Management Plan (GHD, 2017a);
- Land Management Plan (GHD, 2015b);
- Bushfire Management Plan (GHD, 2016c);
- Offset Management Plan (GHD, 2017b);
- Cultural Heritage Management Plan (GHD, 2015c);
- Radiation Management Plan (Cristal Mining Australia [CMA], 2015a);
- Waste Management Plan (GHD, 2019);
- Noise Management Plan (GHD, 2018);
- Energy Saving Environmental Management Plan (GHD, 2014); and
- Air Quality Management Plan (GHD, 2015d).

A more detailed description of the management and monitoring plans and control strategies described above relevant to the Modification is provided in Section 6.

Tronox maintains an extensive environmental monitoring network for the Snapper Mine, including meteorological, dust and water monitoring.

An overview of environmental management actions and environmental monitoring results, including review of the Tronox's performance against the requirements of the management and monitoring plans and control strategies, is presented each year in an Annual Environmental Management Report (AEMR) and distributed to government agencies, stakeholders and interested parties.

1.1.4 Workforce

The approved Snapper and Ginkgo Mines combined operational workforce is up to approximately 420 personnel (Tronox employees and contractors).

The current Snapper Mine workforce is approximately 110 personnel.

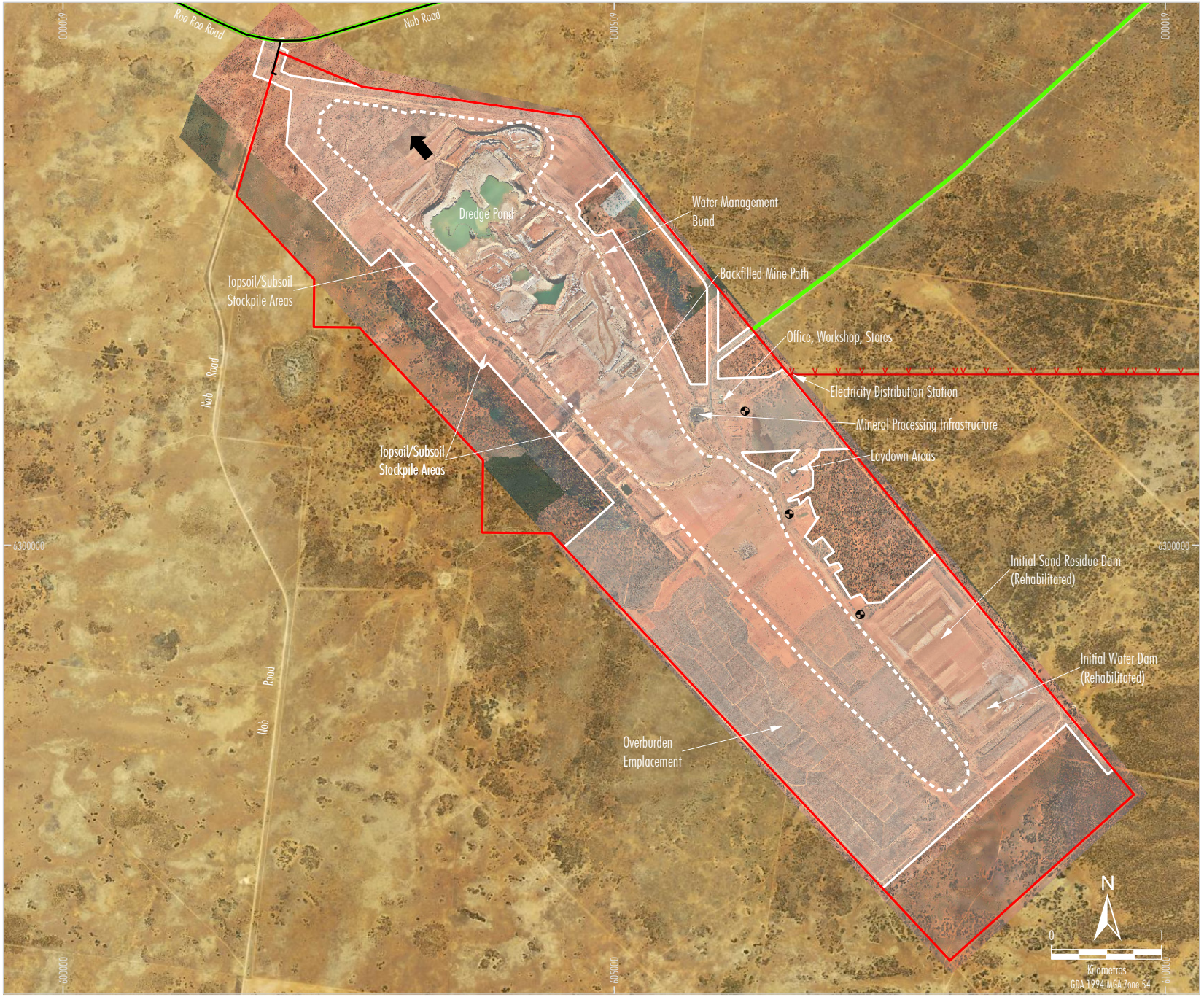
1.1.5 Community Contributions

Tronox plays an active role in the local community through sponsorships of community organisations. Tronox strives to support local communities in the vicinity of its operations including financial support through sponsorships, support programs, employment and the indirect economic growth and benefits that flow from significant company expenditure within these communities.

Tronox is also a regular contributor to schools, sporting groups, festivals, service organisations and the Aboriginal community.

1.2 MODIFICATION OVERVIEW

The Snapper Mine integrates with Tronox's other mineral sands mining and processing operations located in western NSW. Mineral concentrates produced at the Snapper and Ginkgo Mines are currently processed at the MSP.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

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SNAPPER MINE

Existing/Approved Snapper Mine - General Arrangement

Figure 2

CMA-19-08_SNE_201A

Production from the approved Atlas-Campaspe Mine (once operational) will progressively replace Snapper and Ginkgo Mine production as the feed material for the MSP. Construction activities at the Atlas-Campaspe Mine commenced in 2018, and production is scheduled to commence in late 2021.

Production at the approved Snapper Mine is currently scheduled to conclude in mid-2020 (Section 1.1.2). The Snapper Mine workforce is then planned to transition to the Atlas-Campaspe Mine.

Based on this current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine Northern Extension Modification (the Modification) would minimise the risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations without extending the mine life or the size of the approved surface development area.

A detailed description of the Modification is provided in Section 2.

1.3 STRUCTURE OF THE DOCUMENT

This Modification Report is a Statement of Environmental Effects that has been prepared in consideration of the draft *Preparing a Modification Report* Guidelines (Department of Planning and Environment [DP&E], 2019).

This Modification Report is structured as follows:

Section 1	Provides an overview of the existing/approved Snapper Mine, and the background to the Modification.
Section 2	Provides a description of the Modification.
Section 3	Describes the strategic context of the Modification.
Section 4	Describes the general statutory context of the Modification and how the Modification meets relevant statutory requirements.
Section 5	Describes the consultation undertaken in relation to the Modification.
Section 6	Provides a review of the existing environmental management at the Snapper Mine and an environmental assessment of the Modification.
Section 7	Evaluates the merits of the Modification, and provides justification for approval of the Modification.
Section 8	References.

Attachment 1 and Appendices A to G provide supporting information as follows:

Attachment 1	Project Approval (06_0168)
Appendix A	Biodiversity Assessment
Appendix B	Aboriginal Cultural Heritage Assessment
Appendix C	Air Quality Review
Appendix D	Noise Review
Appendix E	Road Transport Review
Appendix F	Hydrogeological Review
Appendix G	Land Contamination Assessment

2 MODIFICATION DESCRIPTION

2.1 OVERVIEW

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (Section 1.2).

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

Although the Modification would extend mining operations at the Snapper Mine by approximately one year, mining operations would still be completed within the approved mine life (i.e. before 10 July 2026) as mining progression to date has been faster than planned,

The indicative general arrangement of the modified Snapper Mine is shown on Figures 3 and 4.

The additional surface development areas and Nob Road realignment (Figures 3 and 4) are herein referred to as the Modification area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

Table 1 provides a comparative summary of the existing/approved and modified Snapper Mine. Based on a review of the proposed changes, Tronox considers that the modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine (Section 4.1.1).

The following sub-sections provide a detailed description of the Modification components.

2.2 GENERAL ARRANGEMENT

The Modification would include an approximate 87.4 hectare (ha) increase in the extent of the existing/approved surface development area at the northern end of the Snapper deposit to allow for (Figure 3):

- an extension of the existing/approved mine path;
- temporary overburden emplacements;
- expanded soil stockpile areas; and
- the extension of other supporting infrastructure (e.g. internal access roads, internal ETLs and other associated minor infrastructure).

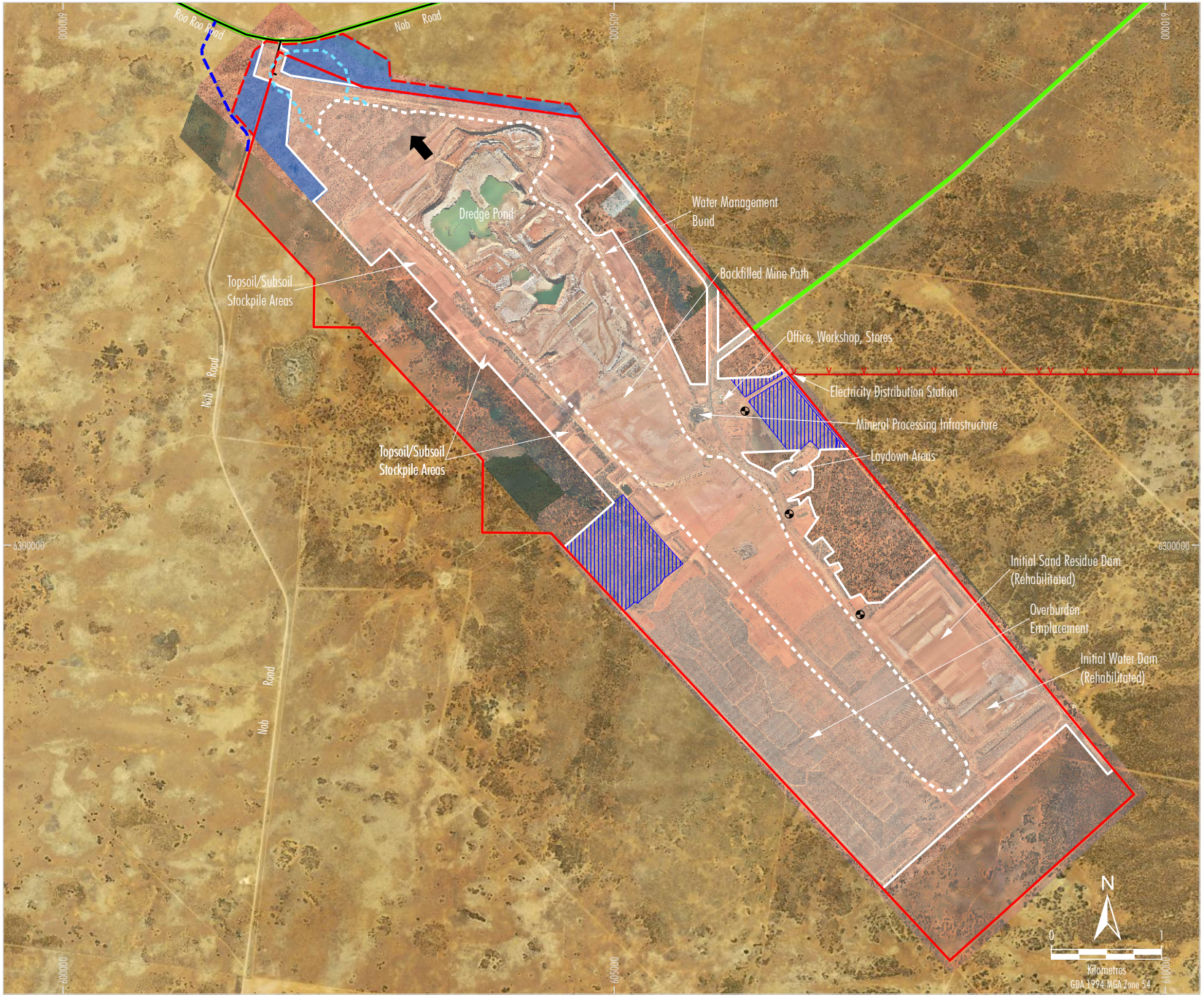
The Modification would also include the relinquishment of approximately 90.7 ha of approved surface development areas no longer required. The Modification would therefore result in an approximate 3.3 ha reduction in surface development area.

2.3 MINING OPERATIONS

2.3.1 Mine Path

The existing/approved mine path extends approximately 8 km in length and up to approximately 1,200 metres (m) wide (Figure 2).

The Modification would include extension of the existing/approved mine path by approximately 600 m at the northern end (Figures 3 and 4). The mine path extension would be up to approximately 500 m wide (Figures 3 and 4).



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

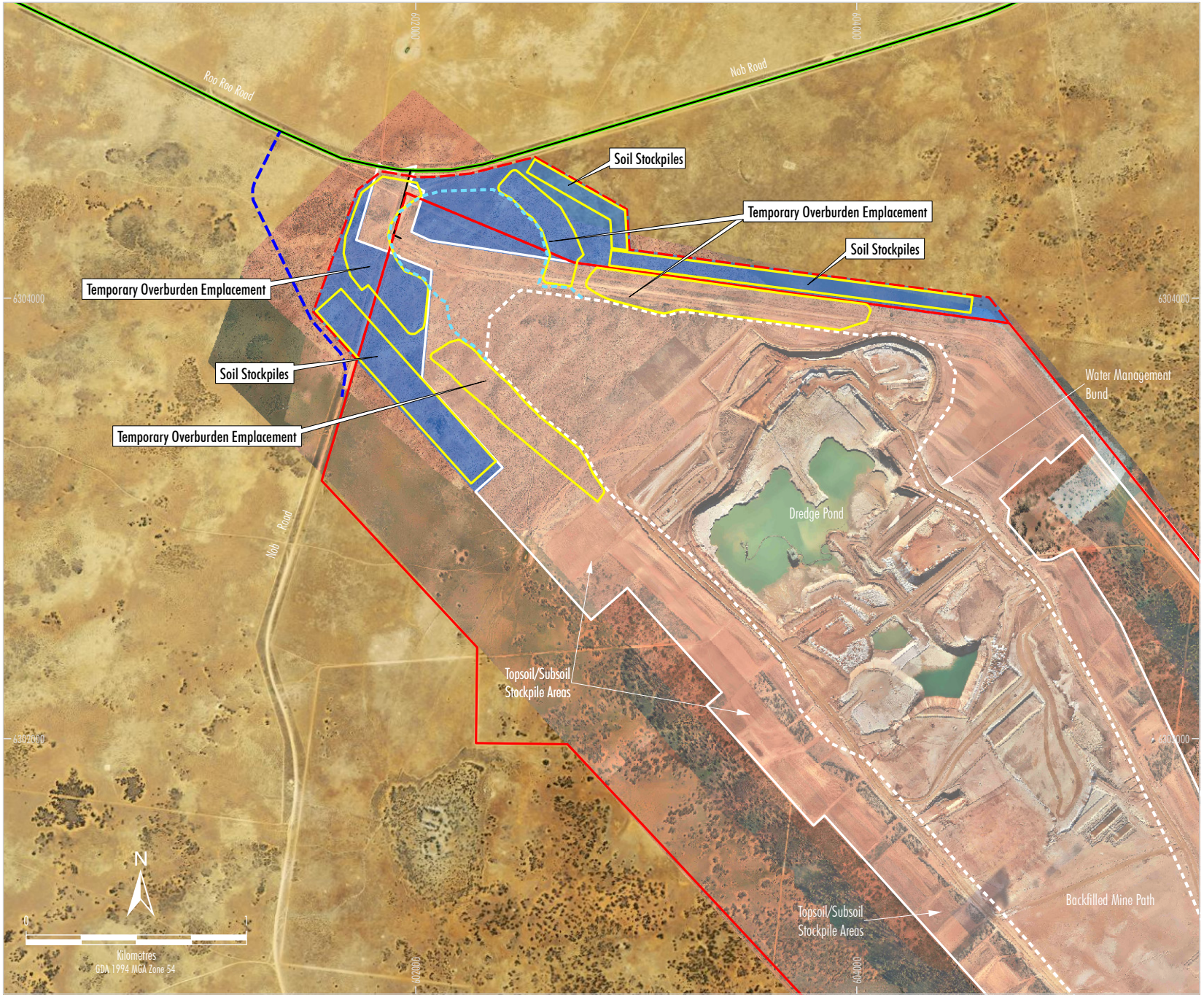
TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure 3

CMA-19-08_SNE_209A



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative Modification Area General Arrangement

Figure 4

CMA-19-08_SNE_202A

Table 1
Comparison of the Existing/Approved and Modified Snapper Mine

Snapper Mine Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Life	• Mining operations until 10 July 2026.	• No change.
Tenement	• Mining Lease (ML) 1621.	• New Mining Lease Application (MLA 1).
Surface Development Area	• Approximately 1681 hectares (ha).	• Overall net reduction in surface development area of approximately 3 ha.
Mining	• Dredge mining producing approximately 14 Mtpa of ore. • Conventional mining (dozers and/or scrapers) for ore unable to be dredge mined.	• No change.
Mineral Concentration and Mineral Concentrate Transport	• Mineral concentrate production up to 621,000 tpa. • Mineral concentrate transport from the Snapper and Ginkgo Mines combined to the MSP up to 975,000 tpa. • Ore concentrated in the primary gravity concentration unit (comprising a screen, surge bin and wet concentrator) to produce HMC. • HMC washed in the salt washing facility prior to processing in the WHIMS circuit to produce ilmenite-rich, leucoxene-rich and non-magnetic (containing rutile-rich and zircon-rich) mineral concentrates.	• No change.
Overburden Management	• Overburden removal ahead of ore extraction areas using conventional truck and shovel methods (e.g. excavators and haul trucks). • A conveyor system and/or haul trucks are approved to transport the overburden to either the mine void behind the advancing dredge pond or in the overburden emplacement	• No change. • Additional temporary off-path overburden emplacements.
Sand Residue and Coarse Reject Management	• Sand residues and coarse rejects placed in either an initial sand residue dam or dredge pond behind the advancing ore extraction area.	• No change.
MSP Process Waste Management	• MSP process waste placed behind the advancing ore extraction areas at either the Ginkgo Mine, Snapper Mine or Atlas-Campaspe Mine. • MSP process waste transport up to 300,000 tpa to the Snapper and Ginkgo Mines.	• No change.
Water Supply	• Water requirements supplied by the Snapper Mine borefield.	• No change.
Electricity Supply	• Electricity supplied by distribution station connected to grid.	• No change.
Site Access	• Access to the Snapper Mine via the HAR. • Eastern and northern (not constructed) access roads connect the Snapper Mine to the HAR.	• No change. • Northern access road would not be constructed.
Employment	• Up to approximately 200 personnel during operations.	• No change.
Rehabilitation Works	• Progressive rehabilitation undertaken as mining advances. • Two final depressions associated with the final dredge pond and water disposal dam, respectively.	• No change to rehabilitation strategy. • Reduction in the number of final depressions from two to one. • Increased size of the remaining final depression.

2.3.2 Mine Fleet

The existing mine fleet includes dozers, excavators, front end loaders and haul trucks. Additional detail on the mine fleet is provided in the Noise Review (Appendix D).

The number of excavators and haul trucks would be reduced as part of the Modification due to narrowing of the mine path as mining progresses north into MLA 1 and therefore fewer excavators and haul trucks are required for overburden removal and handling.

Details of the modified mine fleet are provided in the Noise Review (Appendix D).

2.3.3 Overburden Removal and Handling

The existing/approved overburden removal and handling process involves the removal of overburden ahead of the advancing dredge pond using excavators, dozers and front-end loaders.

Haul trucks and/or a conveyor system are approved to transport overburden behind the advancing dredge pond for backfilling of the mine path or in the overburden emplacement. Haul trucks are currently used to transport overburden.

As the mine path has sufficiently progressed, overburden is now only placed in the mine void behind the advancing dredge pond (i.e. the overburden emplacement is no longer utilised).

The overburden placed in the mine void behind the advancing dredge pond is mounded up to approximately 10 m above the natural ground surface.

As part of the Modification, overburden would be placed temporarily around the crest of the mine path extension (Figure 4), rather than be placed behind the advancing dredge pond. At the end of the mine life, the overburden would be dozer pushed into the mine path to establish the final landform (Section 2.5).

The use of temporary overburden emplacements would minimise overburden handling and reduce costs associated with the development of the final landform.

2.4 WATER MANAGEMENT

Site water management at the Snapper Mine is conducted in accordance with the Water Management Plan (GHD, 2016b).

The key objectives of the Snapper Mine water management system are (Bemax Resources Limited [Bemax], 2007a):

- separation of undisturbed area runoff from disturbed area runoff;
- collection and re-use of surface runoff from disturbed areas (including mining areas and overburden replacement);
- capture and on-site containment of potentially contaminated mine site waters; and
- priority re-use of captured and contained water for dust suppression or process requirements.

To meet these objectives, the water management system is developed progressively over the life of the Snapper Mine.

The objectives of the Snapper Mine water management system would continue to be adopted at the modified Snapper Mine.

2.4.1 Up-catchment Runoff and Sediment Control System

Both temporary and permanent up-catchment diversion bunds/drains will be constructed over the life of the Snapper Mine to divert runoff from undisturbed areas around the mine path, overburden emplacement, soil stockpiles, sand residue dam and other fixed infrastructure areas.

Drainage from disturbance areas within the Snapper Mine surface development area is directed to the evaporation/sediment sumps for containment. Water collected in evaporation/sediment sumps is utilised for dust suppression at the mine site or allowed to evaporate.

The existing/approved Snapper Mine up-catchment runoff and sediment control system would be extended to incorporate the additional Snapper Mine surface development area.

2.5 REHABILITATION STRATEGY

2.5.1 Rehabilitation Objectives

The existing rehabilitation objectives for the Snapper Mine are outlined in Condition 19, Schedule 3 of Project Approval (06_0168), and are summarised in Table 2.

Table 2
Summary of Project Approval Rehabilitation Objectives

Snapper Mine Component	Objectives
Mine Site	• Safe, stable and non-polluting. • Final land use compatible with surrounding land uses. • Final landforms designed to incorporate micro-relief, natural drainage lines and minimise visual prominence by integration with the surrounding landscape. • Restore self-sustaining ecosystems, including establishing local native plant species.
Final Void	• Minimise the size and depth of the final voids as far as is reasonable and feasible. • Minimise the drainage catchment of the final voids as far as reasonable and feasible.
Overburden Emplacement Areas	• Ensure that areas subject to slurried overburden emplacement are covered with a minimum of: – 1 m of non-slurried overburden on the initial slurried sand storage dam; – 3 m of non-slurried overburden for all other areas; in addition to at least 0.2 m of topsoil and at least 0.2 m of subsoil.
Surface Infrastructure	• To be decommissioned and removed (unless otherwise agreed with the Department of Resources and Geoscience).
Agriculture	• Reinstatement of the infrastructure areas to land suitable for light intensity grazing.
Community	• Ensure public safety and minimise the adverse socio-economic effects associated with mine closure.

The Mining Operations Plan[2] (CMA, 2015b) outlines the following short-term rehabilitation objectives:

- *Minimise clearing disturbance areas*
- *Commence vegetation pre clearance in accordance with the Flora and Fauna Management Plan*
- *Clear approved vegetation areas 12 months in advance of mining operations in the appropriate season (late summer – early winter)*
- *Carry out topsoil assessments as part of the Vegetation Clearance Protocol VCP*
- *Employ suitable topsoil removal and storage practices to allow maximum survival of soil biota*
- *Schedule mine planning operations so that OB placement to be consistent with rehabilitation requirements and designs*
- *Progressive rehabilitation*
- *Pest flora and fauna control*
- *Monitoring, Evaluation, Reporting and Improvement to ensure continual improvement*

The Mining Operations Plan also outlines the following long-term rehabilitation objectives (CMA, 2015b):

- *Restoration of a self-generating native landscape that is capable of supporting light intensity grazing*
- *Development and completion of low maintenance, non-polluting and stable rehabilitation landforms*
- *Removal/burial of all required infrastructure and complete rehabilitation of the site*
- *Relinquishment of the mining lease and release from any further liabilities*

These rehabilitation objectives would continue to be adopted at the modified Snapper Mine.

2.5.2 Final Landform Concepts

The existing/approved and modified final landform design concepts for the Snapper Mine are summarised in Table 3.

The Modification would not change the existing/approved final landform concepts with the exception of the final depressions (Table 3).

The number of final depressions would reduce from two to one as a result of the Modification. The water disposal dam final depression would be integrated within the final dredge pond final depression at the northern extent of the mine path (herein referred to as the modified final depression).

[2] The Snapper Mine Mining Operations Plan also addresses the Rehabilitation Management Plan requirements in Condition 19B, Schedule 3 of Project Approval (06_0168).

The extent of the modified final depression would increase as it would incorporate the water disposal dam final depression and more overburden has been able to be placed in the existing backfilled mine path than originally forecast in the *Snapper Mineral Sands Project Environmental Assessment* (Snapper Mine EA) (Bemax, 2007a).

The modified final landform is shown on Figure 5.

The modified final depression would be rehabilitated consistent with the approved design concept, with the exception of improvements to the batter slopes. The batter slopes of the final depression would reduce from 1:4 to between 1:5 and 1:10 (Table 3).

A conceptual cross-section of the modified final depression is shown on Figure 6.

2.5.3 Final Land Use

The approved final land use at the Snapper Mine is light intensity grazing (CMA, 2015b).

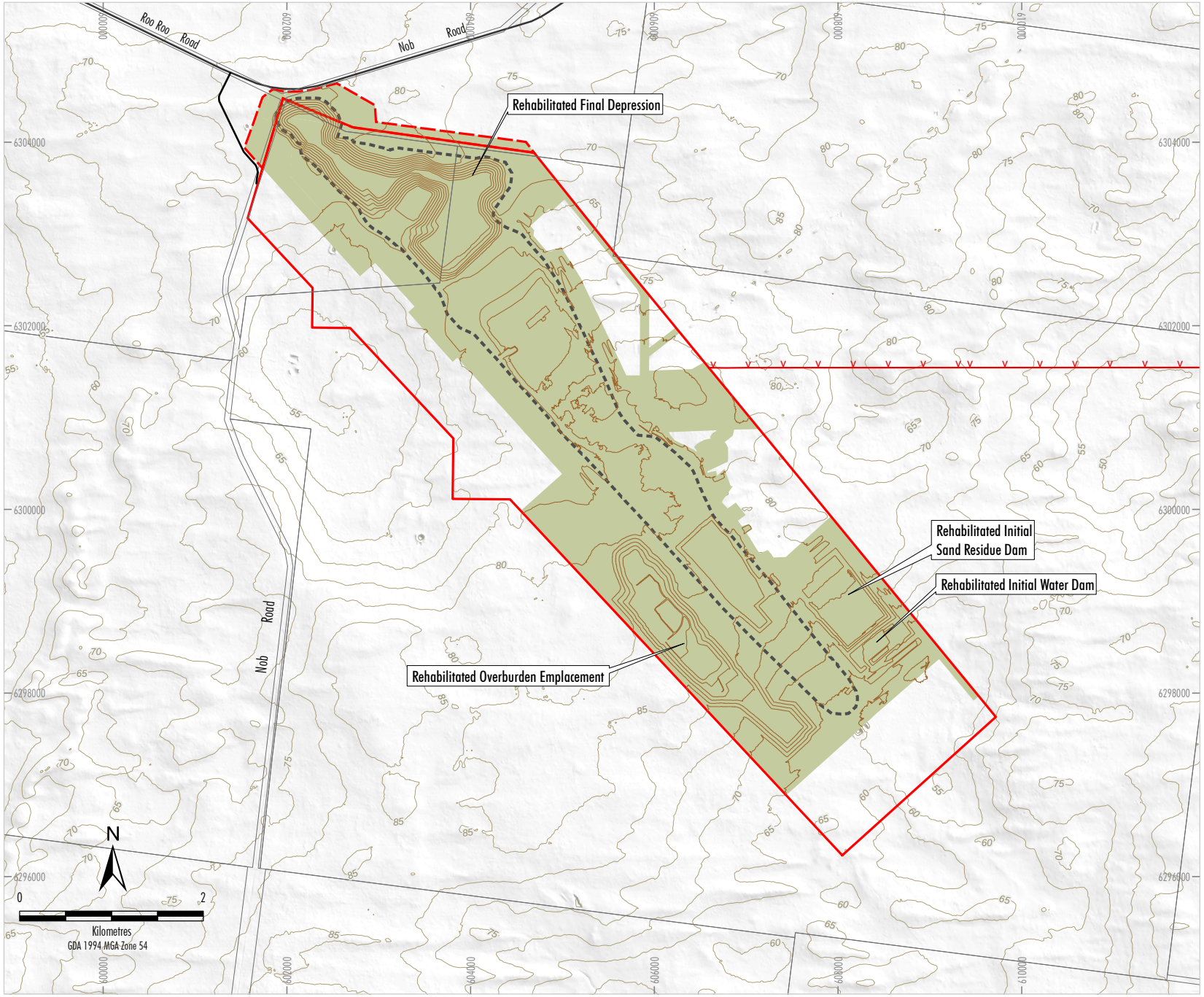
The approved final land use would remain unchanged as a result of the Modification.

2.5.4 Rehabilitation Management

In accordance with Condition 19A, Schedule 3 of Project Approval (06_0168), Tronox will progressively rehabilitate the Snapper Mine, as soon as reasonably practicable following disturbance.

Table 3
Comparison of Existing/Approved and Modified Final Landform Concepts

Final Landform Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Path	• Mine path will be progressively backfilled, shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated. • The final elevation of the shaped mine path will be up to approximately 10 m over the pre-existing landform.	• Unchanged.
Overburden Emplacement	• The height of the overburden emplacement will be up to 20 m. • The batter slopes will be approximately 1:7 or an appropriate alternative determined by slope and erodibility investigations. • The overburden emplacements will be shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Sand Residue Dam	• The height to the sand residue dam will be up to 20 m. • The batter slopes will be approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. • The sand residue dam will be shaped, overburden placed over sand residues, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Infrastructure Areas	• Infrastructure will be removed following the cessation of mining, unless otherwise agreed with the relevant landholder and leaseholder during closure planning. • The infrastructure areas will be shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Final Depression (Water Disposal Dam)	• The water disposal dam will be retained as a depression with batter slopes of approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. • The emptied water disposal dam will include salt-affected surfaces within the storage area. Overburden will be placed over the salt-affected material prior to soil material (e.g. subsoil and topsoil) replacement and revegetation.	• Incorporated into the final dredge pond final depression (see below).
Final Depression (Final Dredge Pond)	• A final depression will be located at the northern extent of the mine path with batter slopes of approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. • The final depression will be partially backfilled with overburden material pushed down from the pit walls and from the overburden emplacement area to a level approximately 2 m to 4 m above the local groundwater table. • The resulting final depression will be similar in nature to the localised topographic depressions that occur in the region. • The salt-affected surface will be covered using the same cover strategy as for the water disposal dam.	• Increased size of the final depression. • The batter slopes of the final depression would reduce from 1:4 to between 1:5 and 1:10. • No other changes to rehabilitation strategy.



LEGEND

- Mining Lease Boundary (ML 1621)
- Mining Lease Application Boundary (MLA 1)
- Extent of Backfilled Mine Path
- Extent of Rehabilitation
- Electricity Transmission Line

Source: NSW Spatial Services (2019); Tronox (2019)

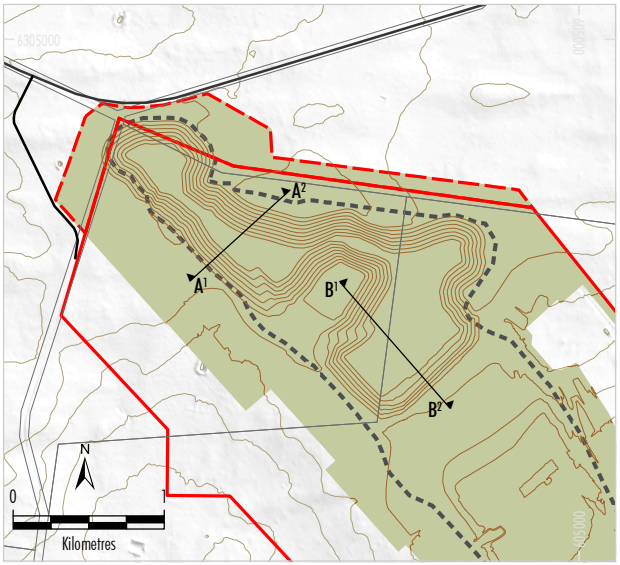
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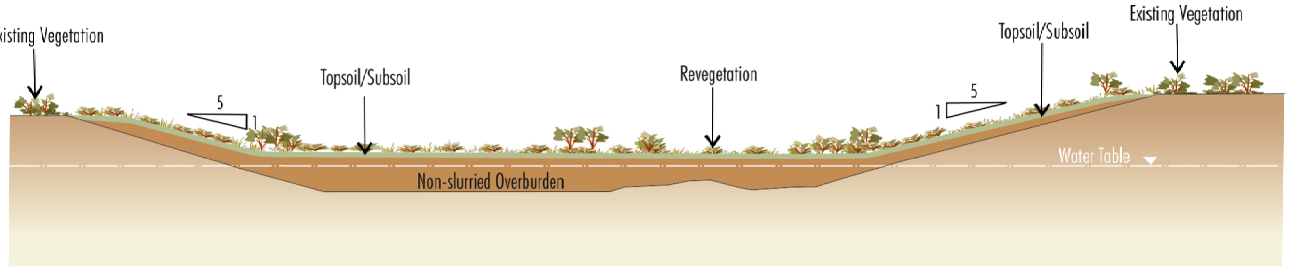
SNAPPER MINE

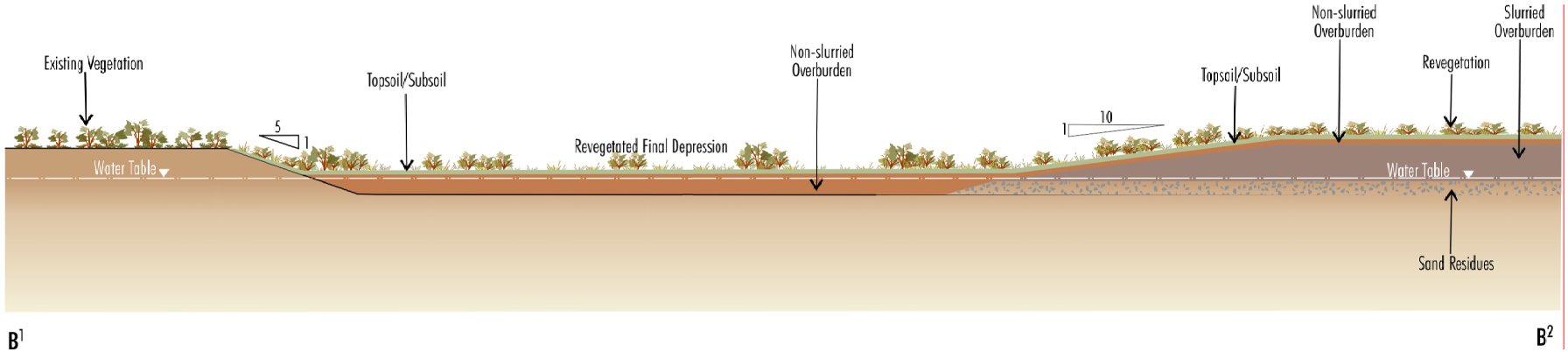
Modified Snapper Mine - Indicative Final Landform

Figure 5

CMA-19-08_SNE_207A







CMA-19-08_SNE_204A

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Conceptual Cross Section -
Rehabilitated Final Depression

Figure 6

The management of rehabilitation at the Snapper Mine is conducted in accordance with the Mining Operations Plan (CMA, 2015b), which includes:

- rehabilitation objectives;
- final landform design;
- rehabilitation domains and objectives;
- rehabilitation methods;
- rehabilitation monitoring and research programs; and
- performance indicators and relinquishment criteria.

The Mining Operations Plan would be updated to incorporate the Modification.

2.6 NOB ROAD REALIGNMENT

The Modification would include the realignment of approximately 1 km of Nob Road south of its intersection with Roo Roo Road. The Nob Road realignment would be approximately 1.35 km long (Figure 3).

The Nob Road realignment would be constructed in accordance with the with the principles outlined in the *Unsealed Roads Manual* (Australian Road Research Board [ARRB], 2009), the requirements of *Guide to Road Design Part 4: Intersections and Crossings – General (*Austroads,2017a) and *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2017b), and in consultation with the Wentworth Shire Council (WSC).

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC has provided in-principle support for the Modification.

A detailed description of the Nob Road realignment is provided in Section 6.7.2 and Appendix E.

As a result of the Modification (including the Nob Road realignment), the approved northern access road would not be constructed (Table 1).

3 STRATEGIC CONTEXT

The Snapper Mine is an existing mineral sands mining operation and forms part of Tronox's operations in western NSW including the Ginkgo Mine, Atlas-Campaspe Mine and the MSP (Section 1).

The western NSW regional economy is centred around agriculture and mining which directly contribute almost 40 percent (%) to the western region's gross regional product (NSW Trade and Investment, 2015).

Land use in the vicinity of the Snapper Mine reflects these dominant industries and comprises pastoral leasehold lands that are used for light intensity rangeland grazing and mineral sands mining.

The area around the Snapper Mine is sparsely populated, with the closest sensitive receivers located significant distances from the Snapper Mine (Section 6.5.1).

The strategic context of the Modification includes consideration of the following:

- maintaining employment for the existing Snapper Mine workforce;
- mineral concentrate production continuity; and
- efficient recovery of additional mineral sands resources in a manner that minimises environmental impacts.

3.1 CONTINUED EMPLOYMENT OPPORTUNITIES

Tronox is a significant employer in western NSW (Section 1.1.4). In addition, Tronox engages a range of local contractors at its western NSW operations (Section 6.11).

The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine in late 2021.

The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in western NSW would, therefore, continue as a result of the Modification.

In addition, the Modification would allow transition of an existing skilled workforce to the Atlas-Campaspe Mine once operational, which would reduce Tronox's costs associated with hiring and training a new workforce for the Atlas-Campaspe Mine.

3.2 MINERAL CONCENTRATE PRODUCTION CONTINUITY

The Modification would allow Tronox to maintain continuity of mineral concentrate production until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine mineral concentrates are separated further off-site to produce ilmenite, leucoxene, rutile and zircon products.

Ilmenite, leucoxene and rutile are sources of titanium dioxide. Demand for titanium dioxide is driven by the pigment, plastic, printing, inks, food colourings, fabric delustering agents, sunscreens, cosmetics, and paper industries.

Rutile is used to make titanium metal used for aircraft component manufacture, golf clubs, sports equipment, surgical implants and water desalination plants. In addition to existing demand, new technology for production of titanium metal is being developed.

Zircon is a key raw material used in the production of floor tiles, sanitary ware, glass and steel refractories, metal castings and specialised glass, as well as faceplates for television monitors and computer screens.

The Modification would allow Tronox to continue to supply mineral concentrate to its downstream operations (including the MSP) and other customers until the commencement of production from the Atlas-Campaspe Mine, thereby avoiding disruption to existing supply chains.

3.3 RECOVERY OF ADDITIONAL MINERAL SANDS RESOURCE

The Modification would promote the efficient and economic recovery of additional mineral sands resources at the Snapper Mine.

An additional 8.5 million tonnes (Mt) of ore producing approximately 170 kilotonnes (kt) of mineral concentrate product would be recovered from the Snapper Mine utilising Tronox's existing western NSW operations. This maximises the use of these established facilities and associated returns on existing financial investment.

The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6).

4 STATUTORY CONTEXT

This section outlines the statutory requirements relevant to the assessment of the Modification.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The EP&A Act and *Environmental Planning and Assessment Regulation 2000* set the framework for planning and environmental assessment in NSW.

4.1.1 Applicability of S4.55(2) of the Environmental Planning and Assessment Act 1979

The Snapper Mine was approved under Part 3A of the EP&A Act in 2007 (Project Approval [06_0168]) (Attachment 1).

As a result of amendments made to the EP&A Act that took effect on 1 March 2018, it is no longer possible for Project Approval (06_0168) to be modified under the former Section 75W of the EP&A Act.

The Snapper Mine was declared a State Significant Development (SSD) under Clause 6 of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* via Government Gazette on 22 February 2019.

Given that the Snapper Mine is now considered to be SSD, Tronox is seeking to modify Project Approval (06_0168) under Section 4.55(2) of the EP&A Act.

Section 4.55(2) of the EP&A Act relevantly provides:

> **4.55 Modifications of consents-generally**
>
> …
>
> *(2) Other modifications*
>
> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:*
>
> *(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and*
>
> *(b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and*
>
> *(c) it has notified the application in accordance with:*
>
> *(i) the regulations, if the regulations so require, or*
>
> *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
>
> *(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.*
>
> *Subsections (1) and (1A) do not apply to such a modification.*

Clause 3BA(6) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* relevantly provides:

> ***3BA Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications***
>
> …
>
> *(6) In the application of section 4.55 (1A) or (2) or 4.56 (1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W):*
>
> *(a) development that was previously a transitional Part 3A project and whose approval was modified under section 75W,*
>
> …

The consent authority is, therefore, required to satisfy itself that any consent as modified would result in the Snapper Mine remaining substantially the same development as was last modified under Section 75W of the EP&A Act (i.e. Modification 5, February 2015), inclusive of consideration of the changes arising from previously approved modifications.

Consideration of the key comparatives detailed in the draft guideline *Modifying an Approved Project* (NSW Government, 2017) when considering whether the Modification could be considered to be "substantially the same" is provided in Table 4.

The Snapper Mine has demonstrably remained a large mineral sands mine that incorporates the following key elements approved under Project Approval (06_0168) (Table 1):

- mining of a mineral sands deposit;
- overburden and sand residue emplacement and backfilling;
- mineral handling and processing facilities;
- mineral concentrate transport activities;
- water supply and water management systems; and
- supporting infrastructure and facilities.

This would also clearly continue to be the case if the Modification was approved (Table 1) and therefore the consent authority can be satisfied that the Snapper Mine incorporating the Modification would remain "substantially the same".

This Modification Report is a Statement of Environmental Effects that has been prepared in support of the application to modify Project Approval (06_0168).

4.1.2 EP&A Act Objects

Section 1.3 of the EP&A Act describes the objects of the EP&A Act as follows:

(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,

(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,

(c) to promote the orderly and economic use and development of land,

(d) to promote the delivery and maintenance of affordable housing,

(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),

(g) to promote good design and amenity of the built environment,

(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

Table 4
Summary Evaluation for "Substantially the Same" Test

Key Comparatives	Approved Snapper Mine[1]	Modified Snapper Mine
Development size, scale and footprint	Large mineral sands mine.	No change.
Intensity including rates of production	14 Mtpa (ore). 621,000 tpa (mineral concentrate).	No change. No change.
Primary, secondary and ancillary use	Secondary use of the area behind the advancing ore extraction area for sand residue and process waste emplacement. Rehabilitation for light intensity grazing.	No change.
Project life and hours of operation	Project Approval to 2026. Operating hours are 24 hours per day, seven days per week.	No change.
Extent, duration and severity of impacts	Snapper Mine life to 2026. Mining within ML 1621. Approved surface development area approximately 1681 ha	No change. Additional mining within MLA 1. Net decrease.

1 Modification 5 approved in February 2015.

The Modification is considered to be generally consistent with the objects of the EP&A Act, because it is a Modification that:

- incorporates:
  - continued development of NSW mineral resources from the Snapper Mine in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6);
  - measures to minimise potential amenity impacts associated with air quality and noise impacts on surrounding land uses (Sections 6.5 and 6.6, respectively);
  - continued employment and other socio-economic benefits to the community;
- involves the orderly and economic use of land as the Modification area is the minimum amount of land required to accommodate the Modification;
- would be conducted in accordance with relevant lease/licence/reserve conditions over Crown land within ML 1621 and MLA 1;
- would support the ongoing provision of community services and facilities through contributions to NSW Government royalties, NSW Government taxes, Commonwealth tax revenue and voluntary contributions to community initiatives;
- is an application under Section 4.55(2) of the EP&A Act that would be determined by the Minister for Planning and Public Spaces however, consultation with the WSC and a range of stakeholders has been undertaken (Section 5); and
- involves public involvement and participation through Tronox's consultation activities (Section 5), which would be ongoing following the public exhibition of this Modification Report and the Department of Planning, Industry and Environment's (DPIE) assessment of the Modification in accordance with the requirements of the EP&A Act.

4.2 OTHER NSW LEGISLATION

In addition to the EP&A Act, the following NSW Acts may be applicable to the Snapper Mine, incorporating the Modification:

- *Biosecurity Act 2015;*
- *Biodiversity Conservation Act 2016* (BC Act);
- *Contaminated Land Management Act 1997*;
- *Crown Land Management Act 2016*;
- *Dams Safety Act 2015*;
- *Dangerous Goods (Road and Rail Transport) Act 2008*;
- *Fisheries Management Act 1994*;
- *Heritage Act 1977*;
- *Local Land Services Act 2013*;
- *Mining Act 1992*;
- *National Parks and Wildlife Act 1974*;
- *Protection of the Environment Operations Act 1997* (PoEO Act);
- *Radiation Control Act 1990*;
- *Roads Act 1993*;
- *Water Management Act 2000*; and
- *Work Health and Safety Act 2011*.

Relevant licences or approvals required under these Acts would continue to be obtained for the modified Snapper Mine. Key plans that would require revision to incorporate the Modification are outlined in Section 4.6.

Additional detail on the likely requirements under some of the key Acts is provided in the sub-sections below.

Mining Act 1992

The modified Snapper Mine would extend beyond the boundary of ML 1621. Tronox would apply to the NSW Division of Resources and Geoscience (DRG) for a new authority (ML) over the MLA 1 area under the *Mining Act 1992*.

Under the *Mining Act 1992*, environmental protection and rehabilitation are regulated by conditions of mining leases, including requirements for the submission of a Mining Operations Plan prior to the commencement of operations, and subsequent Annual Environmental Management Reports (or Annual Reviews).

The current Mining Operations Plan (CMA, 2015b) would require revision to reflect the Modification (including MLA 1).

Protection of the Environment Operations Act 1997

The PoEO Act is the primary NSW legislation that regulates pollution control and licensing. One key feature of the Act is the statutory requirement to apply for and obtain an Environment Protection Licence (EPL) in circumstances where a scheduled activity or activities are being carried out (those activities being defined in Schedule 1 of the PoEO Act).

The approved Snapper Mine is currently licensed under EPL 12799 to conduct "crushing, grinding or separating", "metallurgical activities" and "mining for minerals" as defined in Schedule 1 of the PoEO Act.

Tronox would review EPL 12799 in consultation with the Environment Protection Authority (EPA), and if necessary, vary EPL 12799 under the PoEO Act to incorporate the Modification.

Water Management Act 2000

The *Water Management Act 2000* contains provisions for the licensing, allocation, capture and use of water resources. Under the *Water Management Act 2000*, water sharing plans are being introduced (and many have commenced) for water sources. Water sharing plans establish rules for sharing water between different users and between the various environmental sources (namely rivers or aquifers).

The Snapper Mine is located within the Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* (Appendix F).

Tronox currently holds a combined total of 21,442 share components (units or million litres [ML]) in the Western Murray Porous Rock Water Source for the Snapper, Ginkgo and Atlas-Campaspe Mines. No additional water licences under the *Water Management Act 2000* are required for the Modification (Section 6.9).

Biodiversity Conservation Act 2016

The BC Act sets the legislative framework for biodiversity conservation in NSW.

Section 6.2 considers the potential biodiversity impacts associated with the Modification.

As described in Section 6.2, with reference to Clause 30A, Sections 1(a) and 2(c) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, the Modification would not increase impacts on biodiversity values and therefore, it is considered that a Biodiversity Development Assessment Report (BDAR) is not required.

Roads Act 1993

The Modification would include the realignment of Nob Road around MLA 1 (Section 2.6).

Approximately 1 km of Nob Road (within MLA 1) would be closed to the public (Figures 3 and 4) to allow mining and ancillary development associated with the modified Snapper Mine. Tronox would apply for the relevant approvals under the *Roads Act 1993* to close this section of Nob Road.

In addition, Tronox would apply for the necessary consents under Section 138 of the *Roads Act 1993* for these works.

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC have provided in-principle support for the Modification.

Crown Land Management Act 2016

The *Crown Land Management Act 2016* provides for the management of Crown land in NSW.

The Modification Area is located on the Manilla and Carstairs properties, which are located on Western Lands Lease 4090 (Lot 1926 DP 763904) and Western Lands Lease 4086 (Lot 1927 DP 763905), respectively.

Tronox has consulted with the DPIE – Crown Lands regarding the Modification (Section 5.3) and would obtain relevant *Crown Land Management Act 2016* approvals for the Modification.

4.3 ENVIRONMENTAL PLANNING INSTRUMENTS

Local environmental plans and NSW environmental planning policies that may be relevant to the Modification are discussed below.

4.3.1 Wentworth Local Environmental Plan 2011

The Snapper Mine is located wholly within the Wentworth Local Government Area (LGA) (Figure 1). The following identifies the provisions in the *Wentworth Local Environmental Plan 2011* (Wentworth LEP) which may have relevance to the Modification.

Permissibility

The Snapper Mine is located within Zone RU1 (Primary Production) within the Wentworth LGA.

Under the Wentworth LEP, open cut mining is listed as permissible activity with consent on lands zoned RU1 (Primary Production). Roads are permissible without consent on lands zoned RU1 (Primary Production).

Zone Objectives

Clause 2.3, Section 2 of the Wentworth LEP provides:

> *The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.*

The Snapper Mine is located within Zone RU1 (Primary Production) within the Wentworth LGA. The objectives of Zone RU1 (Primary Production) include:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- ***To encourage diversity in primary industry enterprises and systems appropriate for the area.***
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To ensure the protection of both mixed dryland and irrigation agricultural land uses that together form the distinctive rural character of Wentworth.*
- *To ensure land is available for intensive plant agricultural activities.*
- ***To encourage diversity and promote employment opportunities related to primary industry enterprises**, including those that require smaller holdings or are more intensive in nature.*

4.3.2 State Environmental Planning Policies

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* (Mining SEPP) regularises the various environmental planning instruments that previously controlled mining activities and aims to provide for the proper management of and development of mineral resources.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the *State Environmental Planning Policy [State Significant Precincts] 2005* and *State Environmental Planning Policy [Coastal Management]* 2018).

Clause 7

Clause 7(1) of the Mining SEPP states that development for any of the following purposes may be carried out only with development consent:

> *(b) mining carried out:*
>
> *(i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or*
>
> *(ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999,*
>
> …

The modified Snapper Mine is on land where agriculture is permissible. Therefore, the Modification activities are permissible with development consent.

Part 3 of the Mining SEPP outlines the matters to be considered when determining development applications. Relevant clauses are discussed further below.

Clause 12

Clause 12 of the Mining SEPP requires that, before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) *consider:*
  (i) *the existing uses and approved uses of land in the vicinity of the development, and*
  (ii) *whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and*
  (iii) *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and*

(b) *evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and*

(c) *evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).*

Existing/approved land use in the vicinity of the Snapper Mine is characterised by a combination of mineral sands mining operations and agricultural land uses.

The Modification components are considered to be compatible with existing and future land uses in the vicinity of the Snapper Mine.

The potential impacts of the Modification on land resources are described in Section 6.8.

The Modification would allow for the continued economic extraction of mineral concentrate from the Snapper Mine.

Tronox would implement a range of measures to avoid or minimise incompatibility of the modified Snapper Mine with existing and future land uses in the area. This would be achieved through the implementation of the existing Environmental Management Strategy (GHD, 2016a), with updates to the relevant environmental management plans listed in Section 1.1.3.

Clause 13

Clause 13 of the Mining SEPP outlines considerations for an application for consent for development in the vicinity of an existing mine, petroleum production facility or extractive industry. The modified Snapper Mine does not overlap with any other mineral or petroleum tenements or other extractive industry. Therefore, the Modification would not have a significant impact of current or reasonably foreseeable extraction or recovery of minerals, petroleum or extractive materials.

Clause 14

Clause 14(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

(a) *that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,*

(b) *that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,*

(c) *that greenhouse gas emissions are minimised to the greatest extent practicable.*

In addition, Clause 14(2) requires that, without limiting Clause 14(1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable state or national policies, programs or guidelines concerning greenhouse gas emissions.

The potential impacts of the Modification on groundwater and surface water resources are discussed in Sections 6.9 and 6.10, respectively, including measures to minimise potential impacts.

The potential biodiversity impacts as a result of the Modification are described in Section 6.2.

An assessment of the potential greenhouse gas emissions due to the Modification is provided in Section 6.13.

Clause 15

Clause 15 of the Mining SEPP requires that:

(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.

(2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.

(3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

The Modification would promote the economic recovery of mineral sands resources at the Snapper Mine (i.e. through allowing additional/continued mineral sands extraction at an existing mineral sands mining operation). As such, the Modification aims to achieve efficient resource recovery.

Clause 16

Clause 16(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

(a) require that some or all of the transport of materials in connection with the development is not to be by public road,

(b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,

(c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.

Mineral concentrates generated at the Snapper Mine are transported by road to the MSP via the mineral concentrate transport route for further processing and transport by rail to port.

The transport of mineral concentrate along the mineral concentrate transport route has been undertaken since the commencement of operations at the Ginkgo Mine in 2005.

The Modification would not increase the maximum mineral concentrate production rate for the Snapper Mine, and would not result in any transport impacts on the mineral concentrate transport route (Section 2.1).

Road transport at the Snapper Mine is currently managed in accordance with the Transport Management Plan (GHD, 2015a).

The potential impacts of the Nob Road realignment on the surrounding road transport network are discussed in Section 6.7.

The Road Transport Review concluded that subject to the proposed mitigation measures, no significant impacts on the performance capacity, efficiency and safety of the road network are expected to arise as a result of the Modification (Appendix E).

Clause 17

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. In particular, the consent authority must consider whether conditions of the consent should:

(a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or

(b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or

(c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under clause 3 of Schedule 6 to the Act and the Contaminated Land Management Act 1997), or

(d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.

The rehabilitation of the modified Snapper Mine would generally be conducted in accordance with the existing/approved rehabilitation strategy for the Snapper Mine (Section 2.5).

The Mining Operations Plan (CMA, 2015b) would be updated to incorporate the Modification.

State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

Clause 13 of the *State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)* (SEPP 33) requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

> *(c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and*
>
> *(d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), ...*

The environmental management plans relevant to risks and hazards, and their relevant mitigation measures, would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval [06_0168] conditions).

State Environmental Planning Policy No. 55 (Remediation of Land)

The *State Environmental Planning Policy No. 55* (*Remediation of Land*) (SEPP 55) aims to provide a State-wide planning approach to the remediation of contaminated land. Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of the site for its proposed use.

A consent authority must consider the following under Clause 7(1):

> *(a) it has considered whether the land is contaminated, and*
>
> *(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
>
> *(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

Further, under Clause 7(2), before determining an application for consent to carry out development that would involve a change of use of land, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned, carried out in accordance with the contaminated land planning guidelines.

Tronox (2019) prepared a Stage 1 Preliminary Land Contamination Investigation for the Modification area (Appendix G), in accordance with the Department of Urban Affairs and EPA (1998) *Managing Land Contamination* and the NSW Office of Environment and Heritage's (OEH) (2011b) *Guidelines for Consultants Reporting on Contaminated Sites.*

Tronox (2019) found that further investigation is not required and that the Modification area is suitable for the proposed industrial development (i.e. the mine path extension and associated supporting infrastructure, and Nob Road realignment).

State Environmental Planning Policy No. 44 (Koala Habitat Protection)

The *State Environmental Planning Policy No. 44 (Koala Habitat Protection)* (SEPP 44) applies to certain LGAs (including the Wentworth LGA), and requires the consideration of whether land that is the subject of the Development Application is considered to be "potential Koala habitat" or "core Koala habitat".

Clause 3 of SEPP 44 outlines the aim of the SEPP, which is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline:

> *(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and*
>
> *(b) by encouraging the identification of areas of core koala habitat, and*
>
> *(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.*

Clause 9 of SEPP 44 requires:

> *(1) Before a council may grant consent to a development application for consent to carry out development on land to which this Part applies that it is satisfied is a core koala habitat, there must be a plan of management prepared in accordance with Part 3 that applies to the land.*
>
> *(2) The council's determination of the development application must not be inconsistent with the plan of management.*

An assessment of Koala habitat for the purposes of SEPP 44 was undertaken by the Western Research Institute and Resource Strategies (2007) for the Snapper Mine EA. The assessment concluded that the Snapper Mine area (including the Modification area) does not comprise potential Koala habitat (Western Research Institute and Resource Strategies, 2007).

4.4 NSW GOVERNMENT POLICY

Aquifer Interference Policy

The *Aquifer interference Policy* (AIP) (Department of Primary Industries [DPI], 2012) has been developed by the NSW Government as a component of the NSW Government's Strategic Regional Land Use Policy. The AIP applies State-wide and details water licence and impact assessment requirements.

The stated purpose of the AIP is to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities, such that the take is accounted for in the water budget and water sharing arrangements.

The *Water Management Act 2000* defines an aquifer interference activity as that which involves any of the following:

- *the penetration of an aquifer;*
- *the interference with water in an aquifer;*
- *the obstruction of the flow of water in an aquifer;*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations; and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

The minimal impact considerations in the AIP (DPI, 2012) have been addressed in Section 6.9, and Appendix F.

A Hydrogeological Review (Appendix F) has been prepared in consideration of the AIP for the Modification and the key conclusions are summarised below.

Water Source

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan.

The Water Sharing Plan relevant to the Snapper Mine is the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011*. Therefore, licensing under the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* is required to account for the Modification.

Modelling of Potential Impacts

The potential hydrogeological impacts of the Modification have been reviewed by GEO-ENG (2019), which included a review of the existing groundwater model for the Snapper and Ginkgo Mines (Appendix F).

Licensing Requirements

As described above, the Snapper Mine is located within Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000*.

As described in Section 4.2, Tronox currently holds a combined total of 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Snapper, Ginkgo and Atlas-Campaspe Mines. No additional water licences under the *Water Management Act 2000* are required for the Modification (Section 6.9).

Minimal Impact Considerations

The AIP establishes minimal impact considerations for highly productive and less productive groundwater.

The DPIE – Water mapping indicates that there is no highly productive groundwater in the vicinity of the Snapper Mine. The Snapper deposit lies in the shallow, saline aquifer of the Loxton-Parilla Sands. The water supply bores at the Snapper Mine lie in the deep, saline aquifer of the tertiary Lower Olney Formation/Warina Sands.

An assessment of the Modification against the minimal impact considerations in the AIP was conducted as part of the Hydrogeological Review and is presented in Appendix F.

The Hydrogeological Review concluded that the Modification would meet the “Level 1” minimal impact considerations outlined in the AIP (Appendix F).

Other Groundwater Users

The closest productive groundwater bore to the Snapper Mine is located approximately 16 km north-east, and the drawdown at this bore due to the Modification is predicted to be negligible (Appendix F).

4.5 DEVELOPMENT APPLICATION AREA

The Modification necessitates an extension to the Development Application Area for Project Approval (06_0168). The proposed extension to the Development Application Area includes part of Lot 1926 DP 763904, part of Lot 1927 DP 763905 and the road reserves between these two lots.

Lot 1927 DP 763905 is listed in Appendix 1 (Schedule of Land) of Project Approval (06_0168) however, Lot 1926 DP 763904 is not listed in Appendix 1 of Project Approval (06_0168) as it currently does not form part of the Snapper Mine Development Application Area.

Part of Lot 1926 DP 763904 would therefore need to be added to Appendix 1 of Project Approval (06_0168). In addition, the road reserve would need to be included in Appendix 1 of Project Approval (06_0168).

4.6 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The objective of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to provide for the protection of those aspects of the environment that are of national environmental significance.

Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a controlled action under the EPBC Act. A proposal that is, or may be, a controlled action is required to be referred to the Commonwealth Department of Environment and Energy to determine whether or not the action is a controlled action.

It is concluded that the Modification would not have a significant impact on Matters of National Environmental Significance (MNES) for the following reasons:

- The Modification would not have a significant impact on listed threatened species and ecological communities and/or migratory species as these have not been identified in the vicinity of the Modification area, which comprises of a paddock subject to grazing by goats, introduction of non-native vegetation and past clearing.
- The Modification would not have a significant impact on wetlands of international importance.
- The Modification would not have a significant impact on world heritage properties or national heritage places (i.e. Willandra Lakes Regional World Heritage Area) as the Snapper Mine is located approximately 80 km from the Willandra Lakes Regional World Heritage Area.
- The Modification would not impact the Great Barrier Reef Marine Park and/or Commonwealth marine areas.
- The Modification is not a nuclear action.
- The Modification is not a coal mining or coal seam gas project that could have an impact on a water resource.

It is considered that there is no need to refer the Modification to the Commonwealth Minister for the Environment.

4.7 MANAGEMENT/MONITORING PLANS

As described in Section 1.1.3, the Snapper Mine has an Environmental Management Strategy in place that has been developed to minimise environmental impacts by providing the strategic context for environmental management of the site.

Tronox will continue to implement the existing Environmental Management Strategy at the Snapper Mine, and would review and revise it where necessary (subject to any modified Project Approval conditions) for the Modification.

A more detailed description of the monitoring programs and control strategies relevant to the Modification is provided in Section 6.

4.7.1 Mining Operations Plan

The management of rehabilitation at the Snapper Mine is conducted in accordance with the Mining Operations Plan (CMA, 2015b) (Section 2.5).

The Mining Operations Plan would be updated to incorporate the Modification.

5 ENGAGEMENT

Consultation has been conducted with relevant leaseholders, Aboriginal stakeholders, key NSW Government agencies and the WSC during the preparation of this Modification Report. A summary of this consultation is provided below.

It is anticipated that consultation will continue during the public exhibition of this Modification Report and the assessment of the Modification by the NSW Government.

5.1 RELEVANT LEASEHOLDERS

Tronox provided the leaseholders of the land associated with the Modification area (Section 4.4) a briefing on the Modification, the environmental approval process and the scope of the Modification Report in October 2019, and is continuing to consult with these leaseholders regarding the Modification.

In November 2019, the leaseholders of the land associated with the Modification area provided in-principle support for the Modification.

Furthermore, Tronox undertook consultation with the leaseholders of the land associated with the Modification area during the preparation of the MLA.

5.2 ABORIGINAL STAKEHOLDERS

Aboriginal stakeholders were consulted throughout the preparation of the Aboriginal Cultural Heritage Assessment (ACHA) for the Modification (Appendix B). Consultation was conducted with reference to the DPIE – Biodiversity and Conservation Division (BCD) policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (Department of Environment, Climate Change and Water [DECCW], 2010a).

Further detail on consultation with Aboriginal stakeholders for the Modification is provided in Section 6.3.1.

5.3 NSW GOVERNMENT AGENCIES

Tronox continues to consult with relevant NSW Government agencies on a regular basis in relation to the current activities at the Snapper Mine.

Department of Planning, Industry and Environment

Tronox met with the DPIE on 22 August 2019 to provide an overview of the Modification, proposed approval pathway and the proposed scope of the environmental assessment.

Following the meeting, Tronox wrote to the DPIE regarding the Modification, the proposed approval pathway and the proposed scope of the environmental assessment. The DPIE subsequently wrote to Tronox on 18 October 2019, confirming it agreed with the proposed approval pathway and outlining additional environmental assessment aspects to be considered as part of the Modification application. These environmental assessment aspects have been considered in this Modification Report.

Biodiversity and Conservation Division

Tronox provided a briefing package and held a teleconference with the BCD on 20 September 2019 to provide an overview of the Modification and discuss the approach to assessing potential Aboriginal cultural heritage impacts associated with the Modification. The BCD provided in-principle support for the ACHA approach adopted in this Modification Report.

In addition, Tronox met with the BCD on 8 November 2019 to discuss the approach to assessing potential biodiversity impacts associated with the Modification, and present the preliminary results of the biodiversity assessment and threatened species surveys undertaken for the Modification (Appendix A). During the meeting, the BCD provided in-principle support for the biodiversity assessment approach adopted in this Modification Report.

Natural Resources Access Regulator

Tronox provided a briefing package to the NSW Natural Resources Access Regulator (NRAR) on 13 November 2019 to provide an overview of the Modification, outline the approach to assessing potential water resource impacts associated with the Modification and offer further information if requested.

The NRAR did not request any additional information regarding the Modification.

Environment Protection Authority

Tronox provided a briefing package to the EPA on 13 November 2019 to provide an overview of the Modification, outline the approach to assessing potential noise, air quality and water resources impacts associated with the Modification and offer further information if requested.

The EPA did not request any additional information regarding the Modification.

Crown Lands

Tronox provided a briefing package to the DPIE – Crown Lands on 28 October 2019 to provide an overview of the Modification and outline the leaseholder consultation conducted to date regarding the Modification.

A discussion with the DPIE – Crown Lands was subsequently held on 29 October 2019 to discuss the Modification and the relevant *Crown Land Management Act 2016* approvals required for the Nob Road realignment.

Tronox will continue to consult with the DPIE – Crown Lands regarding the relevant *Crown Land Management Act 2016* approvals required for the Nob Road realignment

Division of Resources and Geoscience

Tronox provided a briefing package to the DRG on 22 November 2019 to provide an overview of the Modification and MLA 1.

Tronox will continue to consult with the DRG regarding the Modification and MLA 1.

NSW Resources Regulator

Tronox provided a briefing package to the NSW Resources Regulator on 13 November 2019 to provide an overview of the Modification, outline the rehabilitation-related aspects of the Modification (Section 2.5) and offer further information if requested.

The NSW Resources Regulator did not request any additional information regarding the Modification.

5.4 WENTWORTH SHIRE COUNCIL

The Snapper Mine is located within the Wentworth LGA.

Tronox consulted with the WSC throughout October and November 2019 regarding the Modification, particularly the realignment of Nob Road.

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC have provided in-principle support for the Modification.

Tronox is continuing to consult with the WSC in relation to the opening and/or closing of road reserves associated with the Nob Road realignment.

Further details on the required road works associated with the Nob Road realignment are provided in Section 6.7.

6 ASSESSMENT OF IMPACTS

6.1 IDENTIFICATION OF KEY ISSUES

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment.

The key environmental issues identified are summarised in Table 5 and addressed in Sections 6.2 to 6.13 and the relevant appendices.

Table 5
Summary of Key Potential Environmental Issues/Impacts

Environmental Aspect	Key Potential Environmental Issues/Impacts Snapper Mine	Report Section/Appendix
Biodiversity	Potential impacts on biodiversity, Aboriginal cultural heritage and historic heritage associated with surface development in the Modification area.	Section 6.2 and Appendix A
Aboriginal Cultural Heritage		Section 6.3 and Appendix B
Historic Heritage		Section 6.4
Air Quality	Potential air quality impacts due to the mine path extension and associated supporting infrastructure, and changes to overburden management.	Section 6.5 and Appendix C
Noise	Potential noise impacts due to extension of the mine path and associated supporting infrastructure, and minor changes to the approved mining fleet.	Section 6.6 and Appendix D
Road Transport	Potential road transport impacts associated with the realignment of Nob Road around MLA 1.	Section 6.7 and Appendix E
Land and Agricultural Resources	Potential land and agricultural resources impacts associated with surface development in the Modification area.	Section 6.8 and Appendix G
Groundwater Resources	Potential groundwater impacts associated with the mine path extension.	Section 6.9 and Appendix F
Surface Water Resources	Potential impacts on surface water resources associated with surface development in the Modification area.	Section 6.10
Social and Economic	Potential social and economic impacts associated with maintaining continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.	Section 6.11
Visual	Potential visual impacts associated with the extension of the mine path and associated supporting infrastructure in MLA 1.	Section 6.12
Greenhouse Gas	Potential increase in greenhouse gas emissions associated with the mine path extension.	Section 6.13
Hazards and Risks	As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.	N/A
Community Infrastructure	As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved community infrastructure impacts is expected.	N/A

6.2 BIODIVERSITY

6.2.1 Background

A Biodiversity Assessment has been prepared by Biodiversity Monitoring Services (2019) in accordance with the requirements of Clause 30A(2)(c) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* and is provided in Appendix A.

The Modification involves extension of the existing/approved mine path and associated supporting infrastructure into additional surface development areas but also relinquishment of approved surface development areas, resulting in a net reduction in surface development area (Section 2.2).

Survey Results

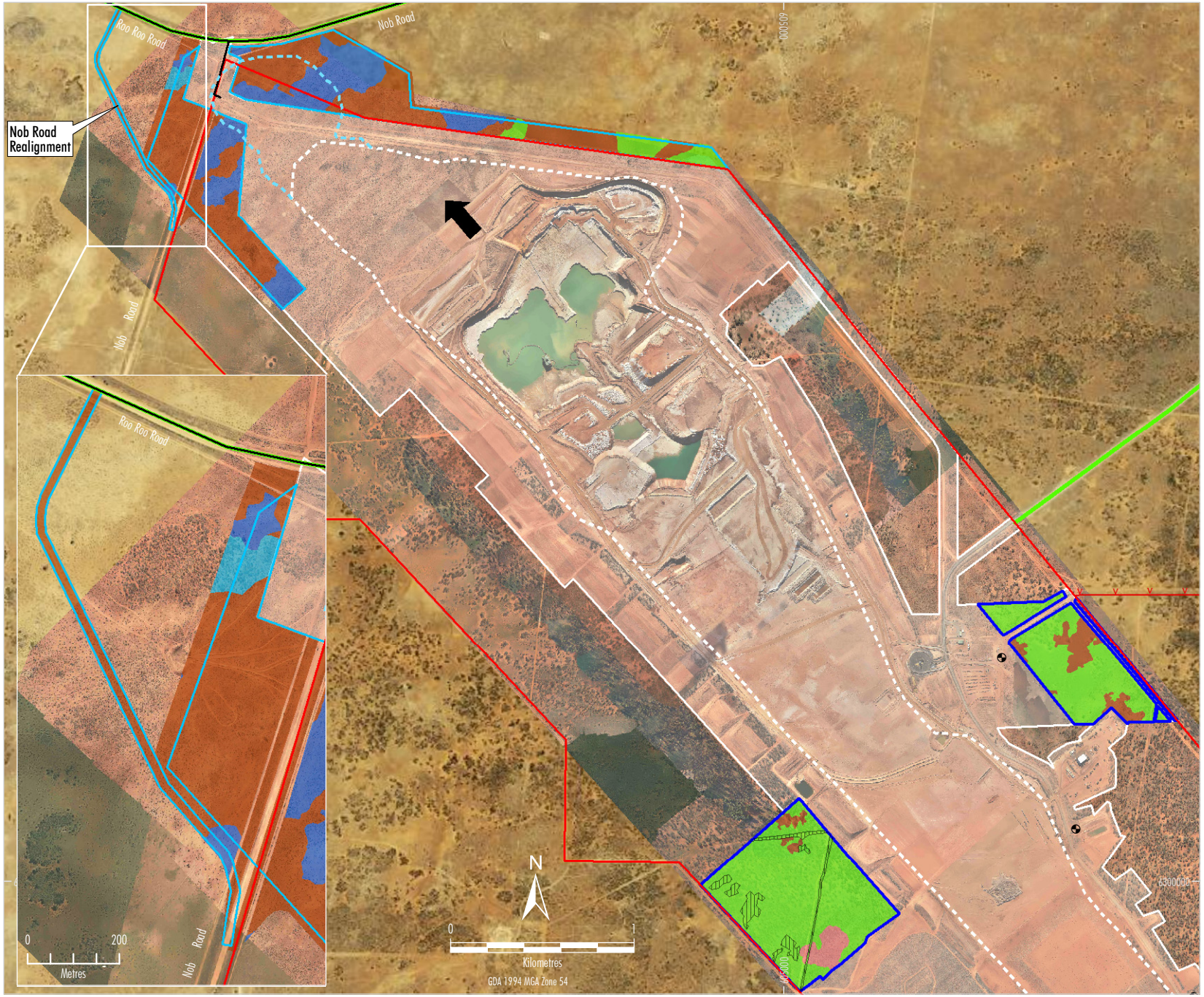
Ecological surveys of the Modification area and approved surface development areas to be relinquished were carried out in October 2019 by Biodiversity Monitoring Services (Appendix A).

The surveys involved vegetation mapping and the collection of vegetation condition (vegetation integrity) data from 23 vegetation plots in accordance with the *Biodiversity Assessment Method* (BAM) (OEH, 2017), threatened flora traverses in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH, 2016) and diurnal bird surveys, call playback, nocturnal spotlighting, pitfall trapping, funnel trapping and habitat assessments in accordance with *Threatened Species Survey & Assessment: Guidelines for developments and activities (working draft)* (Department of Environment and Conservation, 2004) (Appendix A).

The Plant Community Types (PCTs) identified in the Modification area and the approved surface development area to be relinquished are provided in Table 6 and shown on Figure 7.

Table 6
Vegetation Quantification

PCT ID	PCT Name	Approved Surface Development Areas Relinquished (ha)	Modification Area (ha)
Aeolian Chenopod Shrublands			
153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	7.7	52.7
154	Pearl Bluebush low open shrubland of the arid and semi-arid plains	-	28.3
Sand Plain Mulga Shrublands			
143	Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	-	0.7
Semi-arid Sand Plain Woodlands			
58	Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	79.5	5.7
221	Black Oak – Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones	3.5	-
	Total	**87.4**	**90.7**
	Net Change	**Net reduction of 3.3 ha**	



LEGEND

Existing/Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Approved Surface Development Areas Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent

PCT Vegetation Communities

- 58 Black Oak - Western Rosewood Open Woodland
- 143 Narrow-leaved Hopbush - Scrub Turpentine - Senna Shrubland
- 153 Black Bluebush Low Open Shrubland
- 154 Pearl Bluebush Low Open Shrubland
- 221 Black Oak - Pearl Bluebush Open Woodland
- Previously Disturbed

Source: NSW Spatial Services (2019); Tronox (2019); Biodiversity Monitoring Services (2019)
Orthophoto: Tronox (2019)

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SNAPPER MINE

Modified Snapper Mine - Plant Community Types

Figure 7

CMA-19-08_SNE_211A

No threatened flora species or ecological communities listed under the BC Act or EPBC Act are present within the Modification area (Appendix A).

No threatened fauna species listed under the BC Act have been recorded within the Modification area. A feather of the Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) was recorded however the location of the individual when the feather was lost is unknown (Appendix A). There is no breeding habitat for this species in the Modification area.

Offset Areas

Tronox currently has a number of existing offset areas in the surrounding locality, comprising three offset areas for the Ginkgo Mine and two offset areas for the Snapper Mine. The Ginkgo Mine offset areas total approximately 4,274 ha, and the Snapper Mine offset areas total approximately 5,470 ha (i.e. a combined area of 9,744 ha in three distinct areas).

Management and Monitoring Regime

In accordance with Condition 16, Schedule 3 of Project Approval (06_0168), a Flora and Fauna Management Plan (GHD, 2017a) has been prepared for the Snapper Mine, and includes:

- a Vegetation Clearance Protocol;
- a Threatened Species Management Protocol;
- measures to control weeds and feral pests;
- management measures for the establishment of habitat during rehabilitation; and
- a vegetation monitoring program to assess the performance of the rehabilitation areas.

Furthermore, in accordance with Condition 17, Schedule 3 of Project Approval (06_0168), an Offset Management Plan (GHD, 2017b) has been prepared for the Snapper and Ginkgo Mine Offsets, and includes measures for the short, medium and long term management of the offset areas.

6.2.2 Potential Impacts

Overall, the Modification would result in an approximate 3.3 ha reduction in the approved surface development area (Table 6). The Modification area is predominantly within disturbed shrublands whereas the approved surface development areas to be relinquished are predominantly woodland (Figure 7). The PCTs in the additional surface development areas and approved surface development areas to be relinquished are listed in Table 6. The total Modification area would be approximately 87.4 ha.

Table 7 provides an assessment of the impacts of the Modification on biodiversity values. In summary, the Modification would not increase impacts on vegetation abundance, vegetation integrity, habitat suitability, threatened species abundance, habitat connectivity, threatened species movement, flight path integrity or hydrological processes that are known to sustain a threatened species or ecological community. Instead, the Modification would result in a net positive outcome for biodiversity values in the local area.

As the Modification would not increase impacts on biodiversity values, it is considered that a BDAR is not required.

6.2.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in an increased impact on biodiversity values, there would be no change to mitigation measures, management and monitoring already in place for the Snapper Mine.

Notwithstanding, the Flora and Fauna Management Plan (GHD, 2017a) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

Table 7
Impacts of the Modification on Biodiversity Values

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Vegetation abundance *1.4(b) BC Regulation*	*Occurrence and abundance of vegetation at a particular site*	✓	Figure 7 shows the PCTs present in the Modification and Relinquishment areas. The Modification has been designed to avoid or minimise impacts on native vegetation by predominantly locating the supporting infrastructure in derived shrubland subject to grazing. The Modification area is predominantly within disturbed shrublands whereas the approved surface development areas to be relinquished is predominantly woodland. **Accordingly, the Modification would not result in an increased impact on vegetation abundance.**
Vegetation integrity *1.5(2)(a) BC Act*	*Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state*	✓	The VI scores calculated using the BAM Calculator indicates that the majority of the native vegetation to be cleared is generally low. The zone with the highest VI score (83.5) would be the least impacted (0.7 ha), while the majority of surface development (52.7 ha) would occur in the zone with the lowest VI score (19.2). When native vegetation is removed the VI score becomes zero. However, vegetation zones within the areas to be relinquished would no longer become zero and instead would remain at their current VI scores. **Accordingly, the Modification would not result in an increased impact on vegetation integrity.**
Habitat suitability *1.5(2)(b) BC Act*	*Degree to which the habitat needs of threatened species are present at a particular site*	✓	The PCTs present in the Modification area provide marginal habitat for threatened fauna (e.g. some birds may forage on grass seeds from time to time). The native vegetation that would be cleared has been subject to past disturbances (such as vegetation clearance and grazing), which makes the habitat generally poor quality. The derived shrubland of PCT 58, grazed shrubland of PCT 143, intact and grazed shrublands of PCT 153 and intact and grazed shrublands of PCT 154 are not threatened ecological communities (TECs) and no threatened flora species have been recorded within the Modification area. The Modification has been designed to avoid impacts on habitat by predominantly locating the supporting infrastructure in derived shrubland subject to grazing and lacking in many habitat features such as waterbodies and hollow-bearing trees. The Modification would not impact rocks, karst, caves, crevices, cliffs, human made structures or non-native vegetation known to be associated with any threatened species. The Modification is unlikely to reduce the viability of any adjacent habitat due to noise, dust or light spill during construction or operation due to the following: • there would be no change to the mining method, fleet or production rate; • any dust effects would be mitigated by regular watering of roads and soil stockpiles; and • there would be no change to the use of artificial lighting. In addition, measures would be implemented to minimise bushfire risk associated with the Modification. **Accordingly, the Modification would not result in an increased impact on habitat suitability.**

Table 7 (Continued)
Impacts of the Modification on Biodiversity Values

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Threatened species abundance *1.4(a) BC Regulation*	*Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site*	✓	The Modification is unlikely to impact the occurrence and abundance of threatened species, or their habitat, in the locality. The Modification has been designed to avoid potential habitat as far as practicable in consideration of other environmental and practical constraints. The Modification area was generally depauperate of habitat features that would be considered important to the target threatened fauna species and as such the majority of species are considered unlikely to occur. Additionally, vegetation clearance measures would be implemented to minimise potential impacts on biodiversity, including pre-clearing fauna inspections. **Accordingly, the Modification would not result in an increased impact on threatened species abundance.**
Habitat connectivity *1.4(c) BC Regulation*	*Degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range*	✓	The majority of clearance for the Modification would be of shrubland. Given the previous amount of disturbance through clearing and grazing activities and the lack of important habitat features (hollow-bearing trees, water bodies, native grassland, etc), habitat is generally of low quality in the Modification area. Additionally, approved surface development areas with better quality habitat would be relinquished for the proposed surface development in the Modification area. Any existing connectivity associated with the approved surface development areas to be relinquished would remain. **Accordingly, the Modification would not result in an increased impact on habitat connectivity.**
Threatened species movement *1.4(d) BC Regulation*	*Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle*	N/A	The Modification is not likely to impact a well-defined movement pattern for any particular species, given the majority of clearance would be of shrubland. **Accordingly, the Modification would not result in an increased impact on threatened species movement.**
Flight path integrity *1.4(e) BC Regulation*	*Degree to which the flight paths of protected animals over a particular site are free from interference*	N/A	The Modification would not interfere with any flight paths of protected animals, given the majority of clearance would be of shrubland. **Accordingly, the Modification would not result in an increased impact on flight path integrity.**
Water sustainability *1.4(f) BC Regulation*	*Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site*	N/A	The Modification would not impact water quality, water bodies or hydrological processes that are known to sustain a threatened species or TEC. The Modification area does not contain any watercourses or artificial watering points. **Accordingly, the Modification would not result in an increased impact on hydrological processes that are known to sustain a threatened species or TEC.**

* *A biodiversity value is not relevant to a proposed development if the value is not present on the development site and there is no potential for direct or indirect impacts on the biodiversity value if it occurs off-site* (Department of Planning & Environment, 2018).

6.3 ABORIGINAL CULTURAL HERITAGE

An ACHA has been prepared for the Modification by Landskape Natural and Cultural Heritage Management (Landskape) (2019) and is presented in Appendix B.

6.3.1 Background

The ACHA for the Modification has been undertaken in consideration of relevant requirements of various advisory documents and guidelines, including but not limited to (Appendix B):

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a);
- *Due Diligence Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b); and
- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011a).

Previous Archaeological Investigations

A Cultural Heritage Assessment was previously prepared for the Snapper Mine EA by Landskape (2007).

Landskape (2007) recorded 22 Aboriginal cultural heritage sites within ML 1621 (Figure 8), consisting of ten stone artefact scatters, two scatters of stone artefacts with associated hearths, four stone quarries with associated scatters of stone artefacts, four isolated finds of stone artefacts, and two hearth sites.

Nineteen of these sites were recorded in the approved surface development area, while three sites were recorded outside of the approved surface development area. The majority of these sites are located in the southern portion of ML 1621, several kilometres from the Modification area (Figure 8).

Landskape (2010) undertook an ACHA for the area associated with the Snapper Mine ETL corridor, however, no Aboriginal cultural heritage items or places were recorded in the ETL corridor (Landskape, 2010).

A detailed description of previous archaeological investigations and assessments undertaken in the region surrounding the Snapper Mine is provided in Appendix B.

Management and Monitoring Regime

In accordance with Condition 20, Schedule 3 of Project Approval (06_0168), a Cultural Heritage Management Plan (CHMP) (GHD, 2015c) has been prepared for the Snapper and Ginkgo Mines. The CHMP:

- identifies Aboriginal heritage sites and values;
- details the management of Aboriginal heritage sites, including:
  - protocol for the ongoing involvement of the Aboriginal community; and
  - monitoring, management and avoidance measures for known and unknown Aboriginal objects;
- establishes a contingency plan; and
- establishes the roles and responsibilities of Tronox staff with regard to the CHMP.

Consultation

The ACHA included consultation with nine Registered Aboriginal Parties (RAPs), consistent with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a) (Appendix B).

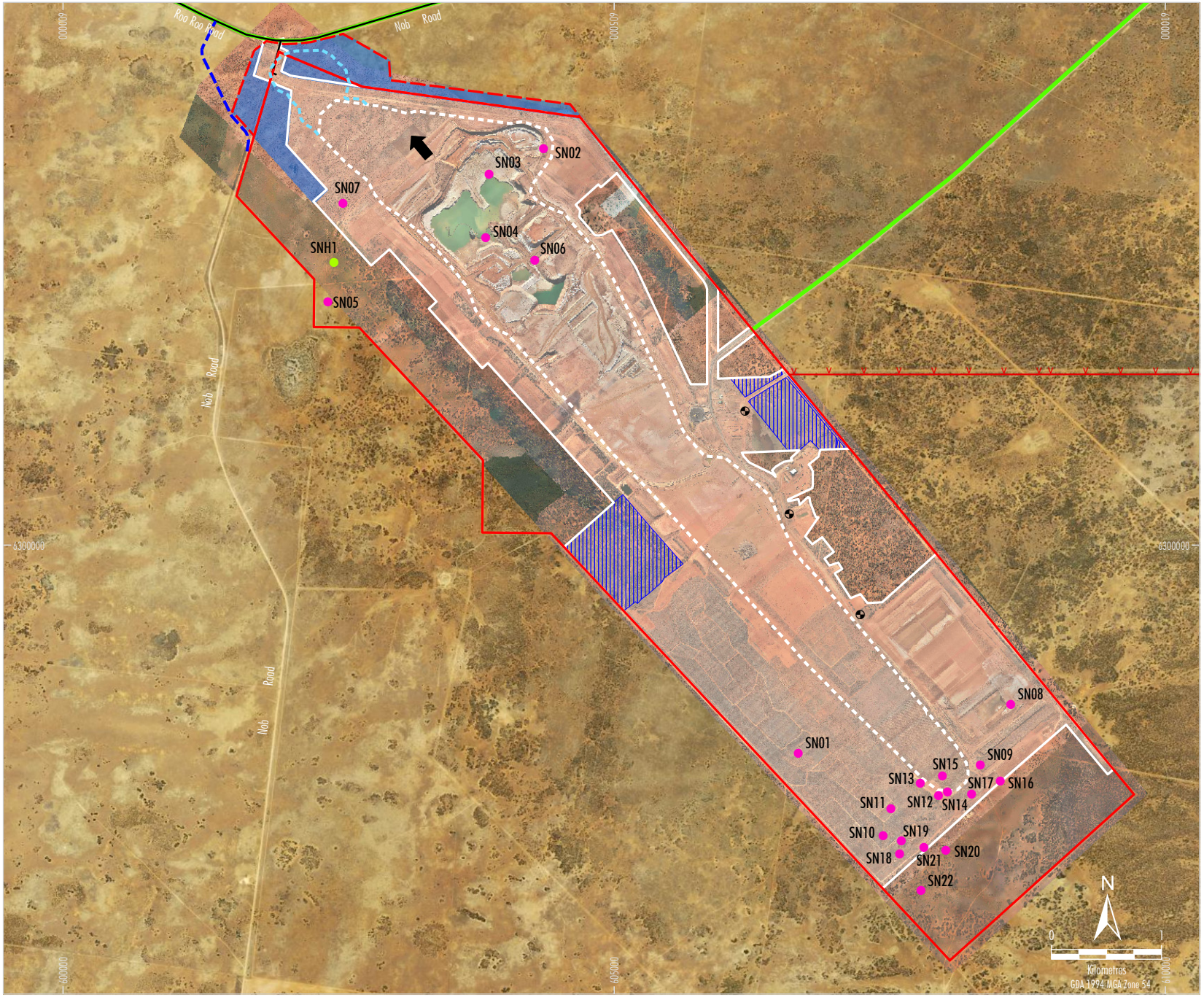
Consultation with the Aboriginal community regarding the Snapper Mine to date has been extensive, and involved various methods of communication including public notices, meetings, written and verbal correspondence, and archaeological survey attendance (Landskape 2007; 2010), review of the draft *Snapper Mineral Sands Project Heritage Management Plan* (Bemax, 2007b)[3] and archaeological salvage at the Snapper Mine (Appendix B).

A detailed description of the consultation undertaken with the RAPs for the Modification is provided in Appendix B, and a summary is provided below.

Information Session

Information regarding the Modification was provided in writing to all RAPs on 30 September 2019, which included an invitation to attend an information session about the Modification, proposed to be held on 5 November 2019 at the Ginkgo Mine. No RAPs attended the information session (Appendix B).

[3] Subsequently, the original *Snapper Mineral Sands Heritage Management Plan* and the *Ginkgo Mine Aboriginal Heritage Management Plan* were consolidated into the existing CHMP (GHD, 2015).



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road
- Aboriginal Cultural Heritage Site
- Historical Cultural Heritage Site

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

S N A P P E R M I N E

Modified Snapper Mine - Aboriginal and Historic Heritage Sites

Figure 8

CMA-19-08_SNE_206B

Aboriginal Cultural Heritage Field Survey

All RAPs were invited to attend a field survey of the Modification area, which was held on 5 November 2019. No RAPs attended the field survey (Appendix B).

Review of the Draft ACHA

A copy of the draft ACHA was provided to all RAPs on 8 November 2019. As at 22 November 2019, no comments have been received on the draft ACHA (Appendix B).

Desktop Review

An Aboriginal Heritage Information Management System (AHIMS) search was undertaken in October 2019 for the Modification area and surrounds. The search identified no Aboriginal heritage sites located within the Modification area (Appendix B).

Archaeological Survey and Results

The field survey of the Modification area was undertaken by suitably qualified archaeologist Dr Matt Cupper (Landskape, 2019) on 5 November 2019.

No Aboriginal cultural heritage sites were identified in the Modification area (Figure 8).

6.3.2 Potential Impacts

No known Aboriginal cultural heritage sites are present within the Modification area, so no known Aboriginal cultural heritage sites, items or values would be potentially impacted by the Modification (Appendix B).

Although the Modification area was sufficiently surveyed, there remains the potential for Aboriginal cultural heritage sites to be located within this area. Such previously unidentified features, should they occur, would probably be isolated finds or low density concentrations of stone artefacts (Appendix B).

The CHMP (GHD, 2015c) contains management measures for any newly identified Aboriginal cultural heritage sites.

6.3.3 Mitigation Measures, Management and Monitoring

Given the Modification would not result in any Aboriginal cultural heritage impacts, no additional management measures are proposed as part of the Modification.

Notwithstanding, the CHMP (GHD, 2015c) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.4 HISTORIC HERITAGE

This section considers potential historic heritage impacts associated with the Modification area.

6.4.1 Background

Previous Archaeological Investigations

A Cultural Heritage Assessment was previously prepared for the Snapper Mine EA by Landskape (2007).

Landskape (2007) recorded one historic heritage site within ML 1621, namely SNH1, located outside the approved surface development area (Figure 8).

Site SNH1 consists of an approximately 100 m x 100 m area that once contained timber stockyards and a nearby area where station workers have camped, known as “Kertne Nob” (Landskape, 2007).

No other items of state or regional historic heritage significance have been identified at the Snapper Mine to date (Figure 8).

Archaeological Survey and Results

A field survey of the Modification area was undertaken by suitably qualified archaeologist Dr Matt Cupper (Landskape, 2019) on 5 November 2019.

No historic heritage sites were identified in the Modification area (Figure 8).

6.4.2 Potential Impacts

No known historic heritage sites are present within the Modification area, so no known historic heritage sites, items or values would be potentially impacted by the Modification (Appendix B).

Although the Modification area was sufficiently surveyed, there remains the potential for historic heritage sites to be located within this area. The CHMP (GHD, 2015c) contains management measures for any newly identified historic heritage sites.

6.4.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any additional historic heritage impacts, no additional management measures are proposed as part of the Modification. Notwithstanding, the CHMP (GHD, 2015c) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.5 AIR QUALITY

An Air Quality Review was undertaken for the Modification by Katestone Environmental Pty Ltd (Katestone) (2019) and is presented in Appendix C.

6.5.1 Background

Sensitive Receivers

The Snapper Mine is located at significant distances from sensitive receivers. The closest sensitive receivers to the Snapper Mine are located approximately 4 km to the north (Manilla homestead) and 7 km to the south (Trelega homestead). Other properties within the proximity of the Snapper Mine include the Roo Roo homestead (12 km north-west) and the Waukeroo homestead (12 km south-west) (Figure 9).

Previous Assessments

A number of air quality assessments have been conducted for the Snapper Mine to date, namely:

- the Air Quality Assessment undertaken for the Snapper Mine EA by Holmes Air Sciences (2007a);
- the Air Quality Assessment undertaken for the 2010 Snapper and Ginkgo Mines Modification by PAE Holmes (2010a); and
- the Air Quality Review undertaken for the 2014 Snapper Mine Production Increase Modification by Pacific Environment Limited (2014a).

The previous air quality assessments assessed the potential air quality impacts at the nearest sensitive receivers to the Snapper Mine operations and HAR.

Pacific Environment Limited (2014a) concluded that no exceedances of the relevant air quality criteria for total suspended particles (TSP), particulate matter 10 micrometres or less in diameter (PM_{10}) and dust deposition were predicted at the nearest sensitive receivers to the Snapper Mine (i.e. the Manilla and Trelega homesteads).

Pacific Environment Limited (2014a) also concluded that non-mine related sources of PM_{10}, such as bushfires and dust storms, could result in occasional exceedances of the 24-hour average criterion for PM_{10} at sensitive receivers.

Management and Monitoring Regime

In accordance with Condition 14, Schedule 3 of Project Approval (06_0168), an Air Quality Management Plan (GHD, 2015d) has been prepared for the Snapper Mine. The Air Quality Management Plan includes measures to:

- minimise the amount of dust generated during drilling and mining operations;
- minimise the amount of surface disturbance ahead of mining operations;
- rehabilitate surface disturbance areas no longer required as soon as practicable;
- minimise the generation of dust along haulage routes; and
- maintain plant and equipment to increase efficiency and minimise emissions.

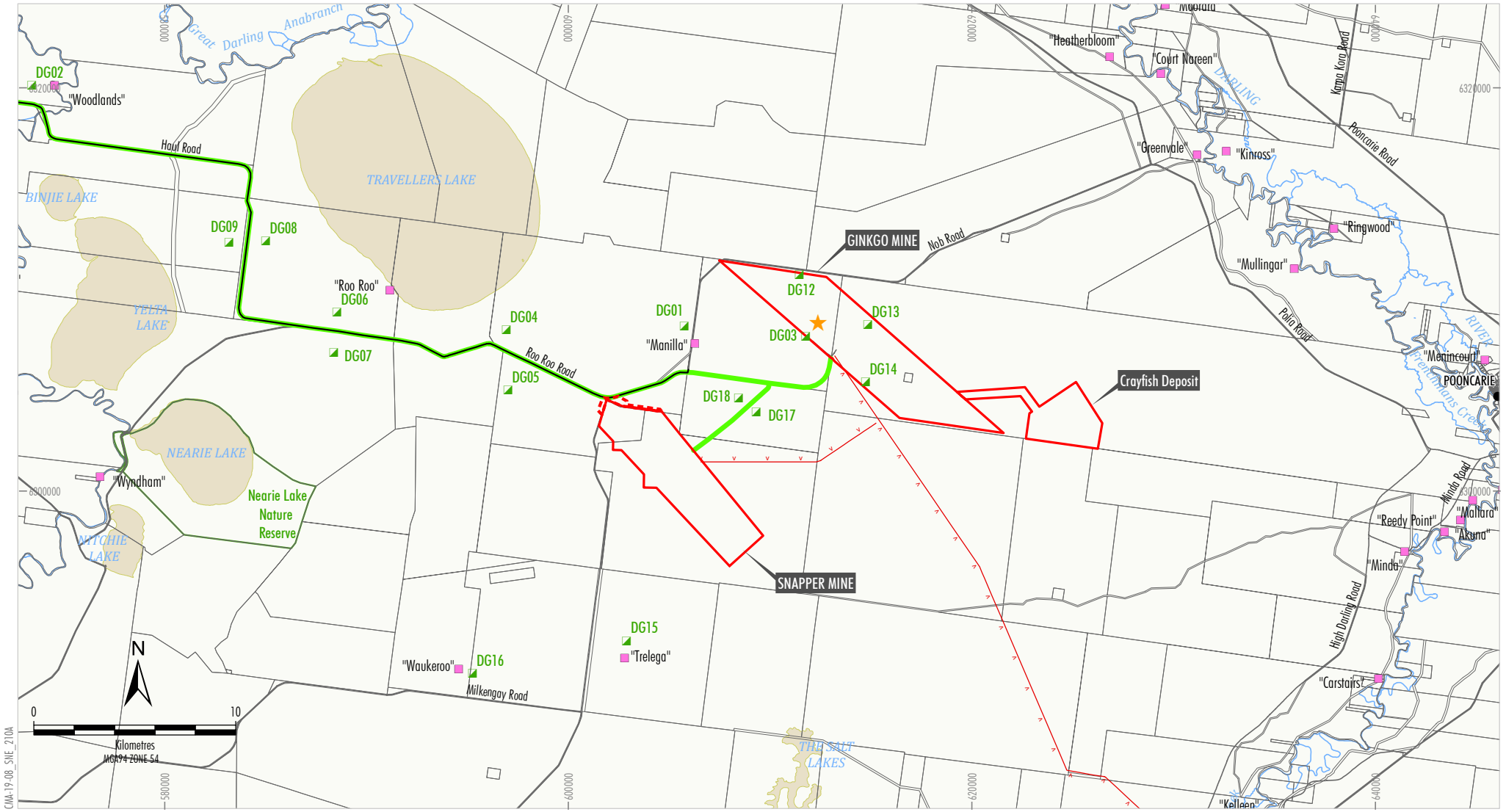
Dust deposition monitoring is conducted at 18 locations (DG01 to DG18) in the vicinity of the Snapper Mine and HAR (Figure 9).

The results of the air quality monitoring program are assessed against the air quality criteria described in Condition 13, Schedule 3 of Project Approval (06_0168).

Monitoring Results

Dust deposition monitoring to date generally indicates compliance with the Project Approval (06_0168) annual average air quality criterion of 4 grams per square metre per month (g/m^2/month) since the commencement of operations at the Snapper and Ginkgo Mines (Appendix C).

Records at the Trelega homestead in 2012 and 2013 exceeded the annual average air quality criterion of 4 g/m^2/month (Appendix C). Pacific Environment Limited (2014a), however, concluded that these elevated dust deposition records were contaminated, and compliance with the annual average air quality criterion of 4 g/m^2/month is achieved after excluding the contaminated measurements.



Source: NSW Spatial Services (2019); Tronox (2019)

LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Cadastral Boundary
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line
- Dwelling
- Dust Gauge
- Meteorological Station

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SNAPPER MINE

Sensitive Receiver and Air Quality Monitoring Locations

Figure 9

Records at the Waukeroo and Manilla homesteads in 2018, and the Manilla homestead in 2019, exceeded the annual average air quality criterion of 4 g/m^2/month (Appendix C). Katestone (2019) concluded that the persistent warm and dry conditions throughout 2018 and 2019 would have contributed to elevated ambient dust levels in the region, and it is likely that these elevated dust deposition records were primarily due to regional dust sources and not operations at the Snapper or Gingko Mines.

To date, Tronox has not received any complaints in regard to air quality (Appendix C).

Air Quality Criteria

Subsequent to the grant of Project Approval (06_0168), the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (DEC, 2005) was updated to include criteria for particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$).

The updated Approved Methods (EPA, 2016) also include a reduced annual average PM_{10} criterion of 25 micrograms per cubic metre (µg/m^3).

Katestone (2019) has assessed the potential air quality impacts of the Modification against the updated Approved Methods (EPA, 2016).

6.5.2 Potential Impacts

The Air Quality Review (Appendix C) has evaluated the potential air quality impacts of the Modification and a summary is provided below.

The following components of the Modification would have the potential to alter particulate matter (e.g. dust) emissions at the Snapper Mine (Appendix C):

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1; and
- temporary placement of overburden around the crest of the mine path extension rather than placing behind the advancing dredge pond, reducing haulage distances.

Pacific Environment Limited (2014a) estimated that haul trucks transporting overburden account for approximately 78% of the total emissions of TSP at the Snapper Mine.

The Modification would result in a decrease in overburden haulage distances of approximately 30%, as overburden would be placed temporarily around the crest of the mine path extension (Figure 4) rather than behind the advancing dredge pond (Section 2.3.2).

Dust emissions generated by overburden haulage would, therefore, be expected to decrease by approximately 30% as a result of the Modification (Appendix C).

The mine path extension for the Modification would be located further from the Manilla homestead (4.3 km) than the existing/approved mine path (3.8 km). The Modification would also result in a minor decrease in distance between soil stockpiles/surface development areas and the Manilla homestead (from approximately 3.6 km to 3.3 km). The relative size of soil stockpiles would not change for the Modification. These changes are expected to result in negligible change to the existing/approved dust deposition rates at the Manilla homestead (Appendix C).

Given the above, and the conclusions of Pacific Environment Limited (2014a) (i.e. compliance with the relevant air quality criteria), it is expected that the modified Snapper Mine would continue to comply with the relevant air quality criteria (including PM_{10} and $PM_{2.5}$) at all sensitive receivers surrounding the Snapper Mine (Appendix C).

Furthermore, as the Modification would result in a reduction in total dust emissions from the Snapper Mine, it is considered there would be no change to the approved potential cumulative air quality impacts, as described by PAE Holmes (2010a), as a result of the Modification (Appendix C).

6.5.3 Mitigation Measures, Management and Monitoring

The Air Quality Management Plan (GHD, 2015d) would continue to be implemented for the Modification.

Given that the Modification is not expected to contribute to any additional exceedances of the relevant air quality criteria at any sensitive receptors in the vicinity of the Snapper Mine, Tronox does not propose any additional air quality management measures.

Notwithstanding, the Air Quality Management Plan (GHD, 2015d) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.6 NOISE

A Noise Review was undertaken for the Modification by Wilkinson Murray (2019) and is presented in Appendix D.

6.6.1 Background

Sensitive Receivers

The Snapper Mine is located at significant distances from sensitive receivers (Section 6.6.1) (Figure 9).

Previous Assessments

A number of noise assessments have been conducted for the Snapper Mine to date, namely:

- the Noise Assessment undertaken for the Snapper Mine EA by Holmes Air Sciences (2007b);
- the Noise Assessment undertaken for the 2010 Snapper and Ginkgo Mines Modification by PAE Holmes (2010b); and
- the Noise Review undertaken for the 2014 Snapper Mine Production Increase Modification by Pacific Environment Limited (2014b).

The previous noise assessments assessed the potential noise impacts at the nearest sensitive receivers to the Snapper Mine operations and HAR.

Most recently, Pacific Environment Limited (2014b) concluded that the approved Snapper Mine will comply with the Project-specific noise criteria at the closest sensitive receiver to the Snapper Mine (i.e. the Manilla homestead) under neutral and adverse meteorological conditions (Appendix D).

Pacific Environment Limited (2014b) also concluded that the approved Snapper Mine would comply with the road traffic noise criteria along the HAR.

Management and Monitoring Regime

In accordance with Condition 12, Schedule 3 of Project Approval (06_0168), a Noise Management Plan (GHD, 2018) has been prepared for the Snapper Mine. The Noise Management Plan includes:

- a noise monitoring program to assess compliance with the Snapper Mine operational and road traffic noise criteria;
- contingency measures for controlling noise at the source and the receiver, and mitigating the transmission of noise between the source and receiver;
- a noise awareness program to educate employees on the effects of noise and quiet work practices – such as staff education programs to reinforce quiet driving styles/attitudes;
- a complaint handling and response protocol for the reporting and assessment of noise complaints, and identifying suitable preventative/corrective actions.

Noise monitoring at the Snapper Mine is undertaken in accordance with the Noise Management Plan (GHD, 2018). In accordance with the Noise Management Plan, compliance noise monitoring was conducted annually from the commencement of Snapper Mine operations until 2015 at the Manilla and Woodlands homesteads (i.e. the closest sensitive receivers to the Snapper Mine and HAR, respectively).

Subsequently, and in accordance with Condition 10, Schedule 3 of Project Approval (06_0168), Tronox obtained signed agreements with the residents of the Manilla and Woodlands homesteads to discontinue noise monitoring at these locations due to ongoing compliance with the relevant noise criteria. Tronox advised the DPIE of these agreements in March 2016.

Monitoring Results

Compliance noise monitoring at the Manilla homestead up to and including 2015 demonstrated compliance with the Project Approval (06_0168) noise criterion of 35 dBA. On occasions where recorded noise levels exceeded 35 dBA, review of monitoring results (and associated recordings) indicated that windy conditions, wildlife and traffic noise were the causes of noise levels exceeding 35 dBA, and were not related to operations at the Snapper Mine (GHD, 2018).

From the commencement of operations to the end of the 2018 Annual Review reporting period, Tronox received no complaints in regard to noise (Appendix D).

A noise complaint from the Manilla homestead was, however, received in early 2019, and in accordance with the Noise Management Plan (GHD, 2018), attended and unattended compliance noise monitoring was undertaken by Tronox and Renzo Tonin & Associates (2019), respectively.

Attended noise monitoring conducted by Tronox indicated that operations at the Snapper Mine were only audible during periods with low ambient noise, periods which corresponded with noise levels below 35 dBA (Renzo Tonin & Associates, 2019).

Renzo Tonin & Associates (2019) conducted unattended noise monitoring at the Manilla homestead from Tuesday 6 August to Saturday 10 August 2019, and found that compliance with the Project Approval (06_0168) criterion of 35 dBA at the Manilla homestead is being achieved.

Noise Criteria

The previous noise assessments undertaken for the Snapper Mine (Holmes Air Sciences, 2007b; PAE Holmes, 2010b; Pacific Environment Limited, 2014b) were prepared in accordance with the *Industrial Noise Policy* (INP) (EPA, 2000), which has since been superseded by the *Noise Policy for Industry* (NPfI) (EPA, 2017).

The INP defines a minimum noise criterion of 35 dBA for the day, evening and night-time. Based on background monitoring conducted by Holmes Air Sciences (2007b), the project-specific noise criteria determined for the Snapper Mine were the minimum applicable criteria (i.e. 35 dBA for the day, evening and night-time).

The NPfI increased the minimum daytime noise criterion to 40 dBA, while the evening and night-time criteria remained at 35 dBA. Wilkinson Murray (2019), therefore, considered the potential noise impacts of the Modification against the NPfI criteria (Section 6.7.2).

6.6.2 Potential Impacts

Operational Noise

The Noise Review (Appendix D) has evaluated the potential noise impacts of the Modification and a summary is provided below.

The following components of the Modification would have the potential to alter noise emissions generated at the Snapper Mine (Appendix D):

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1; and
- minor change to the approved mining fleet.

The Modification would reduce the number of excavators and haul trucks at the Snapper Mine. The reduction in the number of excavators and haul trucks for the Modification would not result in any significant change to the approved overall total sound power level (SWL) associated with the mining fleet (Appendix D).

To quantify the potential increase in operational noise levels at the closest receiver (Manilla homestead) due to extension of the existing/approved mine path and associated supporting infrastructure into MLA 1, Wilkinson Murray (2019) modelled the SWL associated with the modified mining fleet under typical maximum case operational scenarios when all plant and fleet are working concurrently within the Modification area.

Wilkinson Murray (2019) found noise levels at the closest sensitive receiver (i.e. the Manilla homestead) would achieve the Project Approval (06_0168) criterion of 35 dBA, and the NPfI Project noise trigger levels of 40 dBA, 35 dBA and 35 dBA for the day, evening and night-timerespectively, under the neutral and adverse meteorological conditions defined by the NPfI.

Road Noise

The Modification would not result in any changes to mineral concentrate transport. The Modification would, therefore, not result in any changes to the approved potential road traffic noise impacts at the sensitive receivers along the HAR (Appendix D).

The Modification would however include the realignment of Nob Road. Given that the Nob Road realignment would be further away from the closest sensitive receiver (i.e. Manilla homestead) than the current alignment of Nob Road, there would, therefore, be a slight reduction in noise levels at Manilla from the vehicles travelling along this portion of Nob Road (Appendix D).

Cumulative

The predicted cumulative noise level (i.e. due to operations at the Snapper and Ginkgo Mines) at the Manilla homestead would achieve the minimum (night-time) NPfI recommended amenity noise level of 40 dBA under neutral and adverse meteorological conditions. Compliance will therefore be achieved at Trelega, and other sensitive receivers located at greater distances from the Snapper Mine (Appendix D).

6.6.3 Mitigation Measures, Management and Monitoring

The Noise Management Plan (GHD, 2018) would continue to be implemented for the Modification.

Given that the Modification is not expected to contribute to any additional exceedances of the relevant noise criteria at any sensitive receptors in the vicinity of the Snapper Mine, Tronox does not propose any additional noise management measures.

Notwithstanding, the Noise Management Plan (GHD, 2018) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.7 ROAD TRANSPORT

A Road Transport Assessment was undertaken for the Modification by The Transport Planning Partnership Pty Ltd (TTPP) (2019) and is presented in Appendix E.

6.7.1 Background

Local Roads

Local roads in the vicinity of the Snapper Mine relevant to the Modification include Nob Road and Roo Roo Road (Figure 3).

Roo Roo Road is a local unsealed formed road that provides a link between Nob Road and Old Broken Hill Road. The eastern 16 km of Roo Roo Road forms part of the mineral concentrate transport route. In the vicinity of Snapper Mine, Roo Roo Road supports travel speeds in the order of 100 kilometres per hour (km/h).

Nob Road is a local unsealed formed road that provides a link between High Darling Road approximately 38 km north of Wentworth and Polia Road 20 km northwest of Pooncarie. The portion of Nob Road immediately to the west of the Snapper Mine has a poor surface, with rutting and corrugations evident. An approximate 4 km portion of Nob Road forms part of the mineral concentrate transport route, which supports travel speeds in the order of 100 km/h.

The intersection of Nob Road and Roo Roo Road is a basic T-intersection, at which the southern approach of Nob Road meets Roo Roo Road at 90 degrees. Nob Road (south) is the minor road and Roo Roo Road (approaching from the west) and Nob Road (approaching from the east) form the major road. A give way sign controls traffic at the intersection (Appendix E).

Traffic Volumes

Traffic volumes on Nob Road south of Roo Roo Road are an average of 32 vehicles per day (Appendix E).

Traffic volumes on Roo Roo Road west of Nob Road an average of 24 vehicles per day (Appendix E).

Previous Assessment

Traffix (2007) prepared a Road Transport Assessment for the Snapper Mine EA in accordance with the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). The assessment included consideration of the Snapper and Ginkgo Mines, and other road traffic movements not associated with Tronox's operations.

Traffix (2007) found that traffic generation due to the approved Snapper Mine would have little effect on the levels of service and safety of the surrounding road network.

Management and Monitoring Regime

In accordance with Condition 24, Schedule 3 of Project Approval (06_0168), a Transport Management Plan (GHD, 2015a) has been prepared for the Snapper Mine. The Transport Management Plan includes:

- a description of the transport-related environmental controls and associated limits to meet objectives, targets and regulatory approvals;
- measures to be implemented to address the relevant requirements in the *Code of Practice for the Safe Transport of Radioactive Materials* (Australian Radiation Protection and Nuclear Safety Agency, 2008, or its latest version); and
- a Code of Conduct for all drivers transporting materials to and from the Snapper and Ginkgo Mines.

During the 2018 Annual Review reporting period, Tronox received no traffic-related complaints (Appendix E).

Road Maintenance

Tronox contributes to the maintenance of the HAR and other local roads (including Nob Road) in accordance with Conditions 4 and 7, Schedule 3 of the Ginkgo Mine Development Consent (DA 251-09-01).

6.7.2 Potential Impacts

As the Modification would not change Tronox-related traffic generation, the Road Transport Review (Appendix E) has evaluated the potential road transport impacts associated with the realignment of Nob Road, and a summary is provided below.

Nob Road Realignment

The Nob Road realignment would be constructed in accordance with the with the principles outlined in the *Unsealed Roads Manual* (ARRB, 2009), the requirements of Austroads (2017a) *Guide to Road Design Part 4: Intersections and Crossings – General* and Austroads (2017b) *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections,* and in consultation with the WSC.

The Nob Road realignment would be constructed as an unsealed road (Class 4B) to meet the relevant design requirements of the WSC and/or Austroads as required.

The BAR/BAL intersection treatment, as described in Austroads (2017c), would be applied to the new intersection.

Signage would be provided in accordance with Australian Standard 1742.2 (2009).

Intersection Operation

TTPP (2019) concluded that the predicted peak hourly traffic volumes are well below the threshold volumes for analysis and, as such, there is no capacity concern regarding the operation of the proposed intersection of Roo Roo Road with the realignment of Nob Road (Appendix E).

Formal analysis of the operation of the intersection is not justified, and delays experienced by drivers would be very low (Appendix E).

Roadway Capacity and Efficiency

The Modification would not change the number, timing or distribution of vehicle trips on the local road network, and so would have no impact on the midblock capacity available on the roads, nor on the likely interaction between drivers (Appendix E).

Although the Nob Road realignment would be approximately 350 m longer than the current alignment, it would permit higher vehicle travel speeds than occur currently because the road would be constructed to an improved surface standard than the existing road, which would improve the level of service experienced by drivers (Appendix E).

Road Safety

The realignment of Nob Road is expected to have positive impacts on the safety of the Snapper Mine workforce and the road network (Appendix E).

TTPP (2019) considered the potential safety impacts of the modified Snapper Mine operational lighting on the HAR, and concluded that it would not present a potential risk to road safety with the implementation of the proposed visual management measures (Section 6.12.3).

6.7.3 Mitigation Measures, Management and Monitoring

The Transport Management Plan (GHD, 2015a), and its relevant mitigation and management measures, would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.8 LAND AND AGRICULTURAL RESOURCES

This section considers potential land and agricultural resource impacts associated with the Modification area.

6.8.1 Background

Topography

The landform within the Snapper Mine area shows limited relief and comprises generally flat to undulating sandplains covered by a combination of grasslands, low woodland and shrublands (Bemax, 2007a). Elevations in the Modification area range from approximately 70 to 80 m Australian Height Datum (AHD).

Land Use and Agricultural Production

Land use in the Modification area comprises pastoral leasehold lands that are used for light intensity rangeland grazing (Bemax, 2007a).

The Modification Area is located on the Manilla and Carstairs properties, which are located on Western Lands Lease 4090 (Lot 1926 DP 763904) and Western Lands Lease 4086 (Lot 1927 DP 763905), respectively (Section 4.2).

Land and Soil Capability

The Land and Soil Capability system is used to give an indication of the land management practices that can be applied to a parcel of agricultural land. Agricultural land is classified by evaluating biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards (OEH, 2012).

The Modification area is identified as having Land and Soil Capability Classes of 4 and 5. These Land and Soil Capability Classes are defined as (OEH, 2012):

> *Class 4 - Moderate capability land:*
>
> *Class 4 land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.*
>
> *Class 5: Severely limited land:*
>
> *Class 5 land has severe limitations for high impact land management uses such as cropping. There are few management practices generally available to overcome these limitations. However, highly specialised land management practices can overcome some limitations for high value crops or products. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment.*

Land Contamination

A Land Contamination Assessment was undertaken in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011b) by Tronox (Appendix G). It was undertaken in the form of a Stage 1 (or Preliminary Investigation) Land Contamination Assessment.

No potentially contaminating activities or contaminated areas were identified in the Modification area (Appendix G).

On the basis of the Stage 1 (or Preliminary Investigation) Land Contamination Assessment, the Modification area is suitable for the proposed industrial development (i.e. the mine path extension, associated supporting infrastructure and Nob Road realignment) (Appendix G).

Land Resources Management

The Land Management Plan (GHD, 2015b) includes:

- soil management measures;
- remnant vegetation management;
- livestock and pasture management; and
- feral animal and noxious weed control measures.

The Water Management Plan (GHD, 2016b), prepared in accordance with Condition 2, Schedule 3 of Project Approval (06_0168) relevantly includes:

- a summary of erosion and sediment control structures;
- erosion and sediment control management measures;
- soil-stripping management measures;
- salinity management measures;
- monitoring and reporting requirements; and
- contingency measures.

The Bushfire Management Plan (GHD, 2016c), prepared in consultation with the WSC and the NSW Rural Fire Service, relevantly includes:

- procedures for the detection, response, co-ordination and reporting of bushfire events;
- details of fire-fighting activities;
- an Emergency Response Plan for bushfire emergency response procedures and evacuation procedures;
- a Fuel Management Plan; and
- provision of adequate fire breaks/protection works and the fire-fighting equipment on-site (including an Emergency Response team).

Potential land resource impacts associated with the existing/approved Snapper Mine surface development area (Figure 2) have been managed generally in accordance with this existing land resource management regime.

6.8.2 Potential Impacts

The Modification would require approximately 87.4 ha of additional surface development area (Section 2.3.1).

The following land and agricultural resource aspects could potentially be impacted by Modification:

- topographic features;
- soils and erosion potential; and
- land use and capability.

It is noted that the Modification would, however, result in a net reduction in surface development area of approximately 3.3 ha at the Snapper Mine, therefore, there is expected to be no additional impact on potential land and agricultural resources.

These potential impacts and how they relate to the Modification area are described in the following sub-sections. Measures to mitigate these potential impacts are also provided in this sub-section.

Topographic Features

The main features of the Modification area would comprise:

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas; and
- re-alignment of Nob Road around MLA 1.

Given the relative size of the Modification area to the existing/approved Snapper Mine footprint (e.g. 3.5% increase in the length of the mine path), the landform changes outlined above represent a minor extension of the existing/approved topographical changes at the Snapper Mine into the Modification area.

Soils and Erosion

The low rainfall and lack of defined drainage channels in the region generally limit the potential for fluvial erosion and sedimentation.

The potential soil and erosion-related impacts relevant to the Modification include:

- loss of *in situ* soil resources associated with the Nob Road realignment;
- alteration of physical and chemical soil properties during stripping and stockpiling operations;
- reduced soil quality (structure, fertility and microbial activity) of long-term stockpiles; and
- erosion and sediment movement due to exposure of soils during clearance and construction activities.

Potential soil and erosion impacts would be managed by the implementation of the measures outlined in the Water Management Plan (GHD, 2016b).

Land Use and Capability

The Modification would result in a net reduction of approximately 3.3 ha in the amount of potential agricultural land that would be disturbed by the Snapper Mine. Additionally, the approved surface development areas to be relinquished are identified as being comprised entirely of Land and Soil Capability Class 4, while the Modification area is identified as having Land and Soil Capability Classes of 4 and 5.

In addition, the approved final land use at the Snapper Mine is light intensity grazing (Section 2.5), and the Modification would not change the approved final land use.

Land Contamination

Potential land contamination risks were identified as part of the Preliminary Hazard Analysis for the Snapper Mine EA (Bemax, 2007c), and included:

- leaks/spills;
- fire;
- explosion;
- failure (e.g. equipment); and
- vehicle accident.

The Modification would not change the potential impacts identified in the Preliminary Hazard Analysis (Bemax, 2007c) relevant to the potential land contamination risks described above.

6.8.3 Mitigation Measures, Management and Monitoring

The Land Management Plan (GHD, 2015b) would continue to be implemented for the modified Snapper Mine.

In addition, the land and agricultural resource aspects of the Land Management Plan and Water Management Plan would be reviewed and, if necessary, revised for the Modification (subject to any modified Project Approval conditions).

6.9 GROUNDWATER

A Hydrogeological Review was undertaken for the Modification by GEO-ENG (2019) and is presented in Appendix F.

6.9.1 Background

Previous/Existing Assessments

A number of hydrogeological studies (including hydrogeological test work) that are applicable to the Snapper and Ginkgo Mines area have been conducted, including:

- Golder Associates Pty Ltd (2001) *Hydrogeological Assessment of the Ginkgo Mineral Sands Project*.
- Golder Associates Pty Ltd (2007) *Snapper Mineral Sands Project Hydrogeological Assessment*.
- GEO-ENG (2010) *Snapper and Ginkgo Mines – Hydrogeological Assessment*.
- GEO-ENG (2012) *Ginkgo Mine Modification Crayfish Deposit – Hydrogeological Assessment*.
- GEO-ENG (2013) *Ginkgo Mine Modification Modified Request Project Crayfish Deposit – Hydrogeological Assessment*.
- GEO-ENG (2014) *Snapper Mine Production Increase Modification – Hydrogeological Review*.
- CMA (2016) *Ginkgo Mineral Sands Mine Southern Extension Modification Environmental Assessment.*

GEO-ENG (2013) evaluated the potential cumulative impacts of the Snapper and Ginkgo Mines on groundwater resources using hydrogeological conceptualisation and a supporting numerical groundwater model.

The numerical groundwater model was used to simulate the potential effects of the approved Snapper and Ginkgo Mines on the Western Murray Porous Rock Groundwater Source, as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* groundwater dependent ecosystems and existing groundwater users.

GEO-ENG (2013) concluded that:

> *The results from the groundwater modelling indicate negligible groundwater impacts at all potential receiving environments ….*

The conclusions of GEO-ENG (2013) were reviewed in the context of the Snapper Mine Production Increase Modification and it was concluded that (GEO-ENG, 2014):

> *The* [Snapper Mine Production Increase] *Modification is not expected to result in any significant change to the cumulative groundwater impacts associated with the Snapper and Ginkgo (including the proposed Crayfish deposit) Mines (Table 1).*

CMA (2016) evaluated the potential impacts of the Southern Extension Modification and concluded that (Cristal Mining, 2016):

> *Overall changes to impacts on groundwater resources were considered negligible and within the Minimal Impact Considerations of the NSW Aquifer Interference Policy. Groundwater resources would continue to be monitored and managed in accordance with the Borefield Impact Management Plan.*

Regional and Local Hydrogeological Setting

A number of large-scale ridges and basins (likely fault bounded blocks) form the pre-Tertiary basement profile, over which the relatively flat lying Tertiary and Quaternary sediments of the Murray Basin have formed (Appendix F).

Specific groundwater information is provided by the Murray Basin Hydrogeological Map Series (Australian Geological Survey Organisation, 1993), which indicate the general geometry of various aquifers and aquitards, based on sparse distribution of drillholes (Appendix F).

The Snapper, Ginkgo and Crayfish ore bodies lie in the shallow, saline aquifer of the Loxton-Parilla Sands beneath the shallow Quaternary Woorinen and Shepparton Formation Layers (Figure 10) (Appendix F).

Saline aquifers within the underlying Renmark Group have been mapped to include sand beds of the Upper, Middle and Lower Olney Formation and basal Warina Sand (Figure 10). At the Snapper Mine the Upper Olney is indicated to be a thin zone of fine sand directly beneath, and connected to, the Loxton-Parilla Sands (Appendix F).

The Middle Olney Formation is not well defined locally but is more significant to the north where it connects with both the Upper and Lower Olney Formations. The Lower Olney Formation and Warina Sand are located beneath the mine sites overlying pre-Tertiary bedrock. The Geera Clay Aquitard is approximately 130 m thick in the local area and separates the saline Upper and Lower Olney Formation units (Appendix F).

The groundwater flow in all aquifers is from recharge areas in the north and east to discharge in the south-west towards the Murray River and Lake Victoria. The groundwater gradient is very flat with a local gradient of about 1 vertical:10,000 horizontal. Groundwater pressures in each aquifer are similar, with a small downward gradient in the recharge areas (north) and a larger upward gradient in the discharge zone (south) (Appendix F).

The Snapper deposit lies in the shallow, saline aquifer of the Loxton-Parilla Sands (the upper aquifer). The water supply bores at the Snapper Mine lie in the deep, saline aquifer of the tertiary Lower Olney Formation/Warina Sands (the lower aquifer).

Groundwater Quality

Groundwater monitoring results from the Snapper Mine and the Murray Basin Hydrogeological Map Series (Australian Geological Survey Organisation, 1993) indicates salinity in excess of 35,000 milligrams per litre (mg/L) for the upper aquifer and between 14,000 mg/L to 35,000 mg/L for the deep Tertiary Lower Olney Formation/Warina Sand aquifer (the lower aquifer) (Appendix F).

Monitoring to date indicates that salinity (total dissolved solids [TDS]) levels have been stable since the commencement of Snapper Mine operations (i.e. salinity levels have remained high in both the upper and lower aquifers).

Groundwater Users

Previous investigations have identified that groundwater use in the local area is limited to three private wells (Chalky Well, Court Nareen Well and Greenvale Well – Figure 11) which access fresh water lenses above the saline water table. The private bore at Trelega (Figure 11) is not used due to high salinity levels. The lack of active bores in the region is understandable given the poor quality of the groundwater (Appendix F).

Groundwater Dependent Ecosystems

There are currently no high-priority groundwater dependent ecosystems identified in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* (Appendix F).

In addition, GEO-ENG (2014) considered that it is unlikely that there is a groundwater dependent ecosystem at the Snapper Mine as the groundwater table is located approximately 30 m below the surface and there is no evidence of any perched water tables.

Groundwater Licensing

The Snapper Mine is located within the Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000*.

Tronox currently holds a combined total 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Snapper and Ginkgo Mines.

Management and Monitoring Regime

In accordance with Condition 2, Schedule 3 of Project Approval (06_0168), a Water Management Plan (GHD, 2016b) has been prepared for the Snapper Mine. Relevant to groundwater, the Water Management Plan includes:

- relevant groundwater criteria;
- a program for groundwater management and monitoring;
- mitigation measures related to groundwater; and
- a description of the auditing, reporting and reviewing requirements of the Water Management Plan.

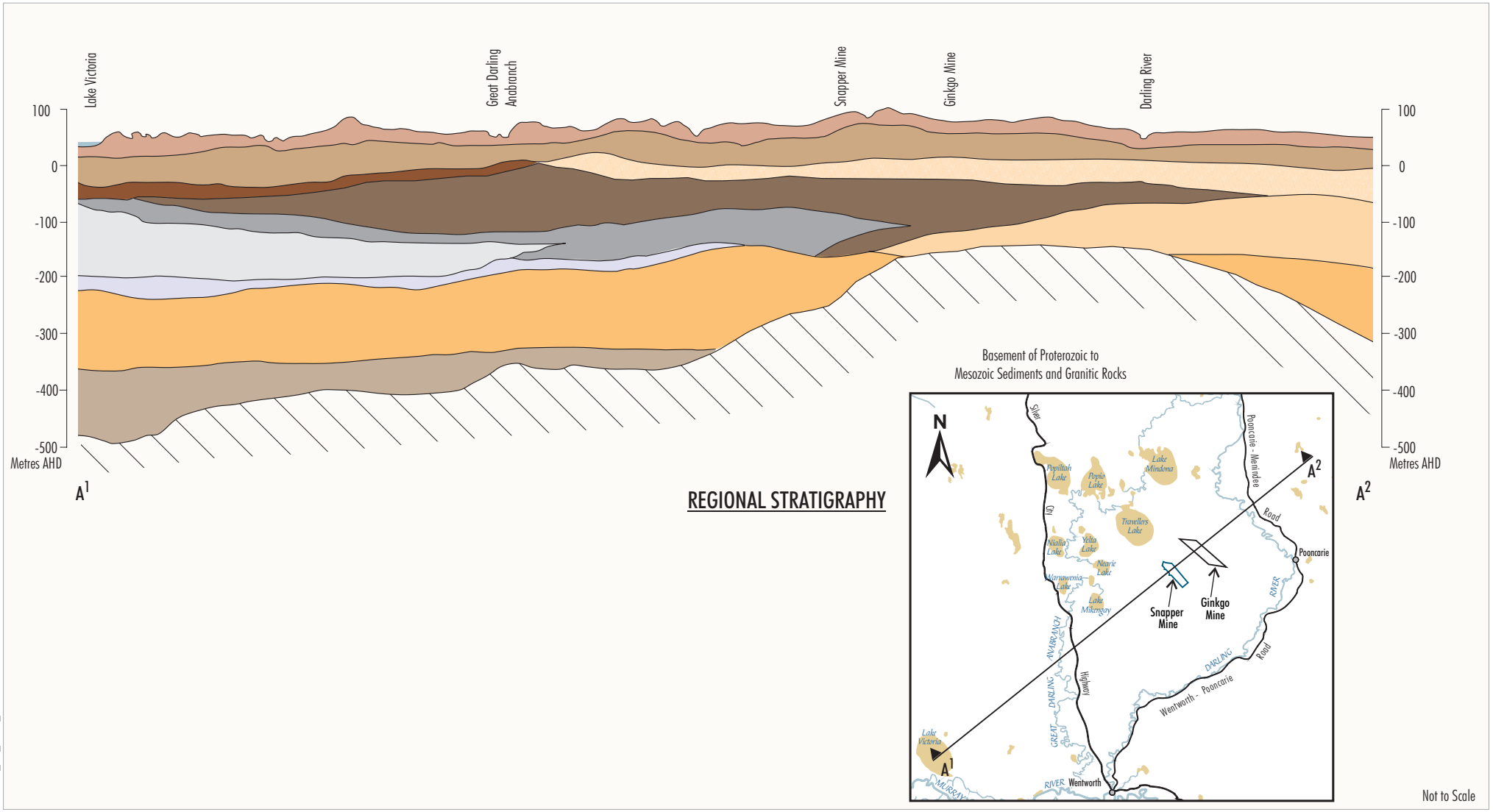
During the 2018 Annual Review reporting period, no incidents relating to groundwater occurred and no complaints were received by Tronox (CMA, 2018).

6.9.2 Potential Impacts

The potential groundwater impacts associated with the Modification include:

- Changes to predicted groundwater drawdown effects in the upper aquifer due to the proposed minor mine path extension and change to the size of the modified final depression.
- Changes to predicted impacts on groundwater users and groundwater-related features due to changes in the predicted groundwater drawdown effects.
- Changes to predicted groundwater quality impacts.

These potential impacts are discussed in more detail below.



REGIONAL STRATIGRAPHY

LEGEND

- Quaternary Sediments
- Loxton-Parilla Sands
- Bookpurnong Beds
- Upper Renmark Group
- Middle Renmark Group
- Geera Clay
- Winnambool Formation
- Murray Group Limestone
- Ettrick Formation
- Lower Renmark Group
- Warina Sand

Source: Golder Associates, (2001)

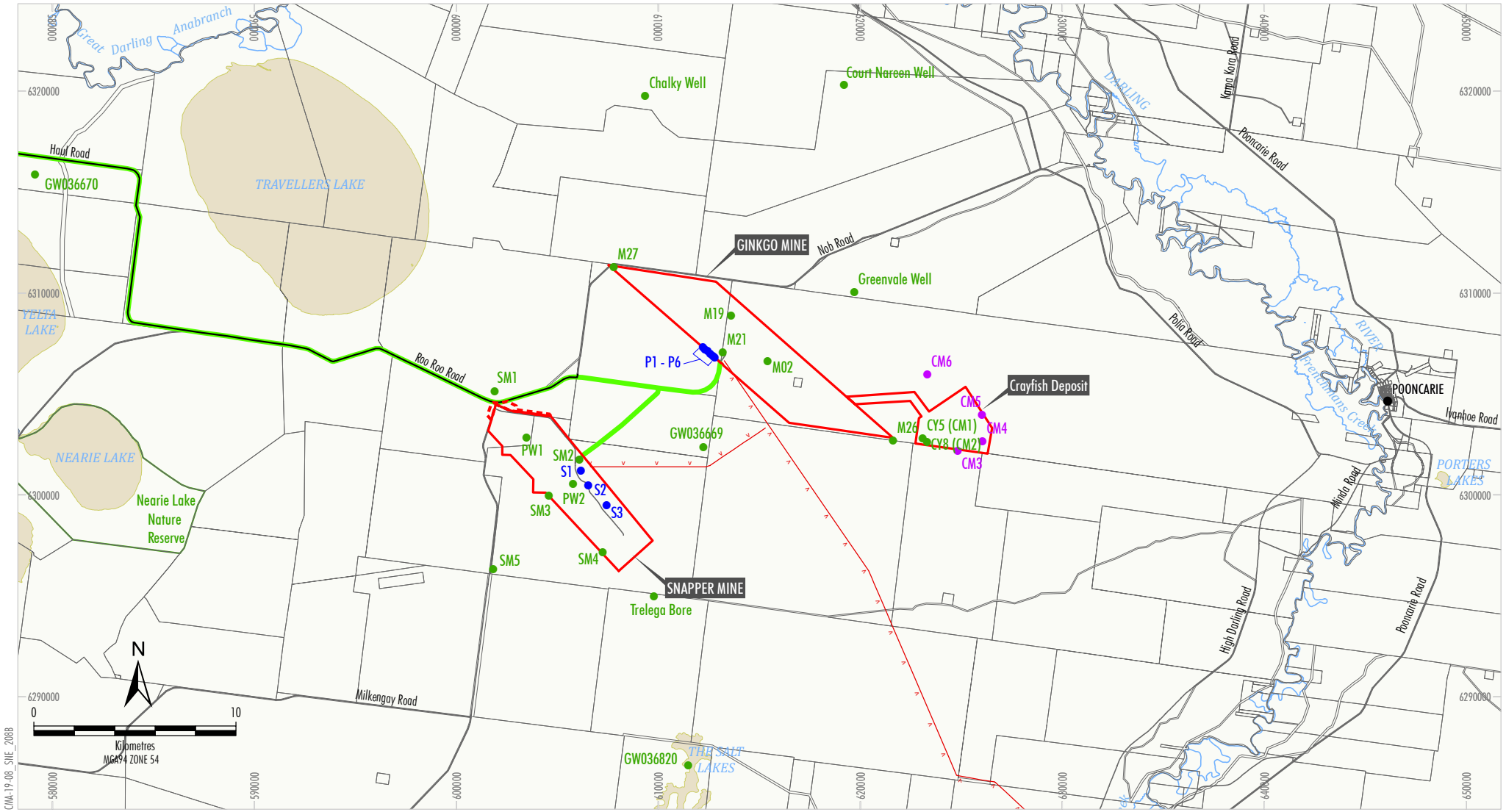
TRONOX

SNAPPER MINE

Regional Stratigraphy

Figure 10

CMA-19-08_SNE_AppGW_001A



CMA-19-08_SNE_208B

Source: NSW Spatial Services (2019); Tronox (2019)

LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Cadastral Boundary
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line
- Existing Groundwater Monitoring Bore
- Existing Water Supply Bore
- Proposed Groundwater Monitoring Bore

TRONOX

SNAPPER MINE

Location of Groundwater Monitoring Sites

Figure 11

Groundwater Drawdown Predictions

As the Modification would not result in any changes to water demand, there would be no change to extraction from the lower aquifer. The Modification would therefore not change the existing/approved potential impacts on the lower aquifer (Appendix F).

The minor (i.e. approximately 600 m) extension to the existing/approved mine path would result in changes to the predicted negligible groundwater drawdown effects in the upper aquifer associated with the existing/approved Snapper Mine (Appendix F).

Specifically, the Modification would result in a minor northern extension to the predicted negligible drawdown in the upper aquifer associated with lowering the dredge pond water level in the extended mine path. Given the minor nature of the proposed mine path extension in the context of the existing/approved mine path, the Modification is not expected to significantly change the approved predicted negligible drawdown effects in the upper aquifer (Appendix F).

The increased extent of the final depression (Section 2.5.2) would, however, result in mounding in the upper aquifer in a portion of the northern section of the mine path due to increased infiltration (Appendix F).

Groundwater Users

The Modification is not expected to have any measurable effect at the three local leaseholder bores (Chalky Well, Greenvale Well and Court Nareen Well [Figure 11]), given the negligible groundwater drawdown effects expected.

Regional Groundwater-Related Features

The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River) (Appendix F).

Groundwater Quality

The Modification is expected to result in negligible impacts on groundwater quality as no significant changes to the mining operations or water management are proposed (Appendix F).

Aquifer Interference Policy

An assessment of the potential groundwater impacts of the Modification against the minimal impact considerations in the AIP (NSW Government, 2012) concluded that the Modification is within “Level 1” minimal impact considerations outlined in the AIP given:

- The *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources, 2011* does not list any high-priority groundwater dependent ecosystems in the vicinity of the Ginkgo Mine.
- The Modification would not result in a cumulative drawdown of more than 2 m at any privately owned water supply work.
- The Modification would not lower the beneficial use category of the groundwater source as it is expected to have negligible impact on groundwater quality.

Further discussion on the AIP is provided in Section 4.4.

Licensing

Tronox currently holds a combined total 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Ginkgo and Snapper Mines (Section 6.9.1).

The Modification would not change the Snapper Mine water supply or make-up water demand (Section 2) and, therefore, the existing volumetric licence allocations held by Tronox are considered to be adequate.

6.9.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any material groundwater water impacts, no additional management measures are proposed as part of the Modification.

Groundwater would continue to be managed in accordance with the Water Management Plan (GHD, 2016b).

Notwithstanding, the Water Management Plan (GHD, 2016b) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.10 SURFACE WATER RESOURCES

This section considers potential surface water impacts associated with surface development in the Modification area.

6.10.1 Background

The Snapper Mine is located within the lower Darling River system, which extends from the Menindee Lakes to the junction of the Darling River and the Murray River at Wentworth. The closest significant regional surface water systems are the Darling River and Great Darling Anabranch, located approximately 30 km south-east and 23 km north-west of MLA 1, respectively (Figure 1).

Due to the limited topographical relief and well dispersed annual rainfall, sandy soils, and high evaporation rates, no well-defined drainage channels are located within the Modification Area. Surface water flows may occur during prolonged rainfall events, where surface waters accumulate in topographic depressions before evaporating and/or seeping into the groundwater table.

Surface Water Users

There are no known surface water users in the Snapper Mine area (CMA, 2017).

Previous Assessments

The potential surface water impacts of the approved Snapper Mine were considered by Bemax (2007a) for the Snapper Mine EA.

Bemax (2007a) concluded that the potential impacts of the approved Snapper Mine on surface water systems are limited due to the distance of the mining activity from any significant surface water systems.

Management and Monitoring Regime

As described in Section 6.8, a Water Management Plan (GHD, 2016b) has been prepared for the Snapper Mine, and includes the following measures:

- a summary of erosion and sediment control structures;
- erosion and sediment control management measures;
- soil-stripping management measures;
- salinity management measures;
- monitoring and reporting requirements; and
- contingency measures.

6.10.2 Potential Impacts

Potential surface water impacts of the Modification would be associated with the proposed surface development in the Modification area.

Water flow direction may change and in places a localised reversal of direction may occur where areas of temporary surface ponding are excavated and exist adjacent to the Modification area (e.g. following rainfall events).

Surface water runoff from the Modification area could potentially contain sediments, dissolved solids, oil, grease, metals and salts. The existing erosion and sediment controls and land contamination controls would be implemented for the Modification, and are described in Section 6.8.

The complex landform and semi-arid climate combine to provide conditions in which the risk of off-site surface water impacts is minimal.

The modified final depression would continue to capture incident rainfall and local surface water runoff, which would temporarily pond in the final depression, prior to evaporating or infiltrating into the upper aquifer. In accordance with the Snapper Mine rehabilitation objectives (Table 2), the drainage extent of the modified final depression would be minimised as far as reasonable and feasible.

No significant surface water impacts are expected as a result of the Modification with the implementation of the measures outlined in the Water Management Plan (GHD, 2016b).

6.10.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any significant material surface water impacts, no additional management measures are proposed as part of the Modification. Surface water will continue to be managed at the Snapper Mine in accordance with the Water Management Plan (GHD, 2016b).

Notwithstanding, the Water Management Plan (GHD, 2016b) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.11 SOCIAL AND ECONOMIC

6.11.1 Background

An economic assessment was undertaken for the Snapper Mine EA by Gillespie Economics (2007), which included a regional economic assessment. Gillespie Economics (2007) concluded that the Snapper Mine will stimulate demand in the regional economy lending to increased business turnover in a range of sectors and increased employment opportunities.

Approximately 110 Tronox employees and contractors are employed at the Snapper Mine.

Local contractors engaged at Tronox's existing operations include:

- Chisholm Earthmoving Pty Ltd;
- Basin Sands Logistics Pty Ltd;
- Cully's Earthmoving Pty Ltd;
- Sunraysia Crane and Rigging Pty Ltd; and
- Ecotypic Pty Ltd.

6.11.2 Potential Impacts

Based on current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations (Section 1.2). The Modification would include the extension of the approved mine path and associated supporting infrastructure into MLA 1, to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Modification would therefore allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine in late 2021. The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the regional economy would therefore continue as a result of the Modification.

The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would, however, avoid potential negative social impacts associated with the loss of employment opportunities at Tronox's operations.

The proposed mine path extension would result in the extraction of approximately 8.5 Mt of ore, producing approximately 170 kt of mineral concentrate product. The estimated NSW Government royalties associated with the mine path extension would be approximately $2.4 million.

In addition, the Modification would allow for the continuation of the collection of taxes by the NSW Government and the Commonwealth Government.

6.11.3 Mitigation Measures, Management and Monitoring

Given that the Modification would result in positive socio-economic impacts, no specific management measures are proposed as part of the Modification.

6.12 VISUAL AMENITY

6.12.1 Background

The Manilla homestead is the closest residence to the Snapper Mine and is located within a slight topographical depression some 4 km to the north. Other properties within the proximity of the Snapper Mine include the Trelega homestead (7 km south), the Roo Roo homestead (12 km north-west) and the Waukeroo homestead (12 km south-west) (Figure 9).

Public viewpoints providing opportunities to view the Snapper Mine are available along Nob Road and the HAR, although views are limited due to the low-rolling topography and intervening vegetation. In addition, the number of potential viewers is limited due to the sparse settlement in the region and the low use of local public roads (Bemax, 2010).

The overburden emplacement, initial sand residue dam and the initial water dam were identified as permanent landscape components that could present limited visual impacts to the viewscape from surrounding viewpoints (Bemax, 2010).

The glow produced by night-lighting at the Snapper Mine is visible at nearby residences and along transport routes, while direct views of mobile machinery lights and operational lighting are not available.

6.12.2 Potential Impacts

Potential visual impacts associated with the Modification would be associated with extension of the mine path towards the HAR (a public viewpoint) and would be either temporary or permanent impacts.

Potential temporary visual impacts would be associated with temporary structures required during operations that would be removed or decommissioned at various stages during and after the mine life (e.g. supporting infrastructure, temporary overburden emplacement, soil stockpiles).

Although the majority of operations would be undertaken below the natural ground level and there is some intervening vegetation between the HAR and the modified Snapper Mine, there is potential for views of the modified Snapper Mine operations to be available along a short section of the HAR. However, given the very low number of road users on the HAR (Section 6.7) a low level of visual impact is expected.

Permanent visual impacts would result from the development of mine landforms that would remain post-mining. The Modification would change the location and size of the final depression (Section 2.5). The level of visual modification associated with the rehabilitated final depression would not be significant, due to its low elevation (i.e. below ground surface level) and the presence of intervening vegetation between the HAR and the modified final depression. Given this insignificant level of visual modification and the very low number of road users on the HAR (Section 6.7), a low level of visual impact would be expected.

As the Modification would not change the existing/approved overburden emplacement, initial sand residue dam and the initial water dam, the potential visual impacts associated with these permanent mine landforms would be unchanged.

The scale and intensity of night-lighting for the modified Snapper Mine would be of a similar intensity when compared to the existing night-lighting at the Snapper Mine.

6.12.3 Mitigation Measures, Management and Monitoring

Tronox would implement the following visual management measures at the modified Snapper Mine:

- Locate lighting plants in the mining areas so that they would be directed away from vehicles travelling along the HAR.
- Continued use of directional lighting and light shields to minimise light spill.

6.13 GREENHOUSE GAS

6.13.1 Background

Previous Assessments

The greenhouse gas emissions associated with the Snapper Mine were estimated in 2010 (Bemax, 2010). The total mine life (including construction) Scope 1 emissions were estimated to be approximately 0.17 million tonne of carbon dioxide equivalents (Mt CO_2-e), with the Scope 2 and Scope 3 emissions estimated to be approximately 0.3 Mt CO_2-e and 1.06 Mt CO_2-e, respectively (Bemax, 2010).

Management and Monitoring Regime

In accordance with Condition 25, Schedule 3 of Project Approval (06_0168), greenhouse gas emission management and monitoring at the Snapper Mine is conducted in accordance with the Energy Saving Environmental Management Plan (GHD, 2014) with the objective to maintain efficient energy use of all equipment and buildings to minimise energy consumption and associated greenhouse gas emissions.

Minimising fuel and electricity usage is an inherent objective of Snapper Mine planning and cost control systems and measures to mitigate greenhouse gas emissions at the Snapper Mine include:

- consideration of energy efficiency in plant and equipment selection/purchase; and
- regular maintenance of plant and equipment to minimise fuel consumption and associated emissions.

Tronox conducts assessments of energy use at the Snapper Mine to identify cost effective energy savings and energy-efficiency opportunities in accordance with the Energy Saving Environmental Management Plan (GHD, 2014).

The effectiveness of these measures to reduce the greenhouse gas emissions (and energy consumption) at the Snapper Mine will be monitored, as Tronox will annually estimate greenhouse gas emissions and energy consumption in accordance with National Greenhouse and Energy Reporting (NGER) scheme requirements.

6.13.2 Potential Impacts

The Modification would not change the mining and/or processing rates at the Snapper Mine (Section 2.1). As diesel and electricity consumption at the Snapper Mine are predominately related to production, it is expected that the total diesel and electricity consumption at the Snapper Mine on an annual basis would not change significantly as a result of the Modification. It follows that greenhouse gas emissions on an annual basis would also not change significantly as a result of the Modification.

Although the Modification would extend mining operations at the Snapper Mine by approximately one year, mining operations would still be completed within the approved mine life (i.e. before 10 July 2026) and therefore the Bemax (2010) greenhouse gas emission estimates would have considered mining operations during this period.

Given the above, the total greenhouse gas emissions from the Snapper Mine (over the whole mine life) estimated by Bemax (2010) would not change significantly as a result of the Modification.

6.13.3 Mitigation Measures, Management and Monitoring

The Energy Saving Environmental Management Plan (GHD, 2014) would continue to be implemented for the Modification and no specific additional management measures are proposed as part of the Modification.

Notwithstanding, the Energy Saving Environmental Management Plan (GHD, 2014) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

7 EVALUATION OF MERITS

The Snapper Mine was approved under Part 3A of the EP&A Act (Project Approval [06_0168]) in 2007.

Tronox proposes modify Project Approval (06_0168) to extend the existing/approved mine path to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

7.1 STAKEHOLDER ENGAGEMENT OVERVIEW

Tronox has consulted with a number of stakeholders during the development of the Modification, including:

- DPIE;
- other relevant NSW Government agencies;
- WSC;
- Aboriginal stakeholders; and
- relevant leaseholders.

The outcomes of engagement with these stakeholders has informed the development of the scope of the Modification and Tronox's preparation of the Modification Report.

7.2 CONSOLIDATED SUMMARY OF ASSESSMENT OF IMPACTS

Tronox operates in accordance with its existing environmental management plans and environmental monitoring programs (Section 1.1.3).

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment. The key environmental issues identified are summarised in Table 8.

7.3 JUSTIFICATION FOR THE MODIFICATION

Approval of the Modification is considered to be justified given:

- The Modification would allow for the continued operation of the Snapper Mine within the approved mine life and without increasing the total area of approved surface development area.
- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine.
- The Modification would allow Tronox to continue to supply its downstream operations (including the MSP) and other customers with mineral concentrate until the commencement of production from the Atlas-Campaspe Mine, avoiding disruption to existing supply chains.

Table 8
Key Outcomes of Environmental Review for the Modified Snapper Mine

Environmental Aspect	Summary of Key Environmental Review Conclusions
Biodiversity	• The Modification would result in a net positive outcome for biodiversity values in the local area. • As the Modification would not increase impacts on biodiversity values, it is considered that a BDAR is not required.
Aboriginal Cultural Heritage	• No known Aboriginal cultural heritage sites are present within the Modification area.
Historic Heritage	• No historic heritage sites are present within the Modification area.
Land and Agricultural Resources	• The Modification would result in a net reduction in surface development area, therefore there is expected to be no additional impact on potential land and agricultural resources.
Air Quality	• Potential air quality impacts associated with the Modification would not contribute to any exceedances of the relevant air quality criteria at the closest sensitive receptors.
Noise	• Noise emissions due to the Modification would not result in any material increase in noise levels, and relevant noise criteria are predicted to be achieved at the closest sensitive receptor, during day, evening and night, under neutral and adverse meteorological conditions.
Road Transport	• A portion of Nob Road would be realigned in consultation with the WSC. • The Modification would have acceptable impacts on the capacity, efficiency and safety of the road network surrounding the Snapper Mine.
Groundwater Resources	• The Modification is not expected to have any measurable effect at leaseholder bores given the negligible groundwater drawdown effects expected. • The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River). • The Modification would have “minimal impact” as defined in the AIP. • Tronox holds sufficient entitlements (21,442 share components or ML) under the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011*.
Surface Water Resources	• Potential surface water impacts associated with the Modification would be minimal with the implementation of existing surface water management measures.
Social and Economic	• The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine. • The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the regional economy would continue as a result of the Modification. • The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would, however, avoid potential negative social impacts associated with the loss of employment opportunities at Tronox’s operations.
Visual	• The potential visual impact associated with views of the modified Snapper Mine operations along a short section of the HAR would be low given the very low number of road users on the HAR.
Greenhouse Gas	• The total greenhouse gas emissions from the approved Snapper Mine (over the whole mine life) would not change significantly as a result of the Modification.
Hazards and Risks	• As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.
Community Infrastructure	• As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved social and community infrastructure impacts is expected.

- The Modification would promote the efficient and economic recovery of additional mineral sands resources while maximising the use of Tronox's established facilities and associated returns on existing financial investment
- The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6).
- The WSC and relevant leaseholders have provided in-principle support for the Modification.

7.4 CONCLUSION

The modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.

In weighing up the main environmental impacts (costs and benefits) and socio-economic benefits associated with the Modification as assessed and described in this Modification Report, the Modification is, on balance, considered to have merit.

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ATTACHMENT 1

PROJECT APPROVAL (06_0168)

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

I approve the project referred to in schedule 1, subject to the conditions in schedules 2 to 4.

These conditions are required to:
- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Frank Sartor MP
Minister for Planning

Sydney 2007

SCHEDULE 1

Application Number:	06_0168
Proponent:	Cristal Mining Australia Limited
Approval Authority:	Minister for Planning
Land:	See Appendix 1
Project:	Snapper Mineral Sands Project

Red type – June 2009 modification
Blue type – December 2009 modification
Green type – October 2010 modification
Orange type – October 2014 modification
Light Blue type – December 2014 Modification
Purple type – February 2015 Modification

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DEFINITIONS

Annual Review	The review required by condition 5 of schedule 4
BCA	Building Code of Australia
Council	Wentworth Shire Council
Day	The period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and Public Holidays
Department	Department of Planning & Environment
Crown Lands	Division of Crown Lands within the NSW Department of Trade & Investment, Regional Infrastructure and Services
DRE	Division of Resources and Energy within NSW Trade and Investment, Regional Infrastructure and Services
EA	The report titled *Snapper Mineral Sands Project – Environmental Assessment* dated March 2007, and associated *Responses to Submissions* dated 22 June 2007
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPL	Environment Protection Licence issued under the *Protection of the Environment Operations Act 1997*
ETL	Electricity Transmission Line
Evening	The period from 6pm to 10pm
Feasible	Feasible relates to engineering considerations and what is practical to build
Ginkgo Mine	The mineral sands mine the subject of DA 251-09-01 and described in the Environmental Impact Statement titled *Ginkgo Mineral Sands Mine Environmental Impact Statement* dated September 2001
ha	Hectares
Haulage Route	The route shown in Appendix 2
Mining operations	The extraction and processing of ore on site
Minister	Minister for Planning, or delegate
MSP	Cristal Mining Australia Limited's Mineral Separation Plant located on the south-western outskirts of Broken Hill
Night	The period from 10pm to 7am on Monday to Saturday, and 10pm to 8am on Sundays and Public Holidays
Non-Proponent held land	Land that is not held by the Proponent
NOW	NSW Office of Water
OEH	Office of Environment and Heritage
Offset Area	The land shown as "Snapper Mine Biodiversity Offset Area" in Appendix 3
Project	The Snapper Mineral Sands Project described in the EA
Proponent	Cristal Mining Australia Limited, or its successors
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
RMS	Roads and Maritime Services
Secretary	Secretary of the Department of Planning & Environment, or nominee
Site	The land bounded by the red line (MLA 1621) plus the ETL from the Ginkgo Mine and access road extensions, shown in Appendix 5
Statement of Commitments	The Proponent's commitments in Appendix 4

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) EA;
   (b) statement of commitments
   (c) modification application 06_0168 Mod 1 and accompanying Environmental Assessment titled *Bemax Resources Limited Snapper Mineral Sands Mine Offset Modification Environmental Assessment* dated April 2009;
   (d) modification application 06_0168 Mod 2 and accompanying Environmental Assessment titled *Bemax Resources Limited Ginkgo Mineral Sands Mine and Snapper Mineral Sands Mine November 2009 Modification Environmental Assessment* dated November 2009;
   (e) modification application 06_0168 Mod 3 and accompanying Environmental Assessment titled *Snapper Mineral Sands Mine and Ginkgo Mineral Sands Mine April 2010 Modification Environmental Assessment*, dated April 2010;
   (f) modification application 06_0168 Mod 4 and accompanying Environmental Assessment titled *Murray Darling Basin Operations Modification Environmental Assessment November 2013,* dated November 2013;
   (g) modification application 06_0168 Mod 6 and accompanying letter titled *Snapper Mineral Sands Mine - Ore Production and Mineral Concentrate Transport Limit Modification,* dated 2 December 2014;
   (h) modification application 06_0168 Mod 5 and accompanying Environmental Assessment titled *Snapper Mine Production Increase Modification Environmental Assessment*, dated August 2014; and
   (i) conditions of this approval.

   Notes:
   - *The general layout of the project is shown in Appendix 5; and*
   - *The statement of commitments is included in Appendix 4 (excluding the commitments which are reflected in, or inconsistent with, this approval).*

3. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable and feasible requirements of the Secretary arising from the Department's assessment of:
   (a) any reports, plans or correspondence that are submitted in accordance with the conditions of this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans or correspondence.

Limits on Approval

5. The Proponent may undertake mining operations on the site until 10 July 2026.

   Note: Under this approval, the Proponent is required to rehabilitate the site and perform additional undertakings to the satisfaction of the Secretary and DRE. Consequently, this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been properly rehabilitated.

6. The Proponent shall not:
   (a) extract more than 14 million tonnes of ore from the site in a calendar year;
   (b) produce more than 621,000 tonnes of mineral concentrate from ore extracted from the site per calendar year; and
   (c) transport more than 975,000 tonnes of mineral concentrate from the site and the Ginkgo Mine combined in a calendar year.

7. The Proponent may only transport mineral concentrate off-site via the haulage route, using RMS approved vehicles.

7A. The Proponent may transport up to 4 million tonnes of unprocessed mineral sands ore to the Ginkgo Mine until 31 December 2011, unless otherwise agreed by the Secretary, limited to a maximum of 2 laden and 2 unladen vehicle movements per hour. All vehicle loads must be covered during transport.

7B. A maximum of 300,000 tonnes per annum of processed waste material may be transported to the Ginkgo and Snapper Mines from the Broken Hill Mineral Separation Plant.

Updating and Staging Strategies, Plans or Programs

8. With the approval of the Secretary, the Proponent may submit any strategies, plans or programs required by this approval on a progressive basis.

To ensure the strategies, plans or programs under the conditions of this approval are updated on a regular basis, the Proponent may at any time submit revised strategies, plans or programs to the Secretary for approval.

With the agreement of the Secretary, the Proponent may prepare any revised strategy, plan or program without consultation with all parties under the applicable condition of approval.

Note:

- *While any strategy, plan or program may be submitted on a progressive basis, the Proponent must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.*
- *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*

Structural Adequacy

9. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:

- *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works.*
- *Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.*

Demolition

10. The Proponent shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*, or its latest version.

Operation of Plant and Equipment

11. The Proponent shall ensure that all plant and equipment used on site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

SOIL AND WATER

Discharges

1. Except as may be expressly provided for by an EPL, the Proponent shall not discharge any water from the site.

Water Management Plan

2. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA and NOW by suitably qualified expert/s whose appointment/s have been approved by the Director-General;
   (b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
   (c) include:
      - Erosion and Sediment Control Measures;
      - Surface Water Management Measures; and
      - Borefield Management Measures.

Erosion and Sediment Control Measures

3. The Erosion and Sediment Control Measures must:
   (a) be consistent with the *Managing Urban Stormwater: Soils and Construction* manual (Landcom, 2004 or its latest version);
   (b) identify activities that could cause soil erosion and generate sediment;
   (c) describe measures to minimise soil erosion and the potential for the transport of sediment;
   (d) describe the location, function, and capacity of erosion and sediment control structures; and
   (e) describe what measures would be implemented to monitor and maintain the integrity of the structures over time.

Surface Water Management Measures

4. The Surface Water Management Measures must:
   (a) describe the salinity management measures on site including the design measures proposed to be used to minimise any lateral seepage of brackish water from the initial water dam, initial emplacement containing the overburden slurry, and initial sand residue dam which could contaminate adjacent soils and cause vegetation dieback;
   (b) describe measures to manage dust suppression water along the haulage route between the Silver City Highway and the site;
   (c) include a program to monitor the effectiveness of these measures, with specific reference to vegetation and soil performance criteria; and
   (d) describe the measures that would be implemented if any exceedances of the performance criteria are detected.

Borefield Management Measures

5. The Borefield Management Measures must include:
   (a) a site water balance;
   (b) data to benchmark the natural variation in groundwater levels and quality prior to any development on site within the predicted drawdown impact zone (identified in the EA);
   (c) groundwater impact trigger levels for relevant landholder bores (e.g. Chalky Well);
   (d) a program to monitor the groundwater impacts of the project;
   (e) the procedures that would be implemented if the groundwater impact trigger levels are exceeded; and
   (f) measures to mitigate and/or compensate landholders who are adversely affected by the groundwater impacts of the project, including the provision of alternative water.

WASTE MANAGEMENT

Waste Management Plan

6. The Proponent shall prepare and implement a Waste Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA by suitably qualified expert/s whose appointment/s have been approved by the Secretary,
   (b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
   (c) include:
      - Landfill Management Measures; and
      - Waste Minimisation Measures.

Landfill Management Measures

7. The Landfill Management Measures must:
   (a) generally meet the environmental goals listed in *Environmental Guidelines: Solid Waste Landfills* (DEC, 1996 or its latest version) and;
   (b) include:
      - design and operation details of waste disposal areas;
      - a management program for backloaded MSP process waste;
      - a system to monitor the movement of backloaded MSP waste; and
      - disposal techniques and handling practices consistent with the *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA, 2005 or its latest version).

Waste Minimisation Measures

8. The Waste Minimisation Measures must:
   (a) identify the various waste streams of the project;
   (b) describe what measures would be implemented to reuse, recycle or minimise the waste generated by the project; and
   (c) include a program to monitor the effectiveness of these measures.

   Note: The waste minimisation measures are not relevant to backloaded MSP process waste, overburden or sand residues.

RADIATION MANAGEMENT

Radiation Management Plan

9. The Proponent shall prepare and implement a Radiation Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA by suitably qualified expert/s whose appointment/s have been approved by the Secretary;
   (b) be submitted to the Secretary for approval prior to carrying out any development on the site;
   (c) be consistent with the *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in mining and Mineral Processing* (ARPANSA, 2005); and
   (d) include:
      - a description of operation and control measures;
      - a description of waste generating processes and waste;
      - demonstration of access to professional expertise;
      - details of radiation monitoring;
      - details of appropriate equipment, staff, facilities and operational procedures;
      - a description of induction and training courses;
      - reporting and periodic review procedures;
      - emergency plans;
      - baseline radiological information;
      - description of the waste management system;
      - radioactive waste monitoring; and
      - a conceptual decommissioning plan.

NOISE

Noise Impact Assessment Criteria

10. The Proponent shall ensure that the noise generated by the project does not exceed 35dB(A) $L_{Aeq(15\ minute)}$ at any residence on non-Proponent held land.

Notes:

- *To determine compliance with the $L_{Aeq(15\ minute)}$ limit, noise from the project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the development is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.*
- *The noise limit above applies under the following meteorological conditions:*
  - *wind speeds of up to 3 m/s at 10 metres above ground level; or*
  - *temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.*
- *These limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.*

Traffic Noise Criteria

11. The Proponent shall ensure that traffic noise generated by the project does not exceed the following noise goals at any residence on non-Proponent held land along the haulage route between the Silver City Highway and the site:
    - $L_{Aeq(1\ hour)}$ 50 dB(A) for 7:00 am to 10:00 pm; and
    - $L_{Aeq(1\ hour)}$ 45 dB(A) for 10:00 pm to 7:00 am.

Noise Monitoring

12. The Proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the Secretary. This program must:
    (a) be prepared in consultation with the EPA;
    (b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
    (c) use a combination of attended and unattended monitoring measures to monitor the performance of the project.

AIR QUALITY

Air Quality Impact Assessment Criteria

13. The Proponent shall ensure that dust generated by the project does not cause additional exceedances of the criteria listed in Tables 1 to 3 at any residence on non-Proponent-held land.

Table 1: Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	30 µg/m^3

Table 2: Short term impact assessment criteria for particulate matter

Pollutant	Averaging period	Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3

Table 3: Long term impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS/NZS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Monitoring

14. The Proponent shall prepare and implement an Air Quality Monitoring Program for the project to the satisfaction of the Secretary. This program must:
    (a) be prepared in consultation with the EPA;
    (b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
    (c) use dust deposition gauges to monitor the performance of the project.

METEOROLOGICAL MONITORING

15. During the life of the project, the Proponent shall ensure that there is a suitable meteorological station in the vicinity of the site that complies with the *Approved Methods for Sampling of Air Pollutants in New South Wales* (DEC, 2007 or its latest version).

FLORA AND FAUNA

Flora and Fauna Management

16. The Proponent shall prepare and implement a Flora and Fauna Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the OEH by a suitably qualified expert(s) whose appointment(s) has been approved by the Secretary;
    (b) be submitted to the Secretary for approval prior to carrying out any development on the site: and
    (c) include a:
        - vegetation clearance protocol which must include procedures for notifying OEH of any clearing activities outside of late summer to early autumn, including any additional mitigation measures to be implemented to minimise impacts on fauna;
        - threatened species management protocol;
        - description of the detailed measures that would be implemented to:
            - control weeds, feral pests, and access;
            - salvage and reuse material from the site for habitat enhancement;
            - collect and propagate seed;
            - manage grazing, fauna entrapment in the dredge pond, bushfires, and remnant vegetation on site; and
        - program to monitor the effectiveness of the protocols and management measures in the plan.

Offset Management Plan

17. The Proponent must prepare and implement an Offset Management Plan to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the OEH by a suitably qualified expert(s) whose appointment(s) has been approved by the Secretary;
    (b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
    (c) describe the measures to implement the flora and fauna offset (see statement of commitment 4 in Appendix 4 and the detailed description of this offset in the EA), including:
        - the objectives for the offset;
        - a description of the short, medium, and long term measures that would be implemented, including appropriate fencing to exclude grazing, incrementally de-stocking the offset area over three years, removal of unnecessary existing fences, erosion control, signage of the offset, revegetation of unnecessary access tracks, animal pest control, weed management, fire management and threatened species management;
        - detailed performance and completion criteria for the implementation of the offset;
        - a detailed description of how the performance of the offset would be monitored, using techniques such as photographic monitoring and permanent flora quadrats;
        - a description of how the offset would be protected in the long-term; and

- details of who would be responsible for monitoring, reviewing and implementing the plan.

Offset Bond

18. After the first Independent Environmental Audit (see Schedule 4) after year 10 of the mining operations, the Proponent shall lodge a suitable offset bond with the Secretary. This bond must be determined by the audit team in consultation with the Proponent, and contain sufficient funds to ensure the remaining works in the Offset Management Plan are fully implemented. The Proponent shall revise this bond to the satisfaction of the Secretary after each subsequent audit.

Notes:
(d) Remaining works are those works required for areas for which completion criteria (as set out in the Offset Management Plan) have not been met, as determined by the Independent Environmental Audit.
(e) Areas for which completion criteria have been met, as verified by the relevant Audit, will not require a bond.
(f) Where offset completion criteria are met for a particular area, as verified by the Audit, the Secretary will release the bond for that area.

REHABILITATION

Rehabilitation Objectives

19. The Proponent shall rehabilitate the site to the satisfaction of DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy for the project, and comply with the objectives in Table 4.

Table 4: Rehabilitation Objectives

Feature	***Objective***
• Mine site (as a whole).	• Safe, stable & non-polluting • Final land use compatible with surrounding land uses • Final landforms designed to incorporate micro-relief, natural drainage lines and minimise visual prominence by integration with the surrounding landscape • Restore self-sustaining ecosystems, including establishing local native plant species
• Final Void	• Minimise the size and depth of the final voids as far as is reasonable and feasible • Minimise the drainage catchment of the final voids as far as reasonable and feasible
• Overburden Emplacement Areas	• Ensure that areas subject to slurried overburden emplacement are covered with a minimum of: - 1 metre of non-slurried overburden on the initial slurried sand storage dam; - 3 metres of non-slurried overburden for all other areas; in addition to at least 0.2 metres of topsoil and at least 0.2 metres of subsoil.
• Surface infrastructure.	• To be decommissioned and removed, unless DRE agrees otherwise
• Agriculture	• Reinstatement of the infrastructure areas to land suitable for light intensity grazing
• Community	• Ensure public safety and minimise the adverse socio-economic effects associated with mine closure

Notes:
- *These rehabilitation objectives apply to all environmental consequences caused by mining taking place after the date of this approval; and to all surface infrastructure sites and other disturbance which forms part of the project, whether constructed prior to or following the date of this approval.*
- *Rehabilitation of environmental impacts and consequences caused by mining which took place prior to the date of this approval may be subject to the requirements of other consents (e.g. under a mining lease).*

Progressive Rehabilitation

19A. The Proponent shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim stabilisation measures must be implemented where reasonable and feasible to control dust emissions in disturbed areas that are not active and which are not ready for final rehabilitation.

Note: It is accepted that parts of the site that are progressively rehabilitated may be subject to further disturbance in future.

Rehabilitation Management Plan

19B. The Proponent shall prepare and implement a Rehabilitation Management Plan for the project, in consultation with the Department, Council and Crown Lands, and to the satisfaction of DRE. This plan must:

(a) be submitted to DRE, for approval within 6 months of the date of approval for MOD 5, or as otherwise agreed with the Secretary;

(b) be prepared in accordance with any relevant DRE guideline and be consistent with the rehabilitation objectives of the project and in Table 4;

(c) describe how the performance of the rehabilitation would be monitored and assessed against the objectives in Table 4;

(d) describe the process whereby additional measures would be identified and implemented to ensure the rehabilitation objectives are achieved;

(e) provide for detailed mine closure planning, including measures to minimise socio-economic effects due to mine closure, to be conducted prior to the site being placed on care and maintenance; and

(f) include a salinity monitoring program for the rehabilitated slurried overburden emplacement areas that describes:
- soil salinity and vegetation health impact assessment criteria;
- a program to monitor soil salinity and vegetation health; and
- a contingency strategy for the investigation, notification and mitigation of identified exceedances of the impact assessment criteria; and

(g) be integrated with the other management plans required under this approval.

Notes:
- *The approved Mining Operations Plan may satisfy the requirements of this condition for a Rehabilitation Management Plan.*
- *The Rehabilitation Management Plan should address all land impacted by the project, and should be suitably integrated with the Rehabilitation Management Plans for the Ginkgo Mine.*

HERITAGE

Aboriginal Cultural Heritage Management Plan

20. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan for the project to the satisfaction of the Secretary. This plan must:

(a) be prepared in consultation with the OEH and the registered Aboriginal stakeholders involved in the preparation of the EA;

(b) be submitted to the Secretary for approval prior to carrying out development on the site; and

(c) include a:
- description of detailed management strategies outlined in statement of commitment 5 in Appendix 4;
- description of the measures that would be implemented if any skeletal remains are discovered during the project; and
- program to monitor the effectiveness of the proposed management strategies.

Non-Indigenous Heritage

21. The Proponent shall protect non-Indigenous cultural heritage site SNH1 (see Appendix 6), and at a minimum erect temporary protective barriers around the site.

TRANSPORT

Monitoring of Mineral Concentrate Transport

21A. The Proponent shall:

(a) keep accurate records of the amount of mineral concentrate transported from the site (on a monthly basis); and

(b) make these records publicly available on its website at the end of each calendar year.

Road Works

22. Prior to carrying out any development on the site, the Proponent shall install appropriate truck warning signs at locations approximately 300 metres in advance of the haulage route intersection with the Silver City Highway and on both sides of the highway to the satisfaction of the RMS.

23. The Proponent shall:
    (a) minimise the amount of dust and debris being carried onto the Silver City Highway by haul trucks from the project; and
    (b) regularly remove this dust and debris from the highway,
    to the satisfaction of the RMS.

Transport Management

24. The Proponent shall prepare and implement a Transport Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the EPA and RMS;
    (b) be submitted to the Secretary for approval within 6 months of the date of approval for MOD 5, unless otherwise agreed by the Secretary; and
    (c) include:
        - Transport of Hazardous Material Measures that would be implemented to address the relevant requirements in the *Code of Practice for the Safe Transport of Radioactive Materials* (ARPANSA, 2001 or its latest version);
        - Code of Conduct for all drivers transporting materials to and from the site including measures that would be implemented to prioritise the use of the haulage route and Nob Road; and
        - a description of the measures that would be implemented to comply with Condition 23.

24A. The Proponent may transport mineral concentrate between the Snapper Mine and the Ginkgo Mine, limited to a maximum of 4 vehicle movements per hour.

Road Maintenance

24B. The Proponent shall maintain the haulage route between the Silver City Highway and the site (including the intersection of the haulage route and the Silver City Highway) to the satisfaction of the relevant roads authority.

Note: In the event that there is a dispute between the Proponent and the relevant roads authority about this condition, then either party may refer the matter to the Secretary for resolution.

Independent Road Safety Audit

24C. Within 6 months of the date of approval for MOD 5, unless otherwise agreed with the Secretary, the Proponent shall commission an independent suitably qualified and experienced person endorsed by the Secretary to undertake a road safety audit of the haulage route between the Silver City Highway and the site (including the intersection of the haulage route and the Silver City Highway). This audit must:
    (a) be undertaken in consultation with Council and RMS; and
    (b) recommend any necessary measures to ensure that the road complies with any relevant road safety requirements.

24D. Within 1 month of receiving the audit report, or as otherwise agreed with the Secretary, the Proponent shall submit a copy of the reports to the Secretary, with a detailed response to any of the recommendations contained in each of the reports, including a timetable for the implementation of any measures proposed to address the recommendations in each of the reports. Any road works recommended in the audit must be undertaken in accordance with this timetable to the satisfaction of the relevant road authority, unless otherwise agreed with the Secretary.

Note: In the event that there is a dispute between the Proponent and the relevant roads authority about the implementation of these conditions, then either party may refer the matter to the Secretary for resolution.

GREENHOUSE GAS

Energy Savings Action Plan

(b) The Proponent shall prepare and implement an Energy Savings Action Plan for the project to the satisfaction of the Secretary. This plan must be:
    (a) be prepared in accordance with the *Guidelines for Energy Savings Action Plan* (DEUS, 2005 or its latest version);

(b) submitted to the Secretary for approval prior to carrying out any development on the site; and
(c) include a program to monitor the effectiveness of the measures to reduce energy use on site.

SCHEDULE 4

ENVIRONMENTAL MANAGEMENT, MONITORING, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT STRATEGY

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Secretary. This strategy must be submitted to the Secretary for approval prior to carrying out any development on the site, and:
   (a) provide the strategic context for environmental management of the project;
   (b) identify the statutory requirements that apply to the project;
   (c) describe in general how the environmental performance of the project would be monitored and managed;
   (d) describe the procedures that would be implemented to:
   - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
   - receive, handle, respond to and record complaints;
   - resolve any disputes that may arise during the course of activities associated with the project;
   - respond to any non-compliance;
   - manage cumulative impacts; and
   - respond to emergencies; and

   (e) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project.

ENVIRONMENTAL MONITORING PROGRAM

2. The Proponent shall prepare and implement an Environmental Monitoring Program for the project to the satisfaction of the Secretary. This program must consolidate the various monitoring requirements of this approval into a single document, and be submitted to the Secretary concurrently with the submission of the relevant monitoring programs.

INCIDENT REPORTING

3. Within 24 hours of detecting an exceedance of the limits/performance criteria in this approval, or the occurrence of an incident that causes (or may cause) harm to the environment, the Proponent shall notify the Department and other relevant agencies of the exceedance/incident.

4. Within six days of notifying the Secretary and other relevant agencies of an exceedance/incident, the Proponent shall provide the Department and these agencies with a written report that:
   (a) describes the date, time and nature of the exceedance/incident;
   (b) identifies the cause (or likely cause) of the exceedance/incident;
   (c) describes what action has been taken to date; and
   (d) describes the proposed measures to address the exceedance/incident.

ANNUAL REVIEW

5. By the end of December 2011, and annually thereafter, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:
   (a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
   (b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the:
   - relevant statutory requirements, limits or performance measures/criteria;
   - monitoring results of previous years; and
   - relevant predictions in the EA;

   (c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
   (d) identify any trends in the monitoring data over the life of the project;
   (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
   (f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

INDEPENDENT ENVIRONMENTAL AUDIT

6. By the end of December 2011, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
   (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
   (b) include consultation with the relevant agencies;
   (c) assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
   (d) review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
   (e) recommend appropriate measures or actions to improve the environmental performance of the project, and/or any assessment, plan or program required under the abovementioned approvals.

   Note: This audit team must include experts in any field specified by the Secretary.

7. Within six weeks of completing this audit, or as otherwise agreed by the Secretary, the Proponent shall submit a copy of the audit report to the Secretary, with its response to any recommendations contained in the audit report.

REVISION OF STRATEGIES, PLANS AND PROGRAMS

8. Within 3 months of:
   (a) submitting an annual review under condition 5 above;
   (b) submitting an incident report under condition 4 above;
   (c) submitting an audit report under condition 6 above; or
   (d) any modification to the conditions of this approval;

   the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Secretary.

   Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.

ACCESS TO INFORMATION

9. Within three months of the approval of any plan/strategy/program required under this approval (or any subsequent revision of these plans/strategies/programs), or the completion of the audits or annual reviews required under this approval, the Proponent shall:
   (a) provide a copy of the relevant document/s to the relevant agencies, and provide a copy to members of the general public upon request; and
   (b) put a copy of the relevant document/s on the Proponent's website;

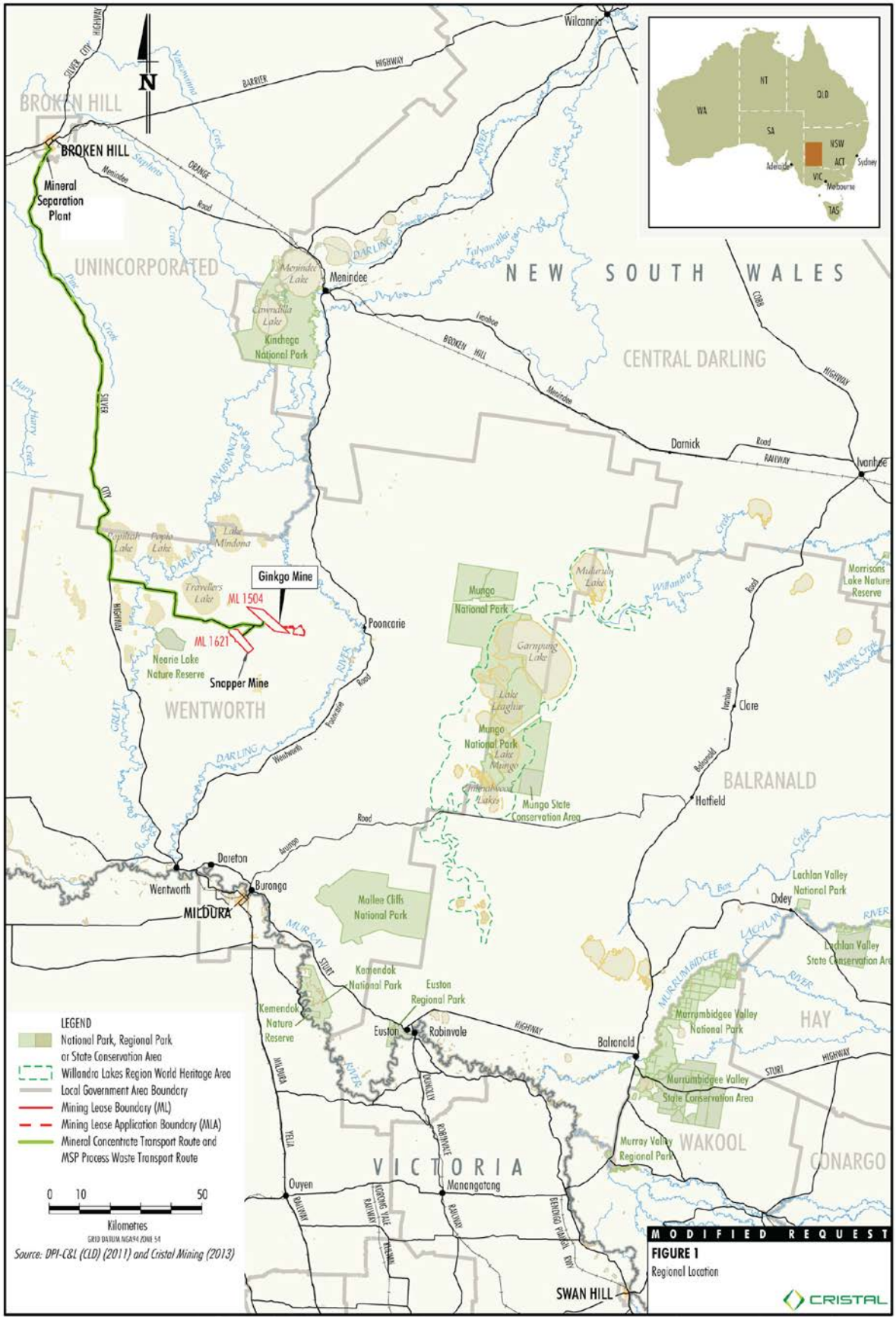
10. During the project, the Proponent shall:
   (a) make a summary of monitoring results required under this approval publicly available on its website; and
   (b) update these results on a regular basis (at least every three months).

APPENDIX 1
SCHEDULE OF LAND

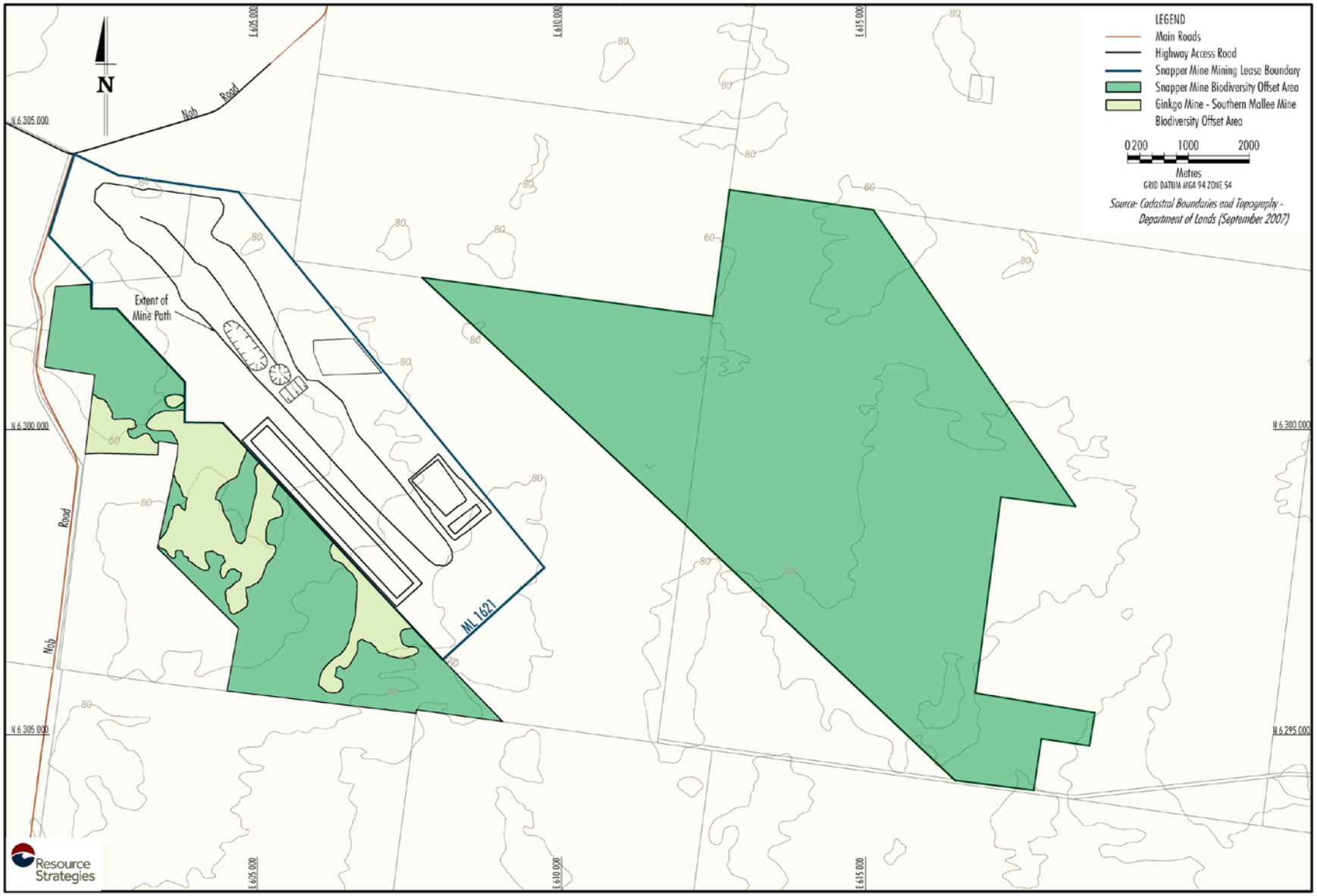
Land Tenure Summary of the Site & Offset Area

Lot/DP	Leaseholder	Property Name
1929/763907	BEMAX Resources Limited	Trelega
5536/768446	BEMAX Resources Limited	Trelega
57/760337	BEMAX Resources Limited	Trelega
1927/763905	G.C. and S.L. Cullinan	Carstairs
1925/763903	M.A. Withers	Manilla
1924/763902	K.D. Ingram	Aston

APPENDIX 2
HAULAGE ROUTE



APPENDIX 3
BIODIVERSITY OFFSETS



APPENDIX 4
STATEMENT OF COMMITMENTS

SOC 1 Emergency Response Plan (ERP)

An ERP will be prepared for the construction and operation of the Snapper Mine to detail responsibilities in the event of emergencies in and around the Snapper Mine area. Snapper Mine fire response will be co-ordinated with the local bushfire brigade.

SOC 2 Community Consultation Plan (Ginkgo Mine CCP)

The *Ginkgo Mine CCP* (BEMAX, 2004a) will be revised to include the Snapper Mine. The CCP will provide for on-going consultation with local residents.

SOC 3 Mining Operations Plan (MOP)

A MOP will be prepared for operation of the Snapper Mine in accordance with the Mining, Rehabilitation and Environmental Management Process (MREMP) guidelines (DPI-MR, 2006 or its latest version) and in consultation with various regulatory and advisory agencies.

The MOP will provide information in regard to mining, processing and rehabilitation operations, relevant lease and development conditions, licences and other approvals. The MOP will also describe:

(a) area(s) to be disturbed;
(b) mining and rehabilitation method(s) to be used and their sequence;
(c) existing surface infrastructure;
(d) progressive rehabilitation schedules;
(e) areas of particular environmental sensitivity;
(f) land and water management systems;
(g) resource recovery;
(h) objectives and process to develop criteria for mine closure;
(i) options for the future use of the site, including the HAR and ETL;
(j) measures that would be implemented to manage closure-related environmental effects of the project (including any adverse impacts associated with the two final voids associated with the final dredge pond and water disposal dam); and
(k) describe how the performance of these measures would be monitored over time.

Note: Rehabilitation aspects of the MOP will be progressively developed and implemented from the commencement of the life of the Snapper Mine. Further, the MOP will be revised periodically as well as prior to any significant alteration to mining and rehabilitation operations including cessation of mining.

SOC 4 Flora and Fauna Offset

A flora and fauna offset will be implemented in the offset area (see Appendix 3). This offset area will

(a) include an enhancement area (see table below); and

Area	***Description***	***Size (ha)***
Offset Areas in Appendix 3	*Enhancement of existing areas of native vegetation communities through natural regeneration and management for conservation.*	*5,471*
Total Minimum Area Conserved		***5,471***

Note: The offset shall be in addition to, and outside, the rehabilitated areas of the project disturbance area.

(b) contain the following vegetation communities:

- *Black Box Woodland;*
- *Black Oak-Rosewood-Wilga Woodland;*
- *Chenopod Mallee Woodland/Shrubland*
- *Irregular Dune Mallee Shrubland;*
- *Bluebush Shrubland;*
- *Linear Dune Mallee Shrubland; and*
- *Austrostipa Grassland.*

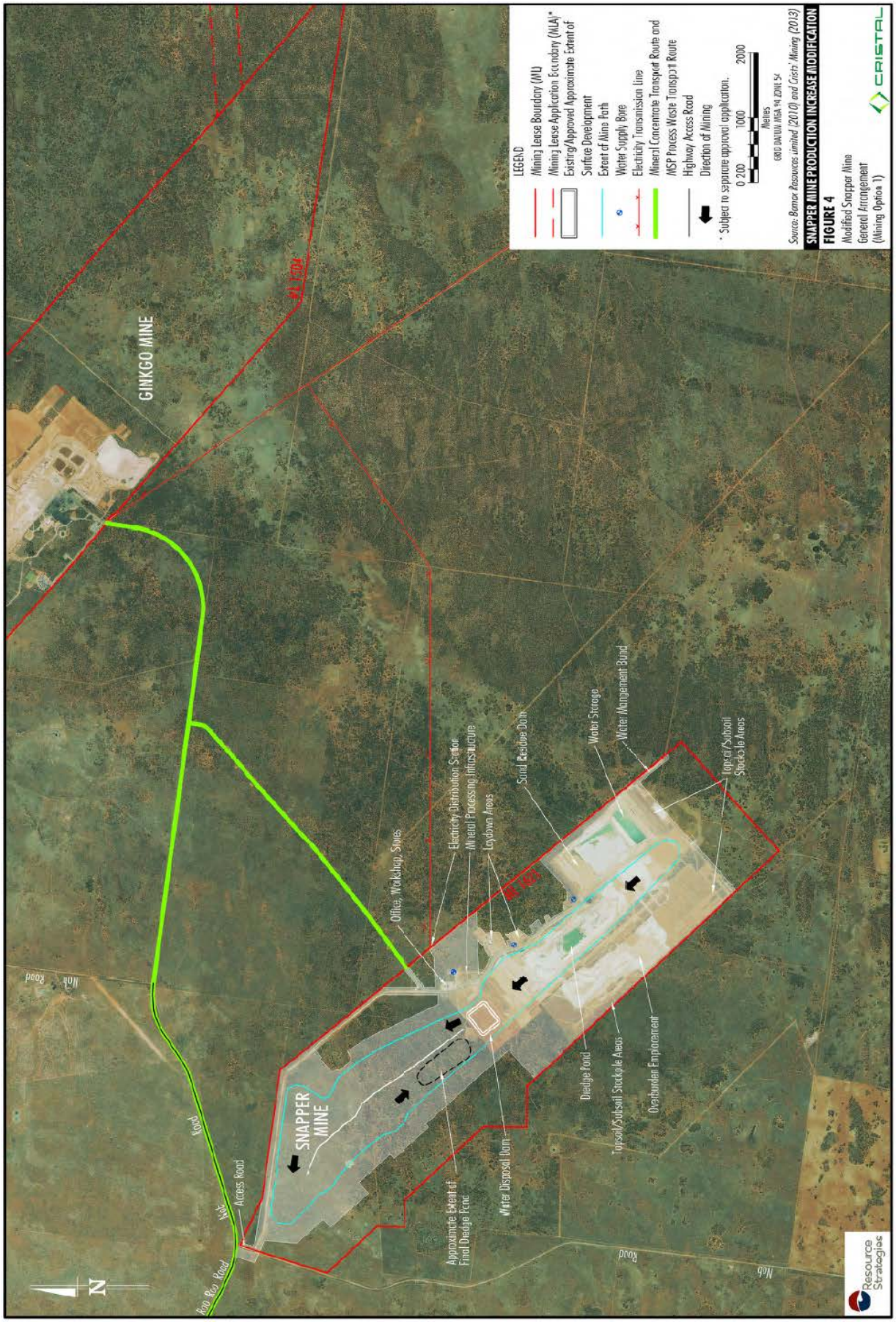
SOC 5 Site Specific Cultural Heritage Management Strategies

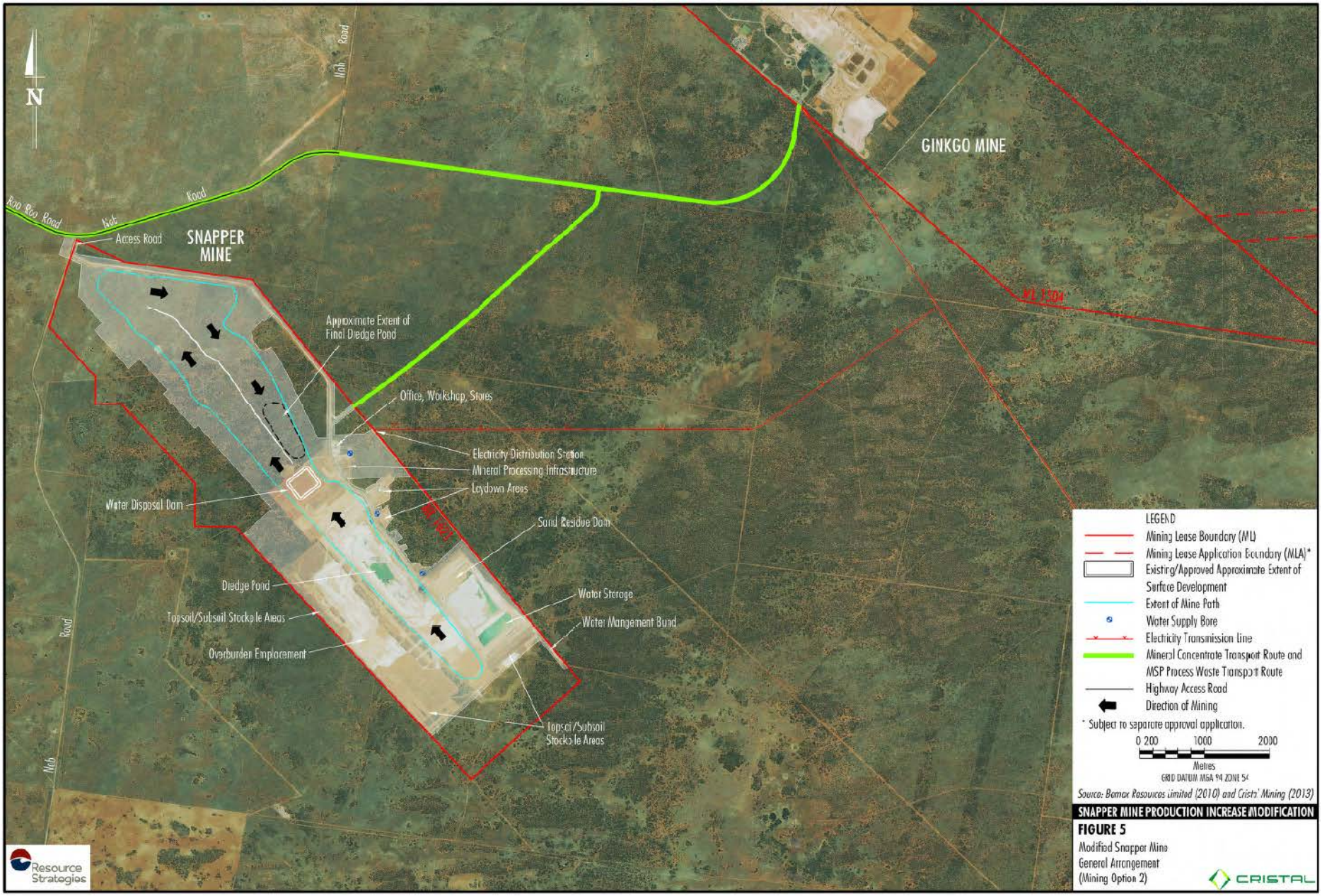
The following site specific management strategies for the cultural heritage sites will be implemented:

Site name	Type	Summary Significance	Potential impacts	Proposed Management Measures
SN01, SN11	Stone quarry, stone artefact scatter	Low-moderate	Direct	Representative sample of stone artefacts shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The representative sample shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH. Lithic technologies and reduction strategies adopted at the stone quarry sites and the relationship of these sites to other sites within the disturbance area shall be investigated.
SN02	Stone artefact scatter, hearth	Low-moderate	Direct	Stone artefacts and heat retainers shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The artefacts and heat retainers shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH. Hearths shall be excavated by an archaeologist and representatives of the local Aboriginal community. Radiocarbon and/or luminescence dating shall be used to determine the ages of the hearths.
SN03	Stone artefact	Low	Direct	The stone artefact shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The artefact shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.
SN04, SN06	Hearth	Low	Direct	The heat retainers shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The heat retainers shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.
SN05	Stone artefact	Low	Indirect	Avoid disturbing the site by erecting a temporary protective barrier around it.
SN07	Stone artefact scatter, hearth	Low	Direct	Stone artefacts and heat retainers shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The artefacts and heat retainers shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.

SN08,SN13, SN17	Stone artefact scatter	Low	Direct	Stone artefacts shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The artefacts shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.
SN09, SN16	Stone artefacts	Low	Direct	Stone artefacts shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The artefacts shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.
SN10,SN12, SN14, SN15, SN18, SN19, SN21	Stone artefact scatter	Low and Low-moderate	Direct/ indirect	Representative sample of stone artefacts shall be recorded, collected, curated and stored at the 'Keeping Place' at BEMAX's Ginkgo Mine by an archaeologist and representatives of the local Aboriginal community. The collected artefacts shall be recorded in sufficient detail to allow a description of the lithic technologies and reduction strategies adopted. The regional and local contexts of the artefacts shall also be analysed and described. The representative sample shall be replaced within rehabilitated areas in consultation with the local Aboriginal community and the OEH.
SN20, SN22	Stone quarry, stone artefact scatter	Moderate-high	Indirect	Temporary protective barriers shall be erected around the sites. BEMAX shall engage an archaeologist and representatives of the local Aboriginal community to supervise the erection of the barriers and monitoring of their maintenance.
SNH1	Kertne Nob outstation and stockyard ruin	Low-moderate	Indirect	Avoid disturbing the site by erecting a temporary protective barrier around it.

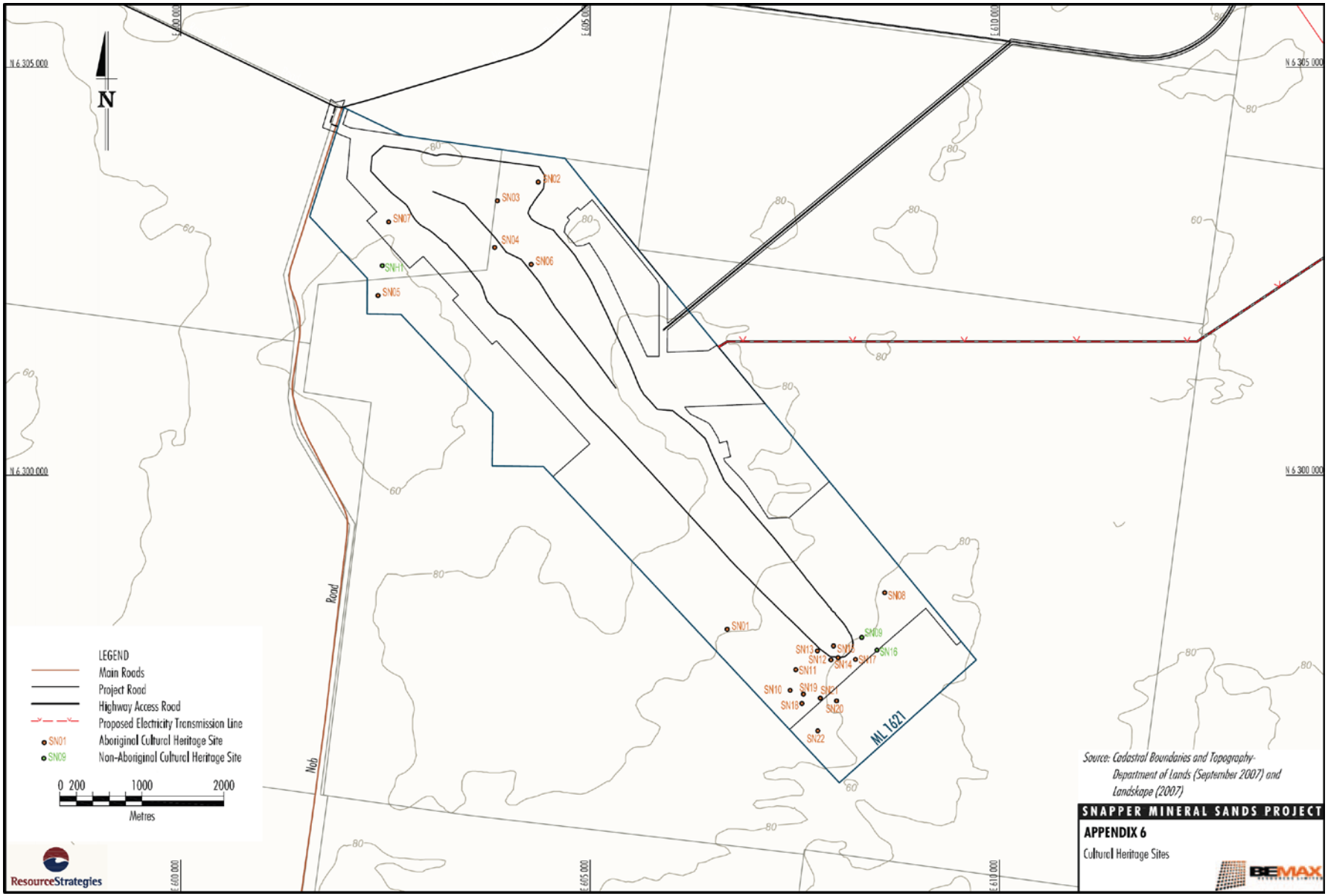
APPENDIX 5
PROJECT LAYOUT




N
Road
Rail Loop Road
Nob
Access Road
SNAPPER MINE
GINKGO MINE
ML 1504
Approximate Extent of Final Dredge Pond
Office, Workshop, Stores
Electricity Distribution Station
Mineral Processing Infrastructure
Laydown Areas
Water Disposal Dam
Sand Residue Dam
Dredge Pond
Water Storage
Topsoil/Subsoil Stockpile Areas
Water Mangement Bund
Overburden Emplacement
Topsoil/Subsoil Stockpile Areas
Road
Nob
Resource Strategies
LEGEND
Mining Lease Boundary (ML)
Mining Lease Application Boundary (MLA)*
Existing/Approved Approximate Extent of Surface Development
Extent of Mine Path
Water Supply Bore
Electricity Transmission Line
Mineral Concentrate Transport Route and MSP Process Waste Transport Route
Highway Access Road
Direction of Mining
* Subject to separate approval application.
0 200 1000 2000
Metres
GRID DATUM MGA 94 ZONE 54
Source: Bemax Resources Limited (2010) and Cristal Mining (2013)
SNAPPER MINE PRODUCTION INCREASE MODIFICATION
FIGURE 5
Modified Snapper Mine General Arrangement (Mining Option 2)
CRISTAL

GINKGO MINE
SNAPPER MINE
LEGEND
Mining Lease Boundary (ML)
Mining Lease Application Boundary (MLA)*
Existing/Approved Approximate Extent of Surface Development
Extent of Mine Path
Water Supply Bore
Electricity Transmission Line
Mineral Concentrate Transport Route and MSP Process Waste Transport Route
Highway Access Road
Direction of Mining
* Subject to separate approval application.
0 200 1000 2000
Metres
GRID DATUM: MGA '94 ZONE 54
Source: Bemax Resources Limited (2010) and Cristal Mining (2013)
SNAPPER MINE PRODUCTION INCREASE MODIFICATION
FIGURE 6
Modified Snapper Mine General Arrangement (Mining Option 3)
CRISTAL
Resource Strategies
N
Rio Rio Road
North Road
Approximate Extent of Final Dredge Pond
Access Road
Office, Workshop, Stores
Electricity Distribution Station
Mineral Processing Infrastructure
Laydown Areas
Sand Residue Dam
Water Storage
Water Management Bund
Topsoil/Subsoil Stockpile Areas
Dredge Pond
Overburden Emplacement
Water Disposal Dam
Topsoil/Subsoil Stockpile Areas
North Road
North Road

APPENDIX 6
CULTURAL HERITAGE SITES



SNAPPER MINE

Northern Extension Modification

Appendix A

Biodiversity Assessment

TRONOX



Snapper Mine Northern Extension Modification

Biodiversity Assessment

for
Tronox Mining Australia Limited

November 2019

Biodiversity Research Pty Ltd
trading as Biodiversity Monitoring Services
ACN 617 530 686

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Document History

Report	Version	Prepared by	Checked by	Submission Method	Date
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Biodiversity Assessment	Issue 3	Andrew Lothian	Nicholas Tong	email	19 Nov 2019

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EXECUTIVE SUMMARY

Biodiversity Monitoring Services were commissioned by Tronox Mining Australia Limited (Tronox) to undertake a flora and fauna survey of three areas investigation areas (the study areas) as part of the Snapper Mine Northern Extension Modification Biodiversity Assessment. The study areas are located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km to the south-east of Broken Hill in western New South Wales (NSW).

The purpose of this document is to report the findings of a review of biodiversity values present in the Study areas and explain why, based on that data, the Northern Extension Modification is not likely to increase impacts on biodiversity values as defined by the NSW *Biodiversity Conservation Act, 2016* (BC Act).

Study areas included two areas (Study Area 1, i.e. the disturbance footprint) to be added to the mine plan (approximately 87.4 hectares [ha]), and two areas (Study Areas 2 and 3) of already approved surface development (approximately 90.7 ha). Tronox wish to forgo surface development in Study Areas 2 and 3 in exchange for approval to develop Study Area 1.

Evidence of only one threatened species listed under the BC Act was located within Study Area 1 during the survey; a feather of the Major Mitchell's Cockatoo (*Cacatua leadbeateri*) in open shrubland. No threatened flora species listed under the BC Act or Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) are known to occur in or around the study areas.

Four Plant Community Types (PCTs) were mapped in Study Area 1. Three PCTs were mapped across Study Areas 2 and 3. A total of 23 Vegetation Integrity plots were conducted in accordance with the Biodiversity Assessment Method.

Mapping of the Study Area 1 shows large areas of shrubland, with smaller areas of derived shrubland and *Black Oak – Western Rosewood open woodland*. Study Areas 2 and 3 comprise mostly *Black Oak – Western Rosewood open woodland* and smaller areas of derived, disturbed or intact shrubland. Most of Study Area 1 is subject to heavy sheep grazing, whereas Study Areas 2 and 3 have remained ungrazed by stock, presumably since commencement of the Snapper Mine. Habitat for several threatened species occurs across all three areas

(hollow-bearing trees and logs), though habitat within Study Areas 2 and 3 is more abundant and of better quality than Study Area 1. Other habitat constraint features, such as waterbodies, native grassland and burrows were absent.

The Northern Extension Modification has been designed to avoid or minimise impacts on native vegetation by predominantly locating the supporting infrastructure in derived shrubland subject to grazing and areas fenced off for mining activity.

In conclusion, the Northern Extension Modification:

- would not increase impacts on biodiversity values as defined by the BC Act and therefore, if the Department of Planning, Industry and Environment is satisfied, a Biodiversity Development Assessment Report is not required; and
- would not increase impacts on threatened species, threatened ecological communities or migratory species listed under the EPBC Act.

Tronox would relinquish (not clear) approximately 90.7 ha of land within the approved Snapper Mine Project area. This would result in a net positive outcome for biodiversity values in the local area.

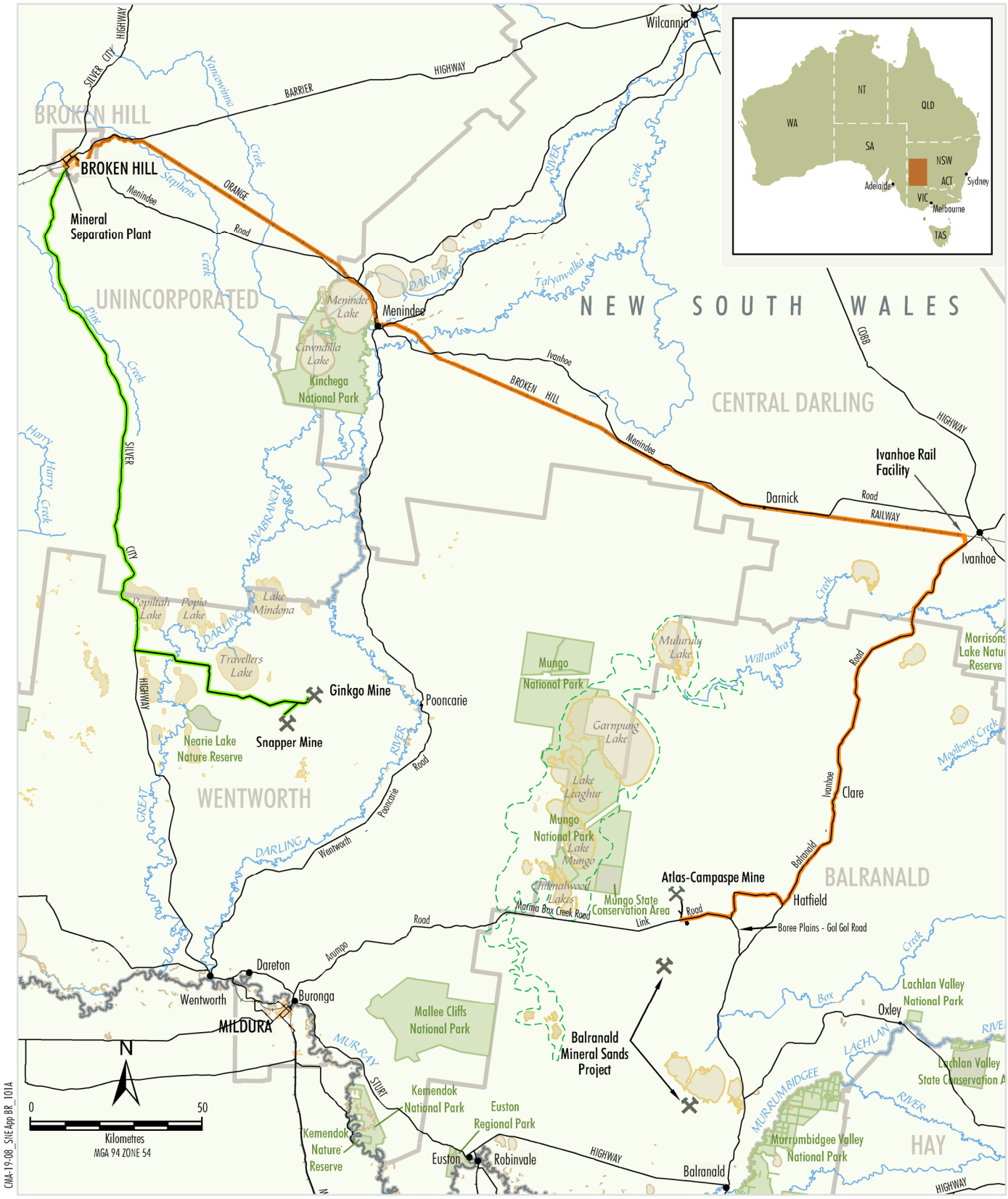
1.0 INTRODUCTION

1.1 BACKGROUND

Tronox Mining Australia Limited (Tronox) proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine and will seek a modification of Project Approval (06_0168) under Section 4.55 of the *Environmental Planning and Assessment Act, 1979* (herein referred to as the Northern Extension Modification). The Northern Extension Modification is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (**Figure 1-1**).

The Northern Extension Modification would include (**Figure 1-2**):

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression;
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area; and
- no change to other approved mine components – production rate, mining method, processing operations, road transport, employment, etc.



LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: © NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)

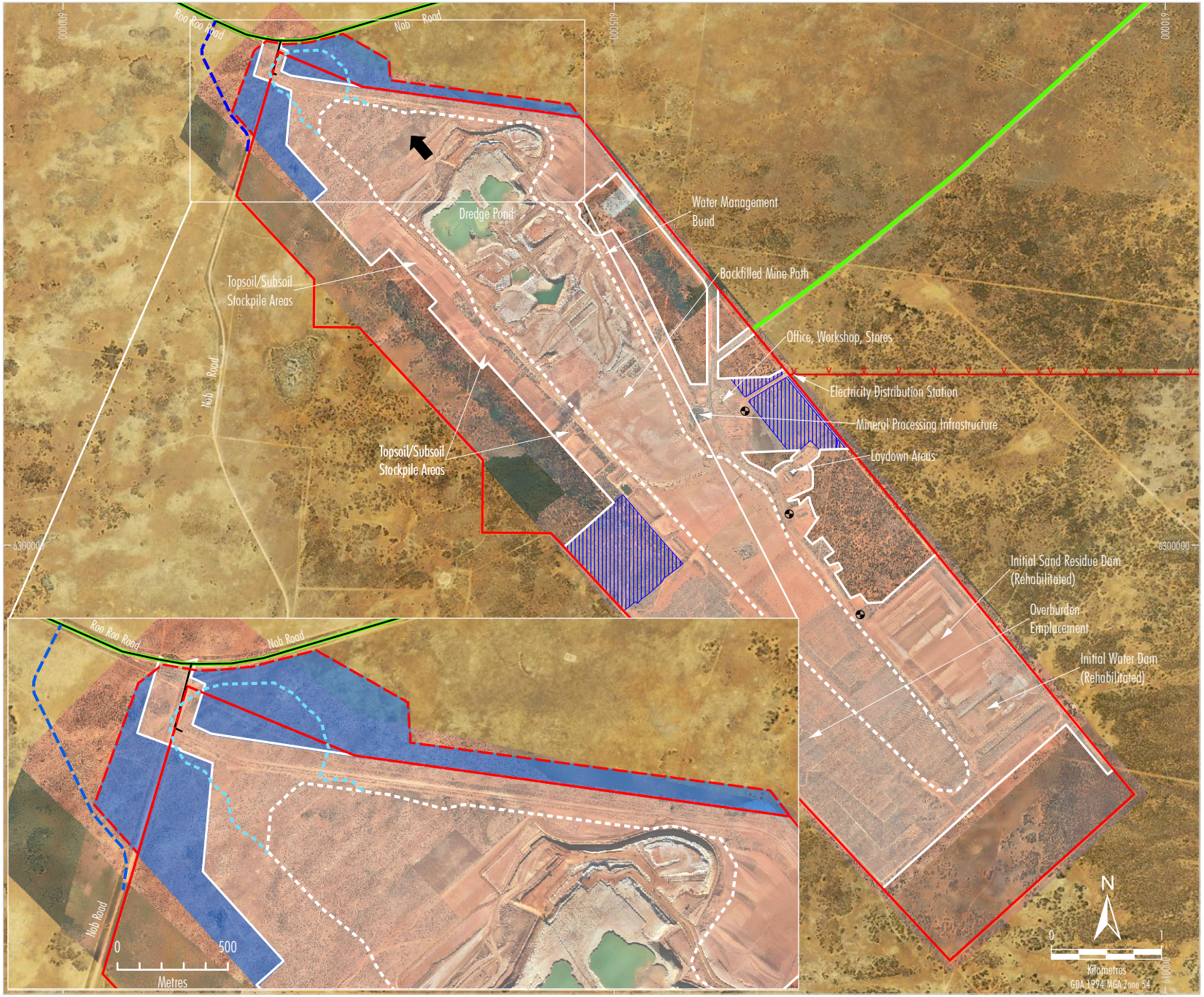
TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1-1



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure 1-2

CMA-19-08_SNE App BR_201C

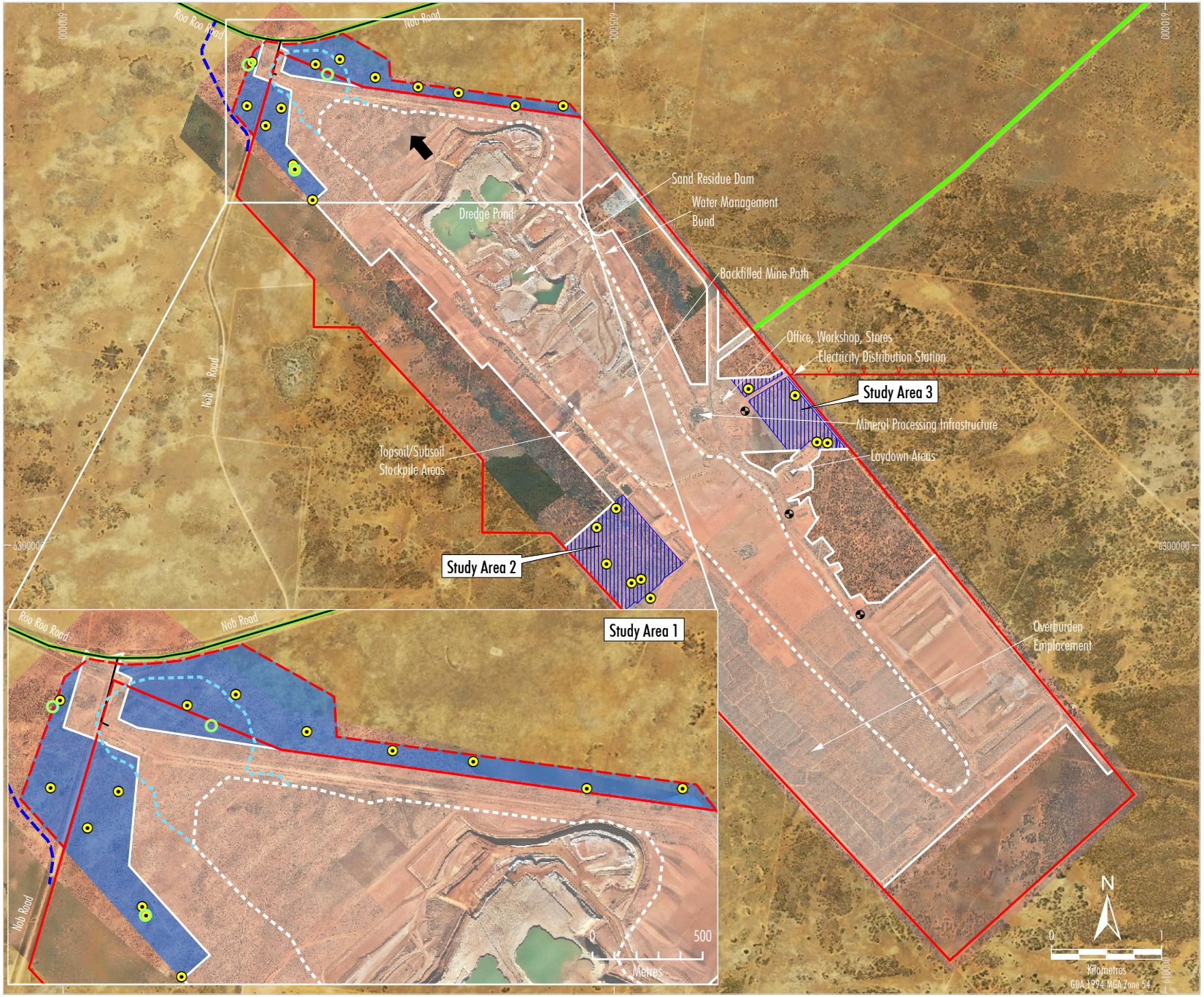
1.2 PURPOSE

Biodiversity Monitoring Services (BMS) was commissioned by Tronox to undertake a vegetation condition assessment, target flora surveys and target fauna surveys across three study areas (Study Areas 1, 2 and 3). Surveys were conducted in accordance with the Biodiversity Assessment Method (BAM). Survey site locations and Vegetation Integrity (VI) plots are shown on **Figure 1-3**.

The study areas include:

- Study Area 1: Approximately 87.4 hectares (ha), located to the northwest of the existing Snapper Mine, between the Snapper Mine and Nob Road;
- Study Area 2: Approximately 57 ha, located to the southwest of the existing Snapper Mine, between the Snapper Mine and the existing Snapper Mine Biodiversity Offset Area; and
- Study Area 3: Approximately 33.7 ha, located to the northeast of the existing Snapper Mine, between the Snapper Mine and the access road to Snapper Mine from Nob Road.

Tronox wish to seek approval for additional clearance within Study Area 1 but also relinquish previously approved clearance in Study Areas 2 and 3 (**Figure 1-3**). The purpose of this document is to report the findings of a review of biodiversity values present and aims to demonstrate to the Department of Planning, Industry and Environment (DPIE) that the Northern Extension Modification (including the proposed development and relinquishment) would not increase impacts on biodiversity values as defined by the NSW *Biodiversity Conservation Act, 2016* (BC Act). This report has been prepared in accordance with the requirements of section 30A(2)(c) of the *Biodiversity Conservation* (Savings and Transitional) *Regulation 2017*.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road
- Vegetation Integrity Plots
- Pitfall Trap

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Survey Sites

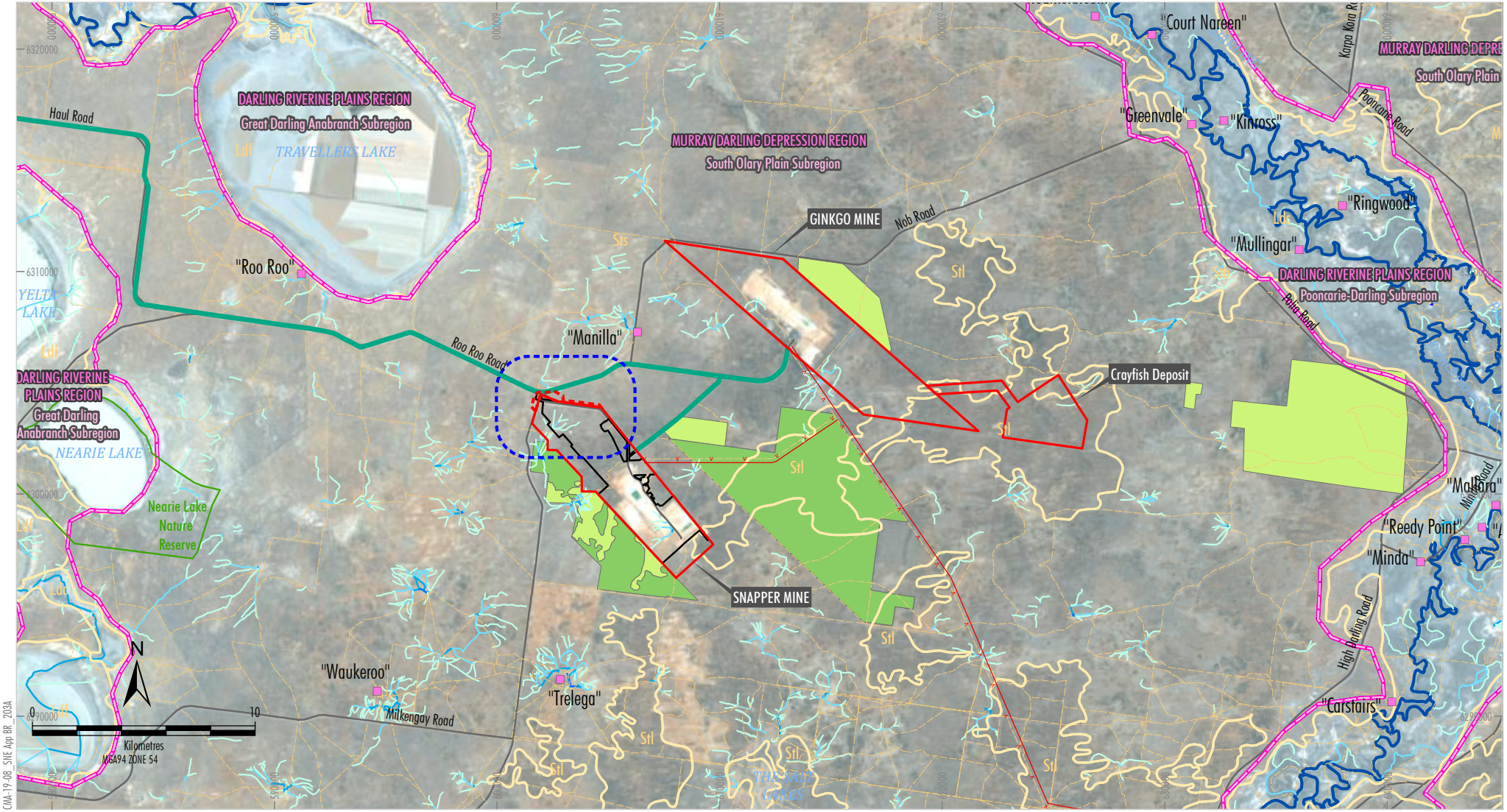
Figure 1-3

CMA-19-08_SNE App BR_202A

Table 1-1 presents a summary of information requirements in accordance with the NSW Department of Planning and Environment (DP&E) (2018).

Table 1-1: General Information

Information Required	Details
Admin	
Proponent	Tronox Mining Australia Limited
Contact Details	Haakon Nielssen, 381 Benetook Avenue, Mildura VIC 3500. 03 5025 4600.
Project ID	Snapper Mine Northern Extension Modification
Author	Andrew Lothian BComm/BSc (Hons. Ecology) BAAS18110 Biodiversity Monitoring Services
Site Details	
Street Address	Nob Road, Pooncarie.
Lot and DP	Lot and DP: 1926, 763904 / 1927, 763905.
Local Government Area	Wentworth Local Government Area.
Description of Existing Development Site	The Northern Extension Modification would involve relinquishment of approved disturbance in Study Areas 2 and 3 for the extension of the approved mine path and supporting infrastructure into a new ML within Study Area 1.
Location	See **Figures 1-1** and **1-4**.
Site Map	See **Figure 1-4**.
Proposed Development	
Description	See Section 1.1.
Site Plan	See **Figure 1-2**.



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Electricity Transmission Line
- Dwelling
- Existing/Approved Surface Development Extent
- 1500 m Buffer to the Proposed Indicative Surface Development Footprint
- Existing Snapper Mine - Biodiversity Offset Area
- Existing Ginkgo Mine - Southern Mallee Offset Area
- IBRA Subregion
- IBRA Region

Mitchell Landscape

- Lda Lower Darling Alluvial Plains
- Ldc Lower Darling Channels and Floodplains
- Ldf Lower Darling Fresh Lakes and Swamps
- Mcu Mallee Cliffs Dunes
- Mld Mallee Cliffs Linear Dunes
- Mcu Mallee Cliffs Salt Lakes and Playas
- Mcs Mallee Cliffs Sandplains
- Stb Scotia Groundwater Basins
- Stl Scotia Linear Dunes
- Sts Scotia Sandplains

Stream Order

- 1
- 2
- 3
- 4
- 5
- 10

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Location/Site Map

Figure 1-4

1.3 EXISTING ENVIRONMENT

1.3.1 REGIONAL LOCATION

The study areas are located in the Murray Darling Depression Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and the South Olary Plain IBRA sub-region (DEE, 2019a) (**Figure 1-4**). The study areas are also within the Western Local Land Service Region.

1.3.2 CLIMATE

The closest Bureau of Meteorology (BOM) weather stations to the study areas are located approximately 30 km east at Pooncarie Mail Agency and 90 km south-southwest at Wentworth Post Office. The mean annual rainfall near the study area is between 268 millimetres (mm) (Pooncarie) and 287 mm (Wentworth) (BOM, 2019). **Plate 1-1** shows that there has been severe rainfall deficiency for the region between October 2016 and September 2019.

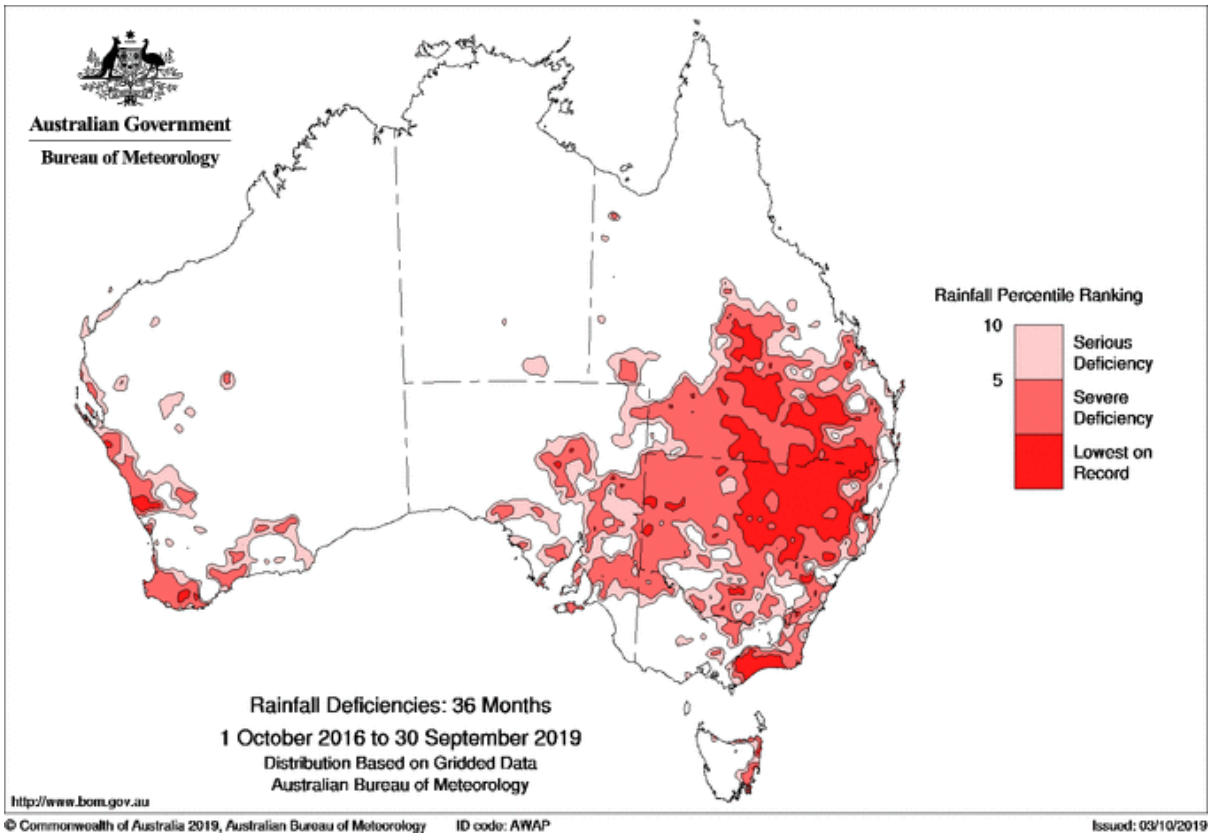


Plate 1-1: Rainfall Deficiency Map for Australia

1.3.3 LANDFORM AND HYDROLOGY

Topography of the surrounding region shows limited relief and comprises generally flat to undulating land covered by a combination of grassland, shrubland and low woodland. Elevation within the study areas range from 60 to 80 metres (m) Australian Height Datum.

The study area does not contain any watercourses or artificial watering points.

1.3.4 LAND USE

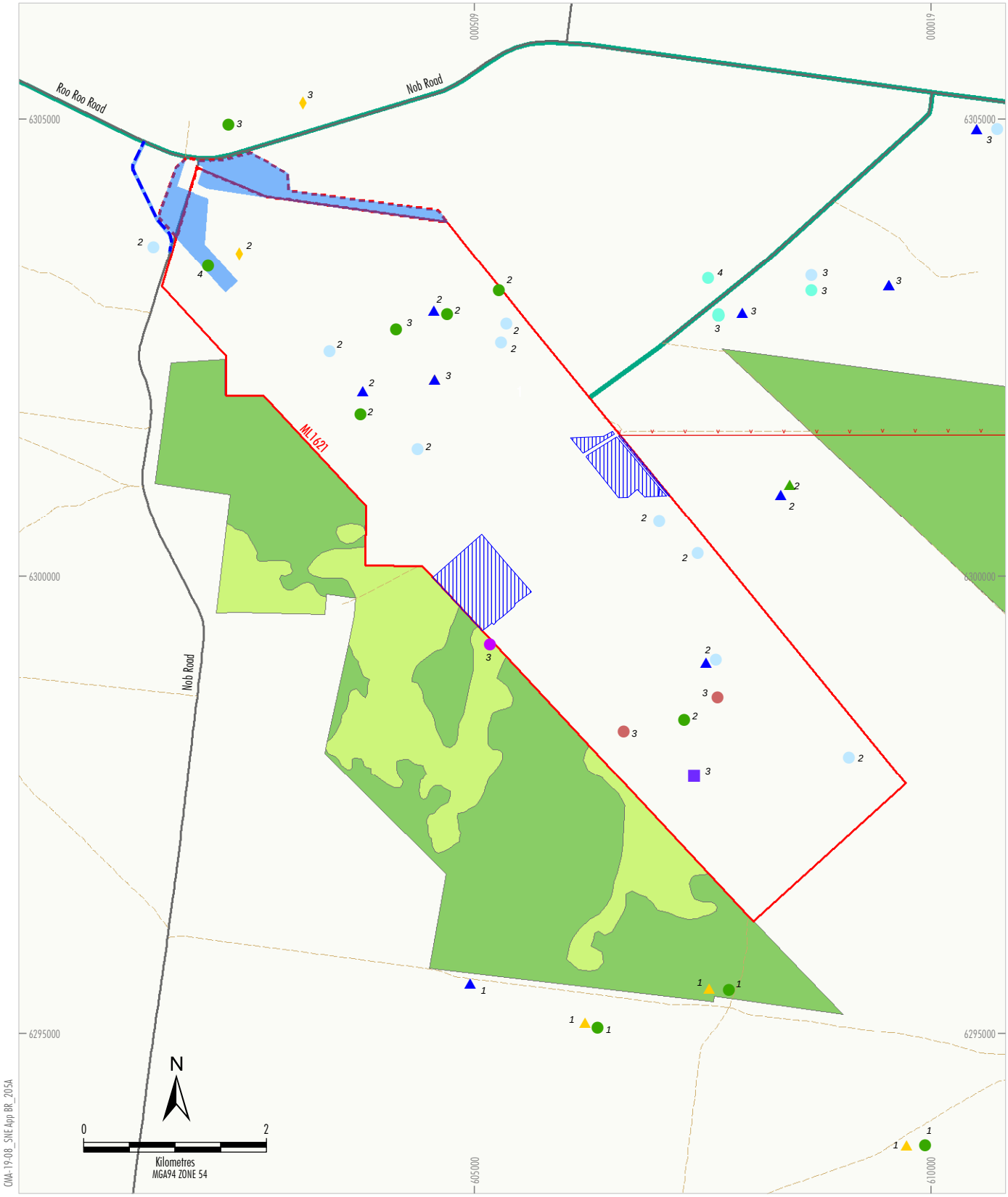
Surrounding land uses (outside of the mining lease) comprise of pastoral leasehold lands that are used predominantly for livestock grazing of native pastures by sheep (*Ovis aries*), cattle (*Bos taurus*) and goats (*Capra hircus)* on Perpetual Western Land Leases. There is an existing Snapper Mine offset located immediately to the southwest of Study Area 2. A small portion of Study Area 1, and all of Study Areas 2 and 3 have had stock excluded for some time, though goats and kangaroos (*Macropus* sp.) still have access for grazing. These areas contain less biological soil crust disturbance than the portions of Study Area 1 that are grazed more intensively by sheep. One-way gates and goat ramps have been installed on the mining lease boundary fence.

2.0 METHODS

A combination of desktop searches, habitat assessment and physical surveys were used to determine the potential presence of threatened flora and fauna species in the study areas.

2.1 DATABASE AND LITERATURE SEARCH

Threatened species previously recorded in the wider locality are summarised in **Appendix A**. Threatened species recorded in the vicinity of Snapper Mine are shown on **Figure 2-1**.



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Electricity Transmission Line
- Realigned Road
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Existing Snapper Mine - Biodiversity Offset Area
- Existing Ginkgo Mine - Southern Mallee Offset Area

Threatened Species

Reptile
- Western Blue-tongued Lizard

Bird
- Hooded Robin (south-eastern form)
- Little Eagle
- Major Mitchell's Cockatoo
- Spotted Harrier
- Varied Sittella

Mammal
- Stripe-faced Dunnart

Bat
- Inland Forest Bat
- Little Pied Bat
- Yellow-bellied Sheathtail-bat

Source: (1) Western Research Institute (2007)
(2) Western Research Institute and Resource Strategies Pty (2007)
(3) DPIE (2019)
(4) Biodiversity Monitoring Services (2019)

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Threatened Species Records

Figure 2-1

2.2 FIELD SURVEYS

VI plots and surveys were undertaken within the study areas for the proposed Northern Extension Modification (**Figure 1-3**). The surveys included targeted flora and fauna surveys and habitat assessment for threatened species listed under the BC Act and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) with potential to occur in Study Area 1. Any threatened species found likely to be present in Study Area 1 were then to be surveyed for in Study Areas 2 and 3. VI plots were also conducted in Study Areas 2 and 3 to allow comparison of biodiversity value with Study Area 1 using BAM metrics.

2.2.1 SURVEY TIMING

The study area was visited between the 1st and 10th October 2019 to conduct targeted flora and fauna surveys and habitat assessments. The study area was surveyed by Andrew Lothian and Nicholas Tong using National Parks and Wildlife Service Scientific Licence No. SL101725 and Department of Primary Industry's Animal Research Authority No. TRIM 16/559.

2.2.2 VEGETATION MAPPING

VI plots were conducted in obviously different areas on the subject land. From this, dominant species in each strata and landscape position were used to identify the most likely Plant Community Type (PCT) match. PCT boundaries on the subject land were then mapped by traversing ecotones over the whole site.

Derived PCTs exist on site. Since the ground strata for all the PCTs identified are essentially the same, sometimes consisting of different dominance ratios of shrub species, derived woodland PCTs (presenting as shrubland with no tree species) were identified by the presence of coarse woody debris on the ground. Shrubland without coarse woody debris was considered to be non-derived. The two bluebush shrubland PCTs were separated based on the dominance of either species (Pearl and Black Bluebush). Interestingly the regional mapping was almost the inverse of what was on the ground, with regionally mapped Pearl Bluebush Shrubland often containing a monoculture of Black Bluebush.

Vegetation zones within PCTs were identified according to disturbance history. Derived woodland was obviously in a different condition state to intact woodland as they lacked any standing tree species. Most of the land in the region would have been historically grazed, so it may not make any sense to stratify the area based on grazing history. However, the portion of Study Area 1 within the mining lease fence has had sheep/stock grazing excluded for a number of years (as evidenced by the presence of a biological soil crust and fewer stock pathways). There are still goats and kangaroos grazing the area, but not to the extent that it is happening outside the mine fence. There were obvious condition state differences associated with roads, tracks and fencelines. The main roads had no vegetation and were excluded from assessment as native vegetation. Minor tracks and tracks down fencelines often exhibited Sclerolaena and weed regrowth.

2.2.3 VEGETATION CONDITION (VEGETATION INTEGRITY PLOTS)

Vegetation integrity was assessed in accordance with Section 5.3 of the BAM (OEH, 2017). After Study Area 1 was stratified into different PCTs, the minimum number of VI plots required for each PCT was calculated using Table 4 of the BAM (OEH, 2017). Due to time constraints, vegetation zones of the same PCT across Study Areas 2 and 3 were pooled and a minimum number of plots surveyed for each PCT only. It is likely that to satisfy the BAM additional plots would be required for the different vegetation condition zones. Instead, VI plots in the *Black Oak – Western Rosewood open woodland* PCT were conducted in patches that were representative of the proportion of each condition state present on the ground; i.e. for the five plots required, one was conducted in a disturbed zone, one in a derived zone, and three in intact areas. If derived state *Black Oak – Western Rosewood open woodland* was approximately 20 percent (%) of that PCT across Study Areas 2 and 3, one VI plot was conducted.

2.2.4 SURVEY TECHNIQUES – THREATENED FLORA

The flora survey methodology follows that specified in the *NSW Guide to Surveying Threatened Plants* (OEH, 2016). A candidate list of threatened plant species was derived by identifying those associated with the PCTs in Study Area 1, and assessing the microhabitat suitability of the site for each species (**Table 2-1**). There were very few threatened plant species records from the surrounding area, with only an unidentified *Swainsona* species being recorded

proximal to site during previous surveys (**Appendix A**). Though the timing of the survey was in accordance with the *Threatened Biodiversity Data Collection*, the area is experiencing prolonged drought. As such, survey conditions were suboptimal. Parallel field traverses were conducted across Study Area 1, searching for threatened plants identified as having potential habitat on site. Ten (10) m traverses were used as three of the four species we were looking for were in the Herb and Forb life form category (see Tables 1 to 3 of OEH, 2016). Due to timing constraints, only approximately 50% of Study Area 1 was traversed. This constituted approximately 50 km of traverses and 12.5 person-hours.

2.2.5 SURVEY TECHNIQUES – THREATENED FAUNA

The fauna survey methodology follows that specified in the draft working guidelines produced by the Department of Environment and Conservation (DEC) (2004). Methodologies for each fauna type are summarised in **Table 2-1** and a summary of the survey effort in each survey period is given in **Table 2-2**.

Table 2-1: Methods Used to Target Threatened Species

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Plants					
Acacia carneorum	Purple-wood Wattle	V	V	Species	Threatened flora survey – 10 m traverses
Atriplex infrequens	A saltbush	V	V	Species	Habitat assessment. Not targeted due to lack of suitable habitat.
Austrostipa nullanulla	A spear-grass	E	-	Species	Habitat assessment. Not targeted due to lack of suitable location.
Brachyscome papillosa	Mossgiel Daisy	V	V	Species	Threatened flora survey – 10 m traverses
Calotis moorei	A burr-daisy	E	E	Species	Threatened flora survey – 10 m traverses

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Cratystylis conocephala	Bluebush Daisy	E	-	Species	Threatened flora survey – 10 m traverses
Kippistia suaedifolia	Fleshy Minuria	E	-	Species	Habitat assessment. Not targeted due to lack of suitable habitat.
Amphibians					
Neobatrachus pictus	Painted Burrowing Frog	E	-	Species	Habitat assessment. Not targeted. Previous consultation from expert suggests original sighting from locality may be erroneous (Biosphere Environmental Consultants, 2007).
Reptiles					
Lucasium stenodactylum	Crowned Gecko	V	-	Species	Pitfall trapping, reptile funnels, spotlighting.
Birds					
Ardeotis australis	Australian Bustard	E	-	Species	Bird survey.
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Bird survey, call playback, spotlighting.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	Species/Ecosystem	Habitat assessment. Not targeted due to lack of suitable location.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Mammals					
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	-	Species	Burrow searches.

Note: Species highlighted are those surveyed by BMS.

1 Conservation status under the BC Act (current as at November 2019). E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at November 2019). E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2019b) (current as at November 2019).

Table 2-2: Total Fauna Survey Effort

Survey technique	Survey effort
Diurnal Bird Survey	30 (30 minutes each)
Call Playback	1
Hand Spotlighting	1 (2 person-hours total)
Diurnal Habitat Traverses	11 (50 km total)
Pitfall and Reptile Funnel Trapping	3 x 30 m lines consisting each of three pits and four reptile funnels, deployed for nine nights

Bird Surveys

DEC (2004) recommend a total of three 60-minute surveys to sample approximately 90% of the species present in an area. Bird surveys were conducted at the three pitfall locations in Study Area 1 each morning over nine days (**Figure 1-3**). Opportunistic records of bird species were made during PCT mapping, VI plot surveys, threatened flora traverses and general driving around site. This incorporated a mix of morning and afternoon survey periods to account for temporal changes in species' use of the study areas. Species targeted during these surveys include Australian Bustard (*Ardeotis australis*), Bush Stone-curlew (*Burhinus grallarius*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Black-breasted Buzzard (*Hamirostra melanosternon*), Little Eagle (*Hieraaetus morphnoides*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Square-tailed Kite (*Lophoictinia isura*). The small amount of coarse woody debris was searched to flush Bush Stone-curlews during PCT mapping and flora traverses of

Study Area 1. Habitat assessment focused on characteristics of the habitat that would be suitable for the species concerned (hollow bearing trees, coarse woody debris, stick nests, waterbodies, etc).

These surveys aimed to pick up any of the threatened species associated with PCTs 58, 143, 153 and 154 in the Murray Darling Depression IBRA region and South Olary Plain subregion during the required survey month (DPIE, 2019b) (**Table 2-3**).

Habitat Assessment

To assess the suitability of the habitat in Study Area 1 for of each of the potential target Species Credit Species, assessment of habitat attributes was conducted (**Table 2-4**). October surveys involved assessment of habitat characteristics that would potentially make the development footprint suitable for threatened species, particularly the species that could not be surveyed for in the time constraints (i.e. *Atriplex infrequens*).

Notes were made on the following attributes:

- Presence of existing raptor nests;
- Presence and size of hollows;
- Presence of feed/prey species;
- Presence of fallen timber; and
- Proximity to dams/watercourse/waterbodies.

Table 2-3: Survey Timing

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Months for Each Species (DPIE, 2019b)											
		BC Act[1]	EPBC Act[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plants																
Acacia carneorum	Purple-wood Wattle	V	V	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Atriplex infrequens	A saltbush*	V	V	Species	Yes	Yes	-	-	-	-	-	-	-	-	Yes	Yes
Brachyscome papillosa	Mossgiel Daisy	V	V	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Calotis moorei	A burr-daisy	E	E	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Cratystylis conocephala	Bluebush Daisy	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kippistia suaedifolia	Fleshy Minuria*	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Amphibians																
Neobatrachus pictus	Painted Burrowing Frog	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reptiles																
Lucasium stenodactylum	Crowned Gecko	V	-	Species	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Birds																
Ardeotis australis	Australian Bustard	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Months for Each Species (DPIE, 2019b)											
		BC Act[1]	EPBC Act[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	-	Yes	Yes	Yes	-	-
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Yes	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Mammals																
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Species highlighted are those surveyed by BMS.

1 Conservation status under the BC Act (current as at November 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at November 2019). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2019b) (current as at November 2019).

* This species was not surveyed for due to the habitat constraint (**Table 2-4**).

Table 2-4: Survey of Threatened Species Habitat Constraints

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (DPIE, 2019b)	Field Assessment of Habitat Constraints
		BC Act[1]	EPBC Act[2]			
Plants						
Acacia carneorum	Purple-wood Wattle	V	V	Species	*None*	N/A
Atriplex infrequens	A saltbush	V	V	Species	*None*	Need fruiting bodies to identify, which only occur Nov-Feb, 4-6 weeks after above average rainfall. Unlikely to be fruiting under current conditions.
Austrostipa nullanulla	A spear-grass	E	-	Species	*Land containing gypseous lunettes and copi rises.* *Geographic constraint: Within 50km of Murray River* (DPIE, 2019c).	No gypseous lunettes or copi rises within Study Area 1. Currently known only in NSW from Nulla Station to the north of Lake Victoria (west of Wentworth). Not within 50 km of Murray River, so excluded due to geographic constraints. Flowers Sep-Dec, 4-6 weeks after significant rain. Unlikely to be flowering under current conditions.
Brachyscome papillosa	Mossgiel Daisy	V	V	Species	*None*	N/A
Calotis moorei	A burr-daisy	E	E	Species	*None*	N/A
Cratystylis conocephala	Bluebush Daisy	E	-	Species	*None*	N/A
Kippistia suaedifolia	Fleshy Minuria	E	-	Species	*Saline lakes, depressions and claypans with Gypseous or calcareous soils, gypseous dunes, or within 50 m.*	No waterbodies, dunes, saline lakes, depressions or claypans within Study Area 1. Excluded based on habitat constraints.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (DPIE, 2019b)	Field Assessment of Habitat Constraints
		BC Act[1]	EPBC Act[2]			
Amphibians						
Neobatrachus pictus	Painted Burrowing Frog	E	-	Species	*None*	N/A Previous expert advice has suggested the original ID may be erroneous so species unlikely to inhabit location.
Reptiles						
Lucasium stenodactylum	Crowned Gecko	V	-	Species	*None*	N/A
Birds						
Ardeotis australis	Australian Bustard	E	-	Species	*None*	N/A
Burhinus grallarius	Bush Stone-curlew	E	-	Species	*Fallen/standing dead timber including logs.*	Survey for fallen/standing dead timber, including logs.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	*Breeding constraint: Other (Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines).*	Survey for living or dead mature trees that could provide breeding habitat within 1 km of large waterbodies and major watercourses.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	*Breeding constraint: Waterbodies (Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts).*	Survey for dead/dying mature trees that could provide breeding habitat within 40 m of riparian vegetation associated with waterbodies or watercourses.
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	*Breeding constraint: Other (Nest trees – live [occasionally dead] large old trees within vegetation).*	Survey for live and dead nest trees and large trees with vegetation that could provide breeding habitat.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	*Breeding constraint: Hollow bearing trees (Living or dead tree with hollows greater than 10 cm diameter).*	Survey for trees with hollows greater than 10 cm diameter, that could provide breeding habitat.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (DPIE, 2019b)	Field Assessment of Habitat Constraints
		BC Act[1]	EPBC Act[2]			
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	*Breeding constraint: Other (Nest trees).*	Survey for nest trees that could provide breeding habitat.
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	Species/Ecosystem	*Breeding constraint: Hollow bearing trees (Living or dead E. camaldulensis with hollows greater than 5 cm diameter, greater than 5 m above the ground OR trees with diameter at breast height [DBH] of greater than 40 cm, within 1 km of watercourses or billabongs. Trees can be isolated but within 20 km of mallee).* *Geographic constraint: Within 20 km of Murray and Murrumbidgee Rivers, within 30 km of Murray River.*	Survey for *E. camaldulensis* trees with hollows greater than 5 cm diameter, greater than 5 m above ground, OR trees with DBH > 40 cm, within 1 km of watercourses/waterbodies that could provide breeding habitat. Not within 30 km of Murray River, so excluded due to geographic constraints.
Mammals						
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	-	Species	*None*	*Search for presence of burrow systems, adding a 2 km buffer.*

Note: Species highlighted are those surveyed by BMS.

1 Conservation status under the BC Act (current as at November 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at November 2019). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2019b) (current as at November 2019).

Pitfall Trapping/Reptile Funnels

Reptiles were surveyed for by pitfall line over nine nights in Study Area 1. Trap locations were stratified by PCT. One line was erected in the *Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland* (PCT 143), one in the *Black Bluebush low open shrubland* containing a patch of Black Oak (PCT 153) and one in *Pearl Bluebush low open shrubland* (PCT 154) (**Figure 1-3**). Each trapline consisted of 30 m of mesh drift fence, with three pitfalls (150 mm diameter pipe, 60 cm deep) and four reptile funnels placed at even spaces along the fence. Pit lines were checked each morning, or twice daily on the two hotter days in the middle of the trapping period. Captures were identified to species.

Call Playback

Nocturnal birds were surveyed for by call playback over one night in Study Area 1. Calls of Bush Stone-curlew were played from a megaphone in the only part of Study Area 1 containing trees and coarse woody debris (PCT 58). An initial listening period of 10 minutes was undertaken, followed by a quick spotlight of the immediate area. The call was played for a period of 30 seconds followed by a 5 minute listen period. This was repeated four times. Surveys were conducted within 2 hours of sunset.

Spotlighting

Nocturnal birds and reptiles were surveyed for by spotlighting in Study Area 1, after the completion of call playbacks. This involved traversing parts of Study Area 1 containing coarse woody debris (PCT 58) with a hand-held 30-Watt spotlight, searching all trees, shrubs and coarse woody debris within the study area. One one-hour, two-person spotlight survey was conducted over a single warm night. Each walked transect covered approximately 1 km.

Due to the scarcity of trees or potential habitat features in Study Area 1, a single night spotlighting was considered sufficient. Furthermore, areas containing habitat constraint for Bush Stone-curlew were also searched by day during threatened flora searches.

Searches

Whilst conducting habitat assessment, PCT mapping, threatened flora searches, and VI plots in Study Areas 1 to 3, additional signs of animal use were noted. This involved searches for scats, burrows, water bodies, raptor nests/perches and potential hollows.

3.0 WEATHER DURING THE FIELD SURVEY

Data from weather station at Pooncarie Mail Agency, NSW (Australian Bureau of Meteorology 2019) is given in **Table 3-1**.

Table 3-1: Weather Records from Pooncarie During 2019 Surveys

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
28/09/2019	4.8	22.8	0
29/09/2019	5.6	-	0
30/09/2019	6.1	23.2	0
01/10/2019	4.2	28.0	0
02/10/2019	6.8	33.0	0
03/10/2019	13.4	32.0	0
04/10/2019	11.0	32.7	0
05/10/2019	17.5	39.2	0
06/10/2019	24.2	33.5	0
07/10/2019	12.7	23.8	0
08/10/2019	10.7	20.0	0
09/10/2019	6.0	22.8	0
10/10/2019	6.8	23.4	0
11/10/2019	6.2	24.6	0

Maximum temperatures were almost one degree Celsius (°C) above average for October in Pooncarie, but minimum temperatures were approximately equal to the long-term average.

Rainfall this October was well below the long-term average of 24.7 mm, with only 0.2 mm of rain falling. A similar story was seen in September with only a quarter of the long-term average rainfall.

Moon phase during the October surveys was waxing from new moon at the beginning of the period to full moon at the end. Conditions during spotlighting and call playback were warm with no wind.

4.0 RESULTS – COMPARISON OF DISTURBANCE AREAS (STUDY AREA 1) AND RELINQUISHMENT AREAS (STUDY AREAS 2 AND 3)

4.1 VEGETATION

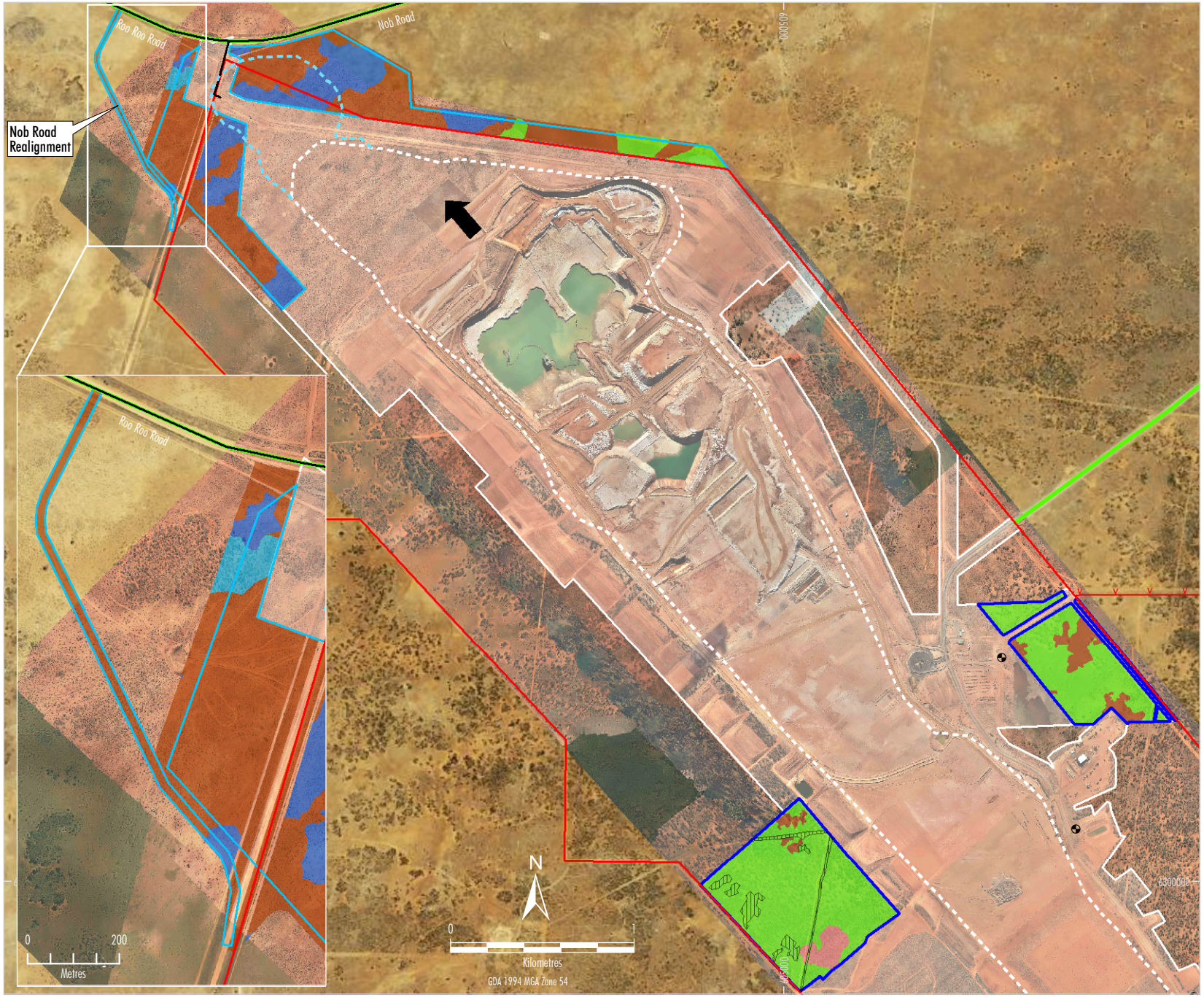
Previous vegetation mapping (FloraSearch, 2007) was not done to PCT level and shows Study Area 1 mapped as *Austrostipa Grassland*. Study Areas 2 and 3 were previously mapped as mixes of *Black Oak – Rosewood – Wilga Woodland* and *Bluebush Shrubland* (FloraSearch, 2007). Historical mapping of the vegetation communities was likely conducted over a much larger geographic area, at a coarser scale, with superseded vegetation community descriptions. The BC Act now requires description of vegetation by PCTs. Designation of PCTs were conducted by traverses of all three study areas, using plant species identifications made during VI plots. These are mapped in **Figure 4-1**.

Study Area 1 consists primarily of native shrub vegetation. A number of exotic (and one high threat exotic) forb species were also present in the ground layer. The eastern portion of the study area was subject to high density grazing with sheep in the paddock at the time of survey. The western portion of Study Area 1, west of Nob Road, was also subject to current grazing, though not quite to the same extent. The portion of the western study area to the east of Nob Road looks to have had grazing excluded for some time as it is fenced off for mining activity. There are still small numbers of goats and kangaroos grazing all three sections. Sections of Study Area 1 mapped as woodland were all present as derived shrubland, with extensive remnant coarse woody debris delineating the natural from derived shrubland.

Study Area 1 contained the following four PCTs:

- PCT 58: *Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion*. Present as isolated clumps of low open Black Oak woodland or derived shrubland. Sparse shrub and ground layer. Occuring on undulating sandplains with red-brown sandy soil. Low tree cover is due to historical clearing or dieback associated with sheep grazing.

- PCT 143: *Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes*. Present as tall open shrubland dominated by Narrow-leaved Hopbush. Ground layer of sclerolaena and bluebush. Occuring on low red-brown sandy rise with deeper soil. Due to the lack of coarse woody debris it is considered a natural community, even though the paddock is subject to grazing.
- PCT 153: *Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones*. Present as open chenopod shrubland less than 1 m high, dominated by Black Bluebush. Occasional scatterings of young Black Oak or Western Rosewood. Occuring on shallow red-brown soil of higher clay content. Often integrading with PCT 154. PCT was defined by an obvious dominance of Black Bluebush over Pearl Bluebush.
- PCT 154: *Pearl Bluebush low open shrubland of the arid and semi-arid plains*. Present as open chenopod shrubland less than 1 m high, dominated by Pearl Bluebush. Occuring on shallow red-brown soil of higher clay content. Often integrading with PCT 153. PCT was defined by an obvious dominance of Pearl Bluebush over Black Bluebush.



LEGEND

Existing/Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricty Transmission Line

Modified Project

- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent

PCT Vegetation Communities

- 58 Black Oak - Western Rosewood Open Woodland
- 143 Narrow-leaved Hopbush - Scrub Turpentine - Senna Shrubland
- 153 Black Bluebush Low Open Shrubland
- 154 Pearl Bluebush Low Open Shrubland
- 221 Black Oak - Pearl Bluebush Open Woodland
- Previously Disturbed

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Plant Community Types Mapped by BMS

Figure 4-1

The area of each PCT and the number of VI plots conducted in each PCT are presented in **Table 4-1**. VI data is presented in **Table 4-2**.

Table 4-1: PCT Summary for Proposed Surface Disturbance Area – Study Area 1

Vegetation Zone	PCT ID	PCT Name	Percent Cleared (DPIE, 2019)	Area (ha)	Number of Plots Completed
Aeolian Chenopod Shrublands					
PCT 153	153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	40% (+/- 50%)	52.7	5
PCT 154	154	Pearl Bluebush low open shrubland of the arid and semi-arid plains	43% (+/- 60%)	28.3	4
Sand Plain Mulga Shrublands					
PCT 143	143	Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	30%	0.7	1
Semi-arid Sand Plain Woodlands					
PCT 58	58	Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	50% (+/- 80%)	5.7	3
			Total	**87.4**	**13**

Table 4-2: Vegetation Integrity Scores – Study Area 1

Vegetation Zone	PCT ID	Patch Size	Composition Condition Score*	Structure Condition Score*	Function Condition Score*	Trees with Hollows	Vegetation Integrity Score*
PCT 153	153	>100 ha	88.7	4.2	-	No	19.2
PCT 154	154	>100 ha	89.2	8.5	-	No	27.6
PCT 143	143	>100 ha	82.2	84.9	-	No	83.5
PCT 58	58	>100 ha	69.2	10.8	26.7	Yes	27.5

* Determined by the BAM Calculator.

Study Areas 2 and 3 consist primarily of native woodland vegetation. A number of exotic (and one high threat exotic) forb species were also present in the ground layer. Both areas have had grazing excluded by the mine fence for a long time, though Study Area 3 is closer to the mine workings, infrastructure and offices, and as such is more disturbed. There are still small numbers of goats and kangaroos grazing both areas. Other sections of derived shrubland exist within Study Area 2, and are clearly visible from the aerial photo. Though treeless, they contain extensive amounts of coarse woody debris on ground, and as such are considered to have been areas of *Black Oak – Western Rosewood open woodland* that has undergone dieback or clearing for grazing. A small portion in the north of Study Area 2 contains chenopod shrubland which lacks any evidence of coarse woody debris. The southern section of Study Area 2 contains an increased density of Pearl Bluebush, which is mostly absent from the rest of the study area. This was considered to be a separate PCT, though one of our plots may have been located close to an ecotone, or contained a patch of lower Pearl Bluebush dominance compared to Black Bluebush.

Sections of Study Area 3 mapped as woodland were mostly present as derived shrubland, with extensive remnant coarse woody debris delineating the natural from derived shrubland. There were some smaller patches of natural shrubland and intact *Black Oak – Western Rosewood open woodland*.

Study Areas 2 and 3 contained the following three PCTs:

- PCT 58: *Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion*. Present as isolated clumps of low open Black Oak woodland or derived shrubland. Sparse shrub and ground layer. Occuring on undulating sandplains with red-brown sandy soil. Low tree cover is due to historical clearing or dieback associated with sheep grazing.
- PCT 153: *Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones*. Present as open chenopod shrubland less than 1 m high, dominated by Black Bluebush. Occasional scatterings of young Black Oak or Western Rosewood. Occuring on shallow red-brown soil of higher clay content. PCT was defined by an obvious dominance of Black Bluebush over Pearl Bluebush.

- PCT 221: *Black Oak – Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones*. Present as open woodland 5-10 m high, dominated by Black Oak upper stratum and Pearl Bluebush shrub layer. Occuring on red-brown sandy loam soil. PCT was defined by an obvious dominance of Pearl Bluebush over Black Bluebush in the understorey, which was otherwise absent from most of Study Area 2. There was evidence of timber collection from this PCT, perhaps due to the short, straight, fence-post sized trees (see **Plate 4-1**).



Plate 4-1: Timber Removal from PCT 221, Study Area 2

The area of each PCT and the number of VI plots conducted in each PCT are presented in **Table 4-3**. VI data is presented in **Table 4-4**.

Table 4-3: PCT Summary for Relinquishment Area – Study Areas 2 and 3

Vegetation Zone	PCT ID	PCT Name	Percent Cleared (DPIE, 2019)	Area (ha)	Number of Plots Completed
Aeolian Chenopod Shrublands					
PCT 153	153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	40% (+/- 50%)	7.7	3
Semi-arid Sand Plain Woodlands					
PCT 58	58	Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	50% (+/- 80%)	79.5	5
PCT 221	221	Black Oak – Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones	30% (+/- 80%)	3.5	2
			Total	**90.7**	**10**

Table 4-4: Vegetation Integrity Scores – Study Areas 2 and 3

Vegetation Zone	PCT ID	Patch Size	Composition Condition Score*	Structure Condition Score*	Function Condition Score*	Trees with Hollows	Vegetation Integrity Score*
PCT 153	153	>100 ha	98.4	2.5	-	Yes	15.6
PCT 58	58	>100 ha	75.8	8.5	30.6	Yes	27.0
PCT 221	221	>100 ha	73.4	17.2	30.4	Yes	33.7

* Determined by the BAM Calculator.

4.2 THREATENED FLORA SPECIES

A total of 46.1 km of threatened flora traverses were walked over 10 days in Study Area 1, plus additional opportunistic searches conducted whilst mapping PCT boundaries in all three study areas. A total of 23 VI plots were also conducted across five PCTs. No threatened plant species were found via any survey method. No records for threatened plants show up in BioNet (DPIE, 2019a) or Atlas of Living Australia (ALA) (2019) within 10 km of the site. Only one possible threatened species has ever been found during surveys for the Tronox mine complex; one unidentified *Swainsona* species (FloraSearch, 2009).

Ten metre spaced traverses were used to look for the following four shrub/forb species in open vegetation:

- Purple-wood Wattle (*Acacia carneorum*) – No Acacia were found in Study Area 1. Two species of Acacia were found in Study Area 2 (*A. brachystachya* and *A. colletioides*), which were not the target species. One species occurred as a 2-4 m tall prickly shrub with long, rigid needle-like leaves.
- Mossgiel Daisy (*Brachyscome papillosa*) – Due to the extended drought conditions, very few forbs were in flower or contained enough material to identify. We did identify one Brachyscome species (*B. lineariloba*) from Study Area 1, and another from walking around Study Area 2 (*B. ciliaris*), but neither were the target species. It is likely that the site does not present the required microhabitat for the species, as none of the known associated species/communities were present (except a small number of Bladder Saltbush growing on a roadside ditch in Study Area 1).
- A burr-daisy (*Calotis moorei*) – Due to the extended drought conditions, very few forbs were in flower or contained enough material to identify. Extensive areas of chenopod shrublands are present in Study Area 1, but in years of survey work in the local area, the species has not been found.
- Bluebush Daisy (*Cratystylis conocephala*) – Though the location is indicative, and there were large amounts of similar looking Pearl Bluebush in Study Area 1, there was a paucity of intact *Black Oak – Western Rosewood open woodland*. That present was scattered and heavily grazed or derived. Study Area 1 could be considered too degraded for this species to be present.

Two other threatened plant species were not looked for due to habitat constraints. There were no saline lakes or depressions in Study Area 1 for Fleshy Minuria (*Kippistia suaedifolia*) to occur around. Though a small number of Atriplex were found in Study Area 1, none contained flowers, fruit or seed. As such, identifications were difficult. A saltbush (*Atriplex infrequens*) is associated with broad drainage tracts, clay flats and irregularly inundated habitats, none of which were present in Study Area 1. It also prefers relatively undisturbed/ungrazed locations which is not a characteristic of Study Area 1.

Though only approximately half of Study Area 1 was officially traversed, I believe we saw enough of it to rule out the likelihood of any of the fore mentioned species being present. As no threatened flora species were found in Study Area 1, no searches were conducted in Study Areas 2 and 3. **Appendix D** lists all flora species identified in VI plots or whilst PCT mapping and conducting flora traverses.

4.3 THREATENED FAUNA SPECIES

Study Area 1 was generally depauperate of habitat features that would be considered important to the target threatened fauna species. There was some standing and fallen dead timber, but only in the 5.7 ha of derived state *Black Oak – Western Rosewood open woodland*. No hollows existed for anything larger than microbats or reptiles.

There were no water points or watercourses in Study Area 1, though a dry farm dam existed immediately to the west of the area. A small dam containing some water was located approximately 375 m to the southeast of the western portion of the study area. The lack of waterbodies renders the site unsuitable for occupation by a number of the bird and frog species.

No large raptor nests were observed in treed areas of Study Area 1.
Study Area 1 is located on mostly grazed shrubland. In general, the habitats of the study area were low quality and lacking in sufficient features for most of the target threatened species. By contrast, Study Area 2 contains substantial amounts of standing and fallen dead timber, abundant nesting opportunities for raptorial birds, and larger hollow bearing trees. In recent years it has been subject to much lower grazing pressure, and is dominated by a structurally

complex woodland mosaic. Study Area 3 contains woodland habitat without stock grazing, but lacks the large Black Oak trees seen in Study Area 2. It is also much closer to the current mine workings.

Appendix D lists all fauna species observed in the study areas during the survey period. Threatened species records are highlighted. **Table 4-5** presents survey results for the targeted threatened fauna species.

Table 4-5: Fauna Species Survey Results

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
Amphibians					
Neobatrachus pictus	Painted Burrowing Frog	E	-	Species	The species is unlikely to utilise the Study Area 1 due to lack of habitat and likelihood that the historical record of the species is erroneous (see explanation below).
Reptiles					
Lucasium stenodactylum	Crowned Gecko	V	-	Species	Species not detected in Study Area 1 with spotlighting or three lines of pitfalls and reptile funnels deployed for nine nights (189 trap nights).
Birds					
Ardeotis australis	Australian Bustard	E	-	Species	Not recorded in Study Area 1, despite 10 days of targeted surveys.
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Not recorded in Study Area 1, despite 10 days of targeted surveys, flushing fallen timber during flora traverses, call playback and spotlighting.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Not recorded in Study Area 1, despite 10 days of targeted surveys. Habitat constraints (potential nest trees, large waterbodies within 1 km) not present (**Table 2-4**).
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	Not recorded in Study Area 1, despite 10 days of targeted surveys. Habitat constraints (potential nest trees, watercourses or riparian vegetation within 40 m) not present (**Table 2-4**).
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Not recorded in Study Area 1, despite 10 days of targeted surveys. One seen foraging within 1 km of Study Area 3. Habitat constraints (potential nest trees) not present (**Table 2-4**).
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	One feather found in Study Area 1 indicating foraging habitat. Breeding habitat constraints (hollow bearing trees with hollows greater than 10 cm) not present (**Table 2-4**).

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Not recorded in Study Area 1, despite 10 days of targeted surveys. Habitat constraints (potential nest trees) not present (**Table 2-4**).
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	Species/Ecosystem	Not recorded in Study Area 1, despite 10 days of targeted surveys. Geographic and habitat constraints (within 30 km of Murray River and *Eucalyptus camaldulensis*) not present (**Table 2-4**).
Mammals					
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	-	Species	No burrows recorded in Study Area 1, despite targeted surveys.

1 Conservation status under the BC Act (current as at November 2019). E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at November 2019). E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2019b) (current as at November 2019).

4.3.1 THREATENED FROG

The Painted Burrowing Frog (*Neobatrachus pictus*) is classified as a 'Species Credit Species' in the *Threatened Biodiversity Data Collection* (DPIE, 2019b). The specified survey period for this species is November and December when adult males can be heard calling to attract a mate (DPIE, 2019b and 2019c). This species is detectable after heavy rainfall (DECC, 2009). There was neither groundwater in the study area, nor any wet weather during our stay making amphibian searches ineffective. As such the species was not surveyed for.

The BioNet Atlas of NSW Wildlife (DPIE, 2019a) still shows records from 2000 for the Painted Burrowing Frog in the Gingko Mine Mining Lease (made by Martin Denny from Mount King Ecological Surveys, the former name of BMS). The records have been revisited and are highly likely to be erroneous. More recent taxonomic and genetic studies have been conducted by Dr Arthur White (Biosphere Environmental Consultants, 2007) and Associate Professor Michael Mahony (The University of Newcastle). The studies concluded that the *Neobatrachus* frogs in the locality were the closely related Common Spadefoot Toad (*Neobatrachus sudelli*). On the strength of these taxonomic and genetic studies from the locality, it is unlikely that the Painted Burrowing Frog is relevant to the study area.

4.3.2 THREATENED REPTILE

The Crowned Gecko (*Lucasium stenodactylum*) is classified as a 'Species Credit Species' in the *Threatened Biodiversity Data Collection* (DPIE, 2019b). The specified survey period is October through March when the species can be readily trapped via pitfall and reptile funnels (DPIE, 2019b). Like most reptiles, they travel deeper underground to avoid the cooler surface temperatures in winter.

There are only two records in BioNet (DPIE, 2019a), and one record from previous surveys in the vicinity for this species (Cenwest 2009). Three lines of pitfalls and reptile funnels were deployed in three different habitats in Study Area 1 over nine nights (189 trap nights) (**Figure 1-3**). Two person-hours were spent spotlight searching areas of coarse woody debris. Nine other reptile species (including one other *Lucasium* species) were captured and/or spotlighted in good abundance, but no Crowned Gecko were found. The Beaded

Gecko (*Lucasium damaeum*) is differentiated from the Crowned Gecko by having no subdigital plates (as opposed to two), spinose scales under digits, and a dorsal stripe splitting at the nape (as opposed to remaining fused over the crown). The Ranges Stone Gecko (*Diplodactylus furcosus*) is another common species in the area, which was absent from many of the NSW field guides until recent editions. This species is differentiated from the Crowned Gecko by being brown-grey in colour (as opposed to red-brown), a short thick tail (as opposed to a long slender tail), and 5-6 cloacal spurs (as opposed to 2-5). The Crowned Gecko is considered unlikely to occur in the mostly grazed shrubland present in Study Area 1.

4.3.3 THREATENED BIRDS

The Australian Bustard, Bush Stone-curlew, White-bellied Sea-Eagle, Black-breasted Buzzard, Little Eagle, Major Mitchell's Cockatoo and Square-tailed Kite were surveyed for over 10 days in October, within the required survey period for all species (DPIE, 2019b). Aside from one Major Mitchell's Cockatoo feather found in Study Area 1, and one Little Eagle seen near Study Area 3, no evidence of breeding habitat was observed in any of the three study areas.

One feather for the Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) was found in Study Area 1, indicating that the study area may be used by the species on occasion. The area however, is unlikely to contain breeding habitat, as none of the trees in Study Area 1 are large enough or old enough to contain 10 cm diameter hollows. The species usually nests in mature mallee trees, and there were no mallee/eucalypt trees over any of the three study areas surveyed.

The Little Eagle (*Hieraaetus morphnoides*) must be surveyed for between August and October when the species occupy large stick nests in tall trees among remnant patches of woodland (DPIE, 2019b and 2019c; Marchant and Higgins, 1993). Surveys were conducted for the species over 10 days, and only one individual was seen approximately 1.8 km north-northeast of Study Area 3. As with other target raptor species, none of the three study areas contain suitable breeding habitat by way of nest trees.

The Square-tailed Kite (*Lophoictinia isura*) is a spring-summer breeding migrant to the south-eastern parts of Australia, nesting in trees along or near watercourses from July to February (DPIE, 2019c; Marchant and Higgins, 1993). As such, the survey effort and period for this species should be considered satisfactory. The presence of nest trees was specifically targeted as it is a recognised habitat constraint (DPIE, 2019b). No potential Square-tailed Kite nests were found during the surveys.

The White-bellied Sea-Eagle (*Haliaeetus leucogaster*) must be surveyed for between July and December when the species occupy large stick nests in emergent eucalypts proximal to water bodies (DPIE, 2019b and 2019c; Marchant and Higgins, 1993). No large stick nests, water bodies or Sea-Eagles were observed in the study area. None of the three study areas contain breeding habitat for the White-bellied Sea-Eagle.

The Black-breasted Buzzard (*Hamirostra melanosternon*) breeds in riparian habitat associated with timbered watercourses in the semi-arid areas of the state (DPIE, 2019c; Marchant and Higgins, 1993). As there are no waterbodies or watercourses on site, Study Area 1 does not contain breeding habitat for the species.

The Australian Bustard (*Ardeotis australis*) was surveyed for in October by diurnal census and was not located. This species can be surveyed for year-round (DPIE, 2019b). BioNet (DPIE, 2019a) and previous surveys for Tronox have not located the species in the local area. As such, Study Area 1 is not likely to contain habitat for the species.

The Bush Stone-curlew (*Burhinus grallarius*) was surveyed for in October by spotlighting, call playback and diurnal flushing of habitat containing fallen logs. This species can be surveyed for year-round (DPIE, 2019b). The species was not sighted or heard during the 10-day survey period, and can be considered absent from the Study Area 1. Fox (*Vulpes vulpes*) scats were observed in the study area, reducing the likelihood of the species presence considerably.

Study Area 1 should be considered foraging (Ecosystem) habitat for all birds but the White-bellied Sea-Eagle, Australian Bustard and Bush Stone-curlew.

4.3.4 THREATENED MAMMAL

The Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*) was surveyed for in conjunction with threatened flora traverses and PCT mapping of Study Area 1. This species can be surveyed for year-round (DPIE, 2019b). No wombat burrows were found during almost 50 km of site traverses at 10 m spacings, only rabbit (*Oryctolagus cuniculus*) warrens. These contained entry holes that would be too small for wombat occupation. The species is not known from the location, and no evidence has been found during extensive surveys of the Snapper, Ginkgo and Crayfish areas over the last 19 years. As such, Study Area 1 does not contain habitat for the Southern Hairy-nosed Wombat.

5.0 POTENTIAL IMPACTS

5.1 VEGETATION CLEARANCE

The total Northern Extension Modification area would be approximately 87.4 ha. The Northern Extension Modification has been designed to avoid or minimise impacts on native vegetation by predominantly locating the supporting infrastructure in derived shrubland subject to high density grazing.

5.2 WEED INCURSION

There would be no change to the management of weeds and introduced flora at the Snapper Mine as a result of the Northern Extension Modification, and therefore there is unlikely to be an increase in potential impacts from introduced flora.

5.3 FERAL ANIMALS

There would be no change to the management of feral animals at the Snapper Mine as a result of the Northern Extension Modification, and therefore there is unlikely to be an increase in potential impacts from feral animals that are already likely to use the habitat in the area.

5.4 ARTIFICIAL LIGHTING

There would be no change to the use of artificial lighting at the Snapper Mine as a result of the Northern Extension Modification and therefore there is unlikely to be an increase in potential impacts from artificial lighting.

5.5 NOISE

The Northern Extension Modification is not likely to materially change the noise emissions from the Snapper Mine as the Northern Extension Modification would not change the mining method, fleet or production rate.

5.6 DUST

The Northern Extension Modification is not likely to materially change the dust emissions from the Snapper Mine as the Northern Extension Modification would not change the mining method, fleet or production rate. The Northern Extension Modification would move disturbance boundaries closer to vegetation not previously subjected to dust from the mine. Such potential impacts would be limited and any dust effects would be mitigated by regular watering of roads and soil stockpiles.

5.7 BUSHFIRE RISK

There would be no change to the management of bushfire risk at the Snapper Mine as a result of the Northern Extension Modification.

5.8 RELINQUISHMENT AREA

In addition to the above, Tronox would relinquish (not clear) approximately 90.7 ha of *Black Bluebush low open shrubland* (PCT 153), *Black Oak – Western Rosewood open woodland* (PCT 58) and *Black Oak – Pearl Bluebush open woodland* (PCT 221) within the Project Approval Boundary (**Table 5-1**). This would result in a net positive outcome for biodiversity values in the local area.

Table 5-1: Comparison of Vegetation Impacts verse Relinquishment

Vegetation to be Cleared in the Northern Extension Modification Area	Vegetation Retained in the Relinquishment Area	Net Outcome
Approximately 87.4 ha of *Black Bluebush low open shrubland* (PCT 153), *Pearl Bluebush low open shrubland* (PCT 154), *Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland* (PCT 143) and *Black Oak – Western Rosewood open woodland* (PCT 58)	Approximately 90.7 ha of *Black Bluebush low open shrubland* (PCT 153), *Black Oak – Western Rosewood open woodland* (PCT 58) and *Black Oak – Pearl Bluebush open woodland* (PCT 221)	Retention of approximately 90.7 ha of *Black Bluebush low open shrubland* (PCT 153), *Black Oak – Western Rosewood open woodland* (PCT 58) and *Black Oak – Pearl Bluebush open woodland* (PCT 221) that would no longer be cleared within the Project Approval Boundary, resulting in a net reduction in disturbance footprint of 3.3 ha

6.0 IMPACT ASSESSMENT – BC ACT

Table 6-1 provides an assessment of the impacts of the Northern Extension Modification on biodiversity values.

Table 6-1: Impacts of the Northern Extension Modification on Biodiversity Values

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Vegetation abundance – 1.4(b) BC Regulation	*Occurrence and abundance of vegetation at a particular site*	✓	**Figure 4-1** shows the PCTs present in the Study Areas. The Northern Extension Modification has been designed to avoid or minimise impacts on native vegetation by predominantly locating the supporting infrastructure in derived shrubland subject to high density grazing. The Northern Extension Modification would relinquish approved development in Study Areas 2 and 3 (slightly larger in size than Study Area 1) with more intact vegetation for proposed development on mostly derived and grazed shrubland in Study Area 1. **Accordingly, the Northern Extension Modification would not result in an increased impact on vegetation abundance.**
Vegetation integrity 1.5(2)(a) BC Act	*Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state*	✓	The VI scores calculated using the BAM Calculator indicates that the majority of the native vegetation to be cleared is generally low (**Table 4-2**). The zone with the highest VI score (83.5) would be the least impacted (0.7 ha), while the majority of surface development (52.7 ha) would occur in the zone with the lowest VI score (19.2) (**Tables 4-1 and 4-2**). When native vegetation is removed the VI score becomes zero. However, vegetation zones within the areas to be relinquished would no longer become zero and instead would remain at their current VI scores (**Table 4-4**). **Accordingly, the Northern Extension Modification would not result in an increased impact on vegetation integrity.**

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Habitat suitability 1.5(2)(b) BC Act	*Degree to which the habitat needs of threatened species are present at a particular site*	✓	The PCTs present in the Northern Extension Modification area provide marginal habitat for threatened fauna (e.g. some birds may forage on grass seeds from time to time). The native vegetation that would be cleared has been subject to past disturbances (such as vegetation clearance and grazing), which makes the habitat generally poor quality. The derived shrubland of PCT 58, grazed shrubland of PCT 143, intact and grazed shrublands of PCT 153 and intact and grazed shrublands of PCT 154 are not TECs and no threatened flora species have been recorded within Study Area 1 (Section 3.2). The Northern Extension Modification has been designed to avoid impacts on habitat by: • predominantly locating the supporting infrastructure in derived shrubland subject to high density grazing and lacking in many habitat features such as waterbodies and hollow-bearing trees; and • relinquishing approved clearing and surface development in Study Areas 2 and 3 (slightly larger in size than Study Area 1) in exchange for surface development in Study Area 1. The Northern Extension Modification would not impact rocks, karst, caves, crevices, cliffs, human made structures or non-native vegetation known to be associated with any threatened species. The Northern Extension Modification is unlikely to reduce the viability of any adjacent habitat due to noise, dust or light spill during construction or operation due to the following: • there would be no change the mining method, fleet or production rate; • any dust effects would be mitigated by regular watering of roads and soil stockpiles; and • there would be no change to the use of artificial lighting. In addition, measures would be implemented to minimise bushfire risk associated with the Northern Extension Modification. **Accordingly, the Northern Extension Modification would not result in an increased impact on habitat suitability.**

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Threatened species abundance 1.4(a) BC Regulation	*Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site*	✓	The Northern Extension Modification is unlikely to impact the occurrence and abundance of threatened species, or their habitat, in the locality. The Northern Extension Modification has been designed to avoid potential habitat as far as practicable in consideration of other environmental and practical constraints. Study Area 1 was generally depauperate of habitat features that would be considered important to the target threatened fauna species and as such the majority of species are considered unlikely to occur. Additionally, vegetation clearance measures would be implemented to minimise potential impacts on biodiversity, including pre-clearing fauna inspections. **Accordingly, the Northern Extension Modification would not result in an increased impact on threatened species abundance.**
Habitat connectivity 1.4(c) BC Regulation	*Degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range*	✓	The majority of clearance for the Northern Extension Modification would be of derived and grazed shrubland. Given the previous amount of disturbance through clearing and grazing activities and the lack of important habitat features (hollow-bearing trees, water bodies, native grassland, etc), habitat is generally of low quality in Study Area 1. Additionally, approved surface development areas (Study Areas 2 and 3) with better quality habitat would be relinquished for the proposed surface development in Study Area 1. Any existing connectivity in Study Areas 2 and 3 (slightly larger in size than Study Area 1) would remain. Study Area 3 adjoins existing Snapper Mine and Ginkgo Mineral Sands Mine Offset Areas. **Accordingly, the Northern Extension Modification would not result in an increased impact on habitat connectivity.**

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
Threatened species movement 1.4(d) BC Regulation	*Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle*	NA	The Northern Extension Modification is not likely to impact a well-defined movement pattern for any particular species, given the majority of clearance would be of derived and grazed shrubland. **Accordingly, the Northern Extension Modification would not result in an increased impact on threatened species movement.**
Flight path integrity 1.4(e) BC Regulation	*Degree to which the flight paths of protected animals over a particular site are free from interference*	NA	The Northern Extension Modification would not interfere with any flight paths of protected animals, given the majority of clearance would be of derived and grazed shrubland. **Accordingly, the Northern Extension Modification would not result in an increased impact on flight path integrity.**
Water sustainability 1.4(f) BC Regulation	*Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site*	NA	The Northern Extension Modification would not impact water quality, water bodies or hydrological processes that are known to sustain a threatened species or TEC. Study Area 1 does not contain any watercourses or artificial watering points. **Accordingly, the Northern Extension Modification would not result in an increased impact on hydrological processes that are known to sustain a threatened species or TEC.**

* A biodiversity value is not relevant to a proposed development if the value is not present on the development site and there is no potential for direct or indirect impacts on the biodiversity value if it occurs off-site (DP&E, 2018).

The Northern Extension Modification would not result in an increased impact on vegetation abundance, vegetation integrity, habitat suitability, threatened species abundance, habitat connectivity, threatened species movement, flight path integrity or hydrological processes that are known to sustain a threatened species or ecological community.

7.0 IMPACT ASSESSMENT – EPBC ACT

Federal assessment under the EPBC Act was conducted via the *Protected Matters Search Tool* (DEE, 2019b). This was used to ascertain whether Matters of National Environmental Significance (MNES) were likely to occur within 10 km of the site. These include:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of International Importance;
- Commonwealth Marine Area;
- Great Barrier Reef Marine Park;
- Nuclear Actions;
- A Water Resource, in relation to coal seam gas development and large coal mining development;
- Listed Threatened Ecological Communities;
- Listed Threatened Species; and
- Listed Migratory Species.

Three wetlands of international importance are listed, but all occur at least 100 km downstream. With the relinquishment of approved surface development in Study Areas 2 and 3, there is unlikely to be any impact (or additional impact over that already approved) from the Northern Extension Modification.

One listed TEC is listed as potentially occurring within 10 km of site:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (Endangered). This community was not found to occur in Study Area 1 (or Study Areas 2 and 3). None of the characteristic species were present, particularly Buloke (*Allocasuarina luehmannii*). As such, there would be no increased impact on this MNES.

Of the eleven listed threatened species, none are listed as occurring proximal to the Northern Extension Modification, despite extensive historical surveys of the area (**Appendix A**). No threatened plants were found during the survey. No Federally listed threatened fauna species

(or habitat constraints for) were observed. There is no free water on site. As such, there would be no impact on wetland birds.

No migratory species were found in Study Area 1 during the bird surveys.

Due to the paucity of habitat values for threatened species in Study Area 1, the fact it is predominantly grazed and the fact that an area of approved surface development with greater habitat values is to be relinquished, no increased impact on MNES is expected to occur. As such, no referral is likely to be necessary under the EPBC Act.

8.0 CONCLUSION

The cumulative impacts of the Northern Extension Modification on native vegetation loss and reduction of fauna habitat are small, and negligible in the regional context given the proposed surface development is to be located on what is predominantly derived shrubland subject to high intensity grazing. Additionally, no TECs would be impacted. It is therefore considered that the Northern Extension Modification would result in no material adverse change to the extent, duration and severity of already approved impacts.

In conclusion, the Northern Extension Modification:

- would not increase impacts on biodiversity values as defined by the BC Act and therefore, if the DPIE is satisfied, a BDAR is not required; and
- would not significantly impact threatened species, TECs or migratory species listed under the EPBC Act.

In addition to the above, Tronox would relinquish (not clear) approximately 90.7 ha of *Black Bluebush low open shrubland* (PCT 153), *Black Oak – Western Rosewood open woodland* (PCT 58) and *Black Oak – Pearl Bluebush open woodland* (PCT 221) within the Project Approval Boundary. This would result in a net positive outcome for biodiversity values in the local area.

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10.0 APPENDICES

10.1 APPENDIX A: THREATENED FLORA AND FAUNA PREVIOUSLY RECORDED IN THE WIDER LOCALITY

Table 10-1: Threatened Flora and Fauna Previously Recorded in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	ALA/BioNet Database[4]	Previous Survey Results in the Wider Locality[5]
		BC Act[1]	EPBC Act[2]			
Plants						
Swainsona spp.	Swainson-pea (tentative)	?	?	Species	-	a
Reptiles						
Strophurus elderi	Jewelled Gecko	V	-	Ecosystem	✓	b, c
Delma australis	Marble-faced Delma	E	-	Ecosystem	✓	b, d
Tiliqua occipitalis	Western Blue-tongued Lizard	V	-	Ecosystem	✓	e, f
Ramphotyphlops endoterus	Interior Blind Snake	E	-	Ecosystem	✓	g
Lucasium stenodactylum	Crowned Gecko	V	-	Species	-	c
Amphibians						
Neobatrachus pictus	Painted Burrowing Frog	E	-	Species	✓	*
Birds						
Circus assimilis	Spotted Harrier	V	-	Ecosystem	✓	h
Falco hypoleucos	Grey Falcon	E	-	Ecosystem	-	f

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	ALA/BioNet Database[4]	Previous Survey Results in the Wider Locality[5]
		BC Act[1]	EPBC Act[2]			
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	✓	b, d, i
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	✓	b, c, d, e, f, i, j, k
Epthianura albifrons	White-fronted Chat	V	-	Ecosystem	✓	b
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	✓	d
Melanodryas cucullate cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	✓	b, d, e, f, i, k
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	ALA	f, k
Calamanthus campestris	Rufous Fieldwren	V	-	Ecosystem	ALA (1989)	-
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	-	f
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	-	j
Oxyura australis	Blue-billed Duck	V	-	Ecosystem	-	f
Stictonetta naevosa	Freckled Duck	V	-	Ecosystem	-	f
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Ecosystem	-	f
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	Species/Ecosystem	-	f
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	-	f
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	-	e

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	ALA/BioNet Database[4]	Previous Survey Results in the Wider Locality[5]
		BC Act[1]	EPBC Act[2]			
Mammals						
Sminthopsis macroura	Striped-faced Dunnart	V	-	Ecosystem	✓	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	✓	b, e, f
Chalinolobus picatus	Little Pied Bat	V	-	Ecosystem	✓	b, c, d, e, f, h, i, k, l
Vespadelus baverstocki	Inland Forest Bat	V	-	Ecosystem	✓	b, c, d, e, f, i, k, l
Pseudomys bolami	Bolam's Mouse	E	-	Ecosystem	✓	b

* This record has been revisited and is likely to be erroneous (see Section 4.3.1).

1 Conservation status under the BC Act (current as at November 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at November 2019). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Biodiversity Credit Class under the *Threatened Biodiversity Data Collection* (DPIE, 2019) (current as at November 2019).

4 Atlas of Living Australia (2019); Department of Planning, Industry and Environment (2019a)

5 Previous survey results from Project area at given sampling sites sourced from the following:

a = FloraSearch (2009)
b = BMS (2017)
c = Cenwest (2009)
d = BMS (2012)
e = Western Research Institute (2007)
f = Mount King Ecological Surveys (2001)
g = Cook (2014)
h = GHD (2016)
i = BMS (2014)
j = Birds Australia (2013)
k = Ogyris Ecological Research (2005-2017)
l = GHD (2017)

10.2 APPENDIX B: VEGETATION INTEGRITY PLOT DATA – STUDY AREA 1

Table 10-2: BAM Attributes (Composition and Structure) Used to Derive Vegetation Integrity Score – Study Area 1

Veg. Zone	Plot ID	Tree		Shrub		Grass		Forb		Fern		Other		HTE
		Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Cover
PCT 153	1	1	2.0	4	30.3	1	0.1	3	0.3	0	0	0	0	0.1
PCT 153	2	0	0	7	8.5	1	0.1	6	0.6	0	0	0	0	0.1
PCT 153	3	0	0	5	2.0	2	0.2	4	0.4	0	0	1	0.1	0.1
PCT 153	4	0	0	4	4.3	1	0.1	3	0.3	0	0	0	0	0.1
PCT 153	5	0	0	4	8.6	3	0.3	6	0.6	0	0	0	0	0.1
PCT 154	6	0	0	6	17.4	2	0.2	7	0.7	0	0	0	0	0.1
PCT 154	7	0	0	5	11.3	1	0.1	3	0.3	0	0	0	0	0.1
PCT 154	8	0	0	6	16.4	0	0	2	0.2	0	0	0	0	0.1
PCT 154	9	0	0	5	15.4	3	0.3	3	0.3	0	0	0	0	0.1
PCT 143	10	0	0	9	23.6	2	0.2	5	0.5	0	0	0	0	0.1
PCT 58	11	2	3.1	4	15.3	0	0	1	0.1	0	0	0	0	0.1
PCT 58	12	1	3	8	15.8	5	0.5	7	0.7	0	0	1	0.1	0.1
PCT 58	13	0	0	6	1.7	1	0.1	4	0.4	0	0	0	0	0.1

Table 10-3: BAM Attributes (Function) Used to Derive Vegetation Integrity Score – Study Area 1

Veg. Zone	Plot ID	Stem class (DBH), count, a = absent, p = present							# large trees (>30cm for semi-arid woodland)	# trees with hollows	Length of logs (m)	Mean litter cover (%)
		80+ cm	50-79 cm	30-49 cm	20-29 cm	10-19 cm	5-9 cm	<5 cm				
PCT 153	1	-	-	p	a	p	a	a	1	0	2.0	12.8
PCT 153	2	-	-	a	a	a	a	a	0	0	0	0.4
PCT 153	3	-	-	a	a	a	a	a	0	0	0	9.8
PCT 153	4	-	-	a	a	a	a	a	0	0	0	0
PCT 153	5	-	-	a	a	a	a	a	0	0	0	3.2
PCT 154	6	-	-	a	a	a	a	a	0	0	0	5.4
PCT 154	7	-	-	a	a	a	a	a	0	0	0	2.4
PCT 154	8	-	-	a	a	a	a	a	0	0	0	1.2
PCT 154	9	-	-	a	a	a	a	a	0	0	0	1.2
PCT 143	10	-	-	a	a	a	a	a	0	0	0	33.6
PCT 58	11	-	-	a	p	a	a	p	0	6	44.0	7
PCT 58	12	-	-	a	p	p	a	a	0	1	20.5	6.4
PCT 58	13	-	-	a	a	a	a	a	0	0	26.0	1.2



Plate 10-1: VIS Plot Area1W-Dod (PCT143)



Plate 10-2: VIS Plot Area1W-Shrub1 (PCT154)



Plate 10-3: VIS Plot Area1W-Oak1 (PCT153)



Plate 10-4: VIS Plot Area1E-Shrub2 (PCT153)



Plate 10-5: VIS Plot Area1E-Shrub3 (PCT153)



Plate 10-6: VIS Plot Area1E-Shrub4 (PCT154)



Plate 10-7: VIS Plot Area1E-Oak2 (PCT58)



Plate 10-8: VIS Plot Area1E-Oak3 (PCT58)



Plate 10-9: VIS Plot Area1E-Oak4 (PCT58)

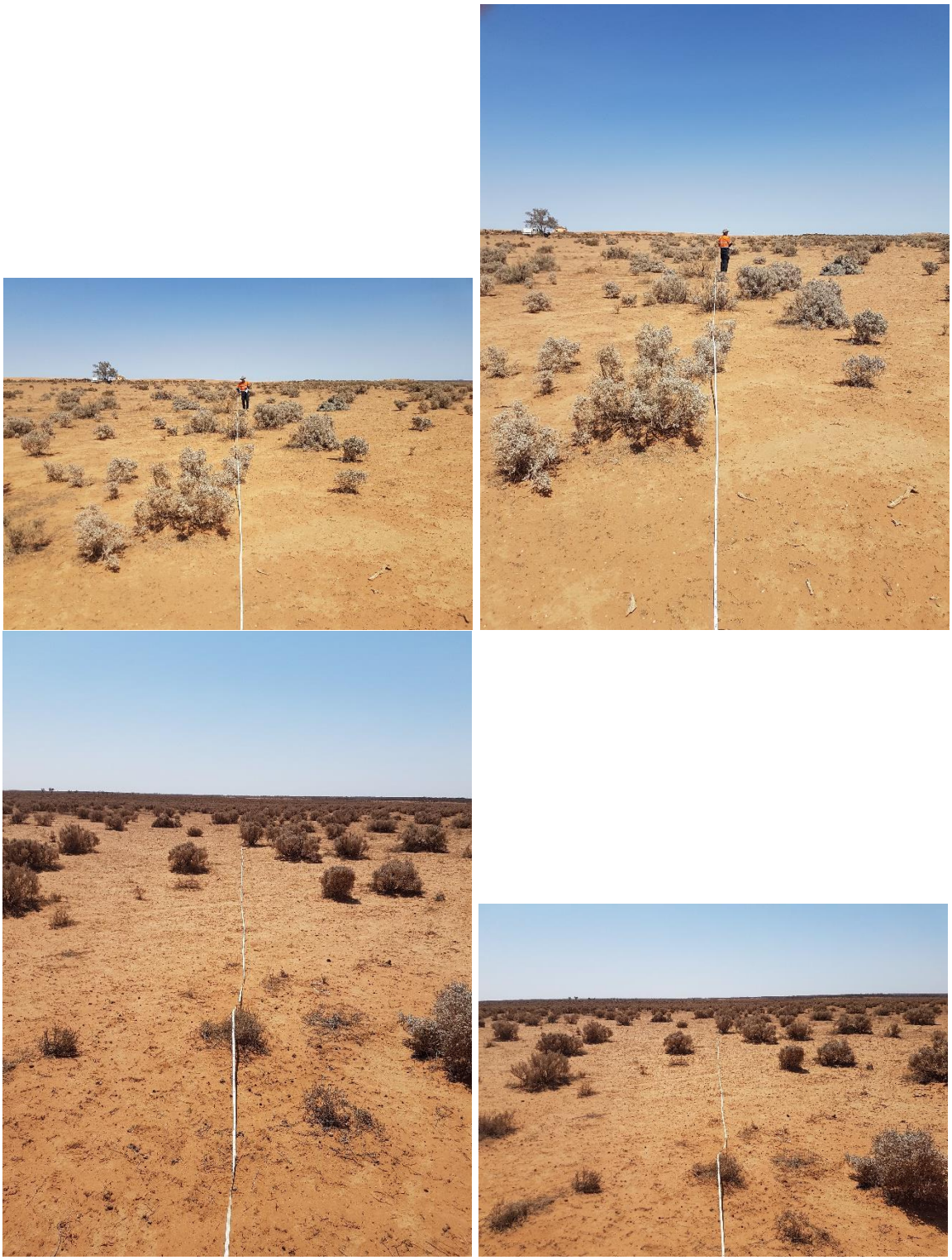


Plate 10-10: VIS Plot Area1E-Shrub5 (PCT154)

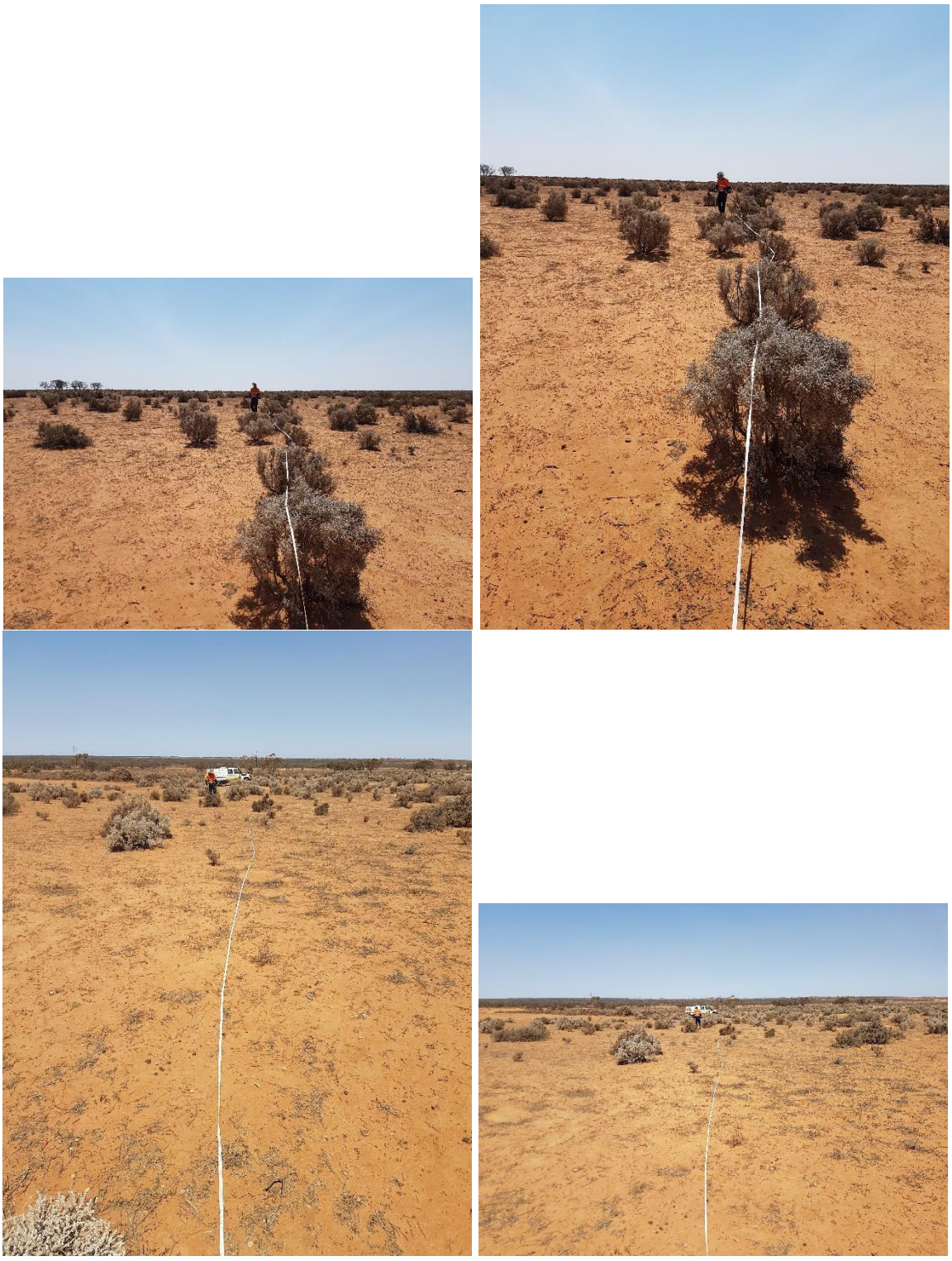


Plate 10-11: VIS Plot Area1W-Shrub6 (PCT154)



Plate 10-12: VIS Plot Area1W-Shrub7 (PCT153)



Plate 10-13: VIS Plot Area1W-Shrub8 (PCT153)

10.3 APPENDIX C: VEGETATION INTEGRITY PLOT DATA – STUDY AREAS 2 AND 3

Table 10-4: BAM Attributes (Composition and Structure) Used to Derive Vegetation Integrity Score – Study Areas 2 and 3

Veg. Zone	Plot ID	Tree		Shrub		Grass		Forb		Fern		Other		HTE
		Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Richness	Cover	Cover
PCT 153	14	0	0	8	7.9	2	0.2	6	0.7	0	0	0	0	0.1
PCT 153	15	0	0	7	7.5	3	0.3	8	0.8	0	0	0	0	0.1
PCT 153	16	0	0	4	5.3	2	0.2	6	0.7	0	0	0	0	0.1
PCT 58	17	2	7	12	8.3	1	0.1	10	1.0	0	0	1	0.1	0.1
PCT 58	18	2	2.1	7	11.6	1	0.1	6	0.6	0	0	0	0	0.1
PCT 58	19	0	0	5	4.7	1	0.1	10	1.0	0	0	0	0	0.1
PCT 58	20	2	5	5	15.8	2	0.2	10	1.1	0	0	1	0.1	0.1
PCT 58	21	0	0	4	4.0	2	0.2	7	0.7	0	0	0	0	0.1
PCT 221	22	2	3.1	6	9.6	2	0.2	10	1.1	0	0	0	0	0.1
PCT 221	23	1	5	6	15.5	2	0.2	5	0.5	0	0	0	0	0.1

Table 10-5: BAM Attributes (Function) Used to Derive Vegetation Integrity Score – Study Areas 2 and 3

Veg. Zone	Plot ID	Stem class (DBH), count, a = absent, p = present							# large trees (>30cm for semi-arid woodland)	# trees with hollows	Length of logs (m)	Mean litter cover (%)
		80+ cm	50-79 cm	30-49 cm	20-29 cm	10-19 cm	5-9 cm	<5 cm				
PCT 153	14	-	-	a	a	a	a	a	0	0	6.0	0.4
PCT 153	15	-	-	a	a	a	a	a	0	0	0	3.4
PCT 153	16	-	-	a	a	a	a	a	0	3	4.0	1.8
PCT 58	17	-	-	a	p	p	p	p	0	3	38.2	21.6
PCT 58	18	-	-	a	p	p	a	a	0	1	38.0	4.8
PCT 58	19	-	-	a	a	a	a	a	0	0	0	6.2
PCT 58	20	-	-	p	p	p	a	a	1	4	31.5	26.8
PCT 58	21	-	-	a	a	a	a	a	0	0	82.5	11.0
PCT 221	22	-	-	a	p	a	a	a	0	3	86.0	12.4
PCT 221	23	-	-	a	p	p	p	a	0	2	102.5	4.8



Plate 10-14: VIS Plot Area2-Oak1 (PCT58)



Plate 10-15: VIS Plot Area3-Shrub1 (PCT153)

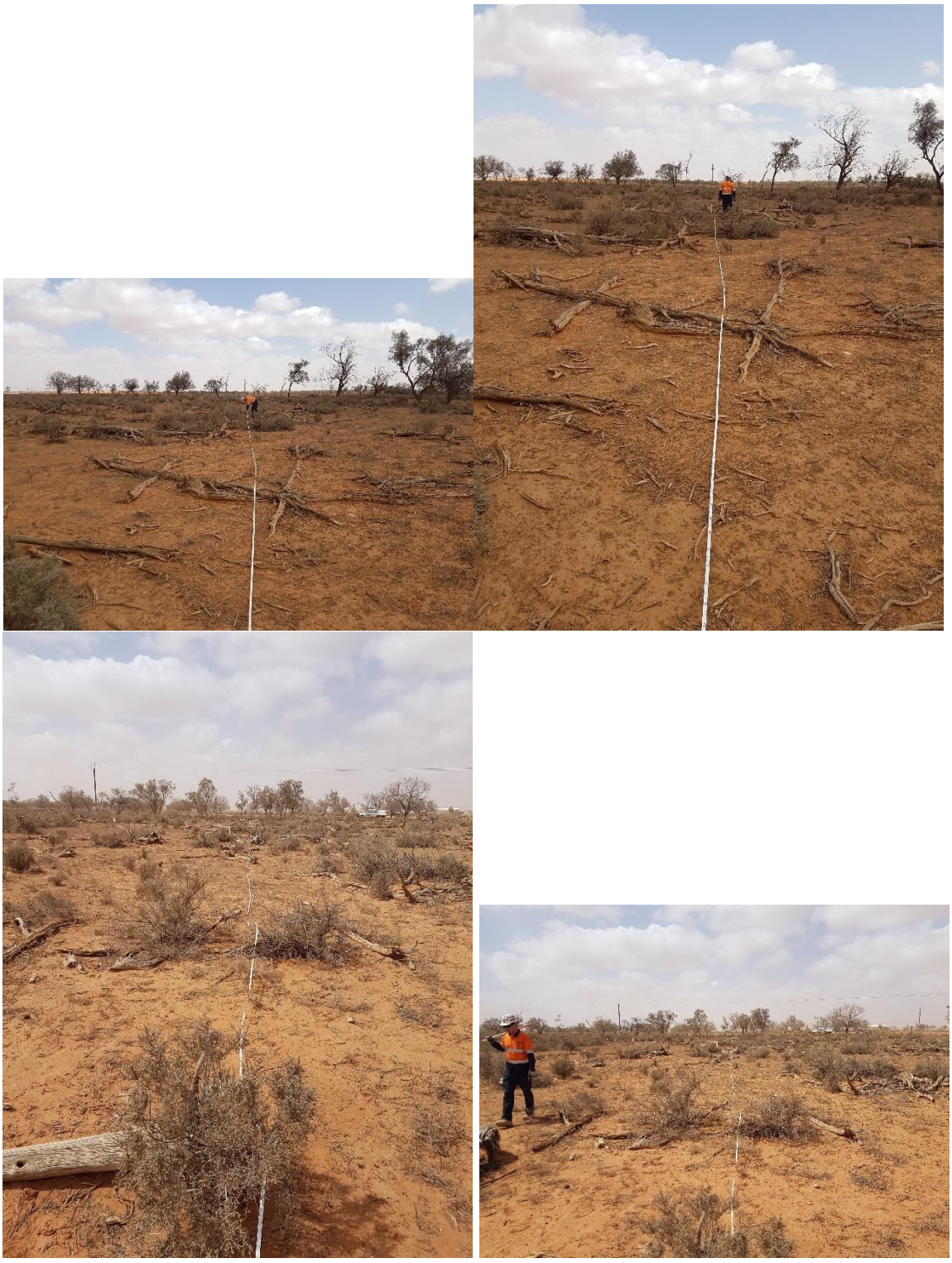


Plate 10-16: VIS Plot Area3-Oak2 (PCT58)



Plate 10-17: VIS Plot Area3-Oak3 (PCT58)



Plate 10-18: VIS Plot Area2-PearlW1 (PCT221)



Plate 10-19: VIS Plot Area2-PearlW2 (PCT221)



Plate 10-20: VIS Plot Area2-Oak4 (PCT58)

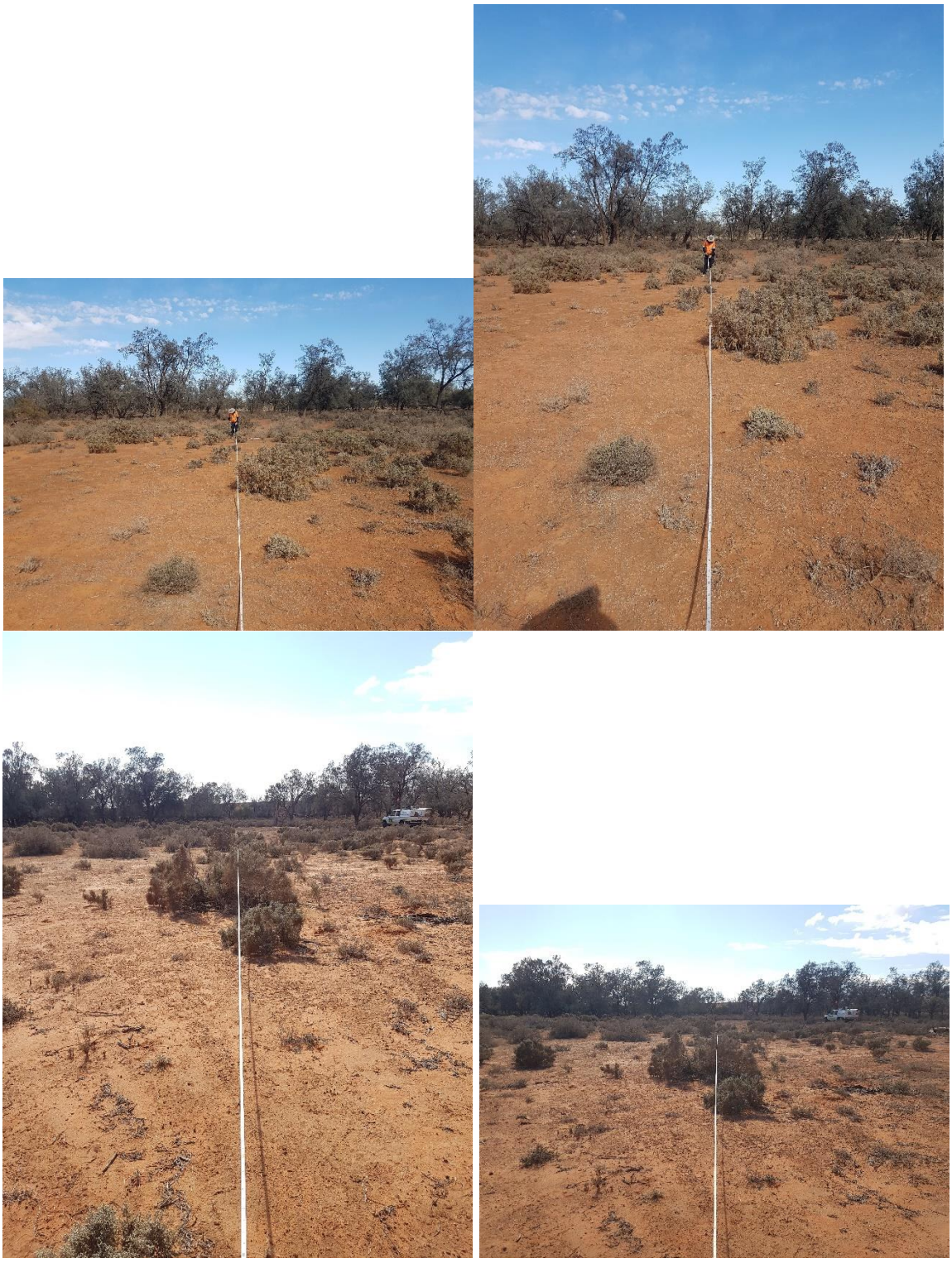


Plate 10-21: VIS Plot Area2-Shrub2 (PCT153)



Plate 10-22: VIS Plot Area3-Shrub3 (PCT153)



Plate 10-23: VIS Plot Area2-Oak5 (PCT58)

10.4 APPENDIX D: FLORA AND FAUNA SPECIES LOCATED WITHIN THE STUDY AREAS

Table 10-6: Flora Species Located Within the Study Areas

Family name	Scientific name	Common name	Native, Exotic, High Threat Exotic	Study Area 1	Study Areas 2+3
Plants					
Aizoaceae	*Psilocaulon granulicaule*	Wiry Noon-flower	E	✓	-
Aizoaceae	*Tetragonia eremaea*	-	N	✓	✓
Aizoaceae	*Tetragonia moorei*	-	N	✓	✓
Apocynaceae	*Marsdenia australis*	Doubah	N		✓
Asphodelaceae	*Asphodelus fistulosus*	Onion Weed	N	✓	✓
Asteraceae	*Actinobole uliginosum*	Flannel Cudweed, Cotton Weed	N	-	✓
Asteraceae	*Brachyscome lineariloba*	Hard-headed Daisy	N	✓	✓
Asteraceae	*Brachyscome ciliaris*	Variable Daisy	N	-	✓
Asteraceae	*Calocephalus sonderi*	Pale Beauty-heads	N	✓	✓
Asteraceae	*Calotis hispidula*	Bogan Flea	N	✓	✓
Asteraceae	*Hypochaeris spp.*	Flatweed	E	✓	-
Asteraceae	*Lemooria burkittii*	Wires and Wool	N	-	✓
Asteraceae	*Leontodon rhagadioloides*	Cretan Weed	E	✓	-
Asteraceae	*Rhodanthe corymbiflora*	Grey Sunray	N	-	✓
Asteraceae	*Rhodanthe pygmaea*	Pigmy Sunray	N	✓	✓
Asteraceae	*Rhodanthe stuartiana*	-	N	-	✓
Asteraceae	*Vittadinia cuneata*	Daisy	N	✓	✓
Asteraceae	-	Cudweed sp. 1	E	✓	-
Boraginaceae	*Heliotropium curassavicum*	Smooth Heliotrope	E	✓	-
Boraginaceae	*Calotis sp. 3 (Omphalolappula concava?)*	-	N	-	✓
Brassicaceae	*Alyssum linifolium*	Flax-leaf Alyssum	E	✓	✓
Brassicaceae	*Carrichtera annua*	Wards weed	HTE	✓	✓
Brassicaceae	*Harmsiodoxa blennodioide*	-	N	-	✓
Brassicaceae	*Lepidium spp.*	-	N	-	✓
Brassicaceae	*Sisymbrium spp.*	Rocket, Mustard	E	✓	✓
Brassicaceae	*Stenopetalum lineare*	Threadcress	N	-	✓
Casuarinaceae	*Casuarina pauper*	Black Oak, Belah	N	✓	✓
Chenopodiaceae	*Atriplex angulata*	-	N	-	✓
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	N	✓	✓

Family name	Scientific name	Common name	Native, Exotic, High Threat Exotic	Study Area 1	Study Areas 2+3
Chenopodiaceae	*Atriplex sp. 1*	-	N	✓	✓
Chenopodiaceae	*Atriplex spongios*	Pop Saltbush	N	✓	✓
Chenopodiaceae	*Atriplex vesicaria*	Bladder Saltbush	N	✓	-
Chenopodiaceae	*Chenopodium cristatum (Dysphania cristata)*	Crested Crumbweed	N	✓	-
Chenopodiaceae	*Dissocarpus paradoxus*	Cannonball Burr	N	✓	✓
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush	N	✓	✓
Chenopodiaceae	*Maireana georgei*	Slit-wing Bluebush	N	✓	✓
Chenopodiaceae	*Maireana pyramidata*	Black Bluebush	N	✓	✓
Chenopodiaceae	*Maireana sclerolaenoides*	Wolly-fruited Copperburr	N	-	✓
Chenopodiaceae	*Maireana sedifolia*	Pearl Bluebush	N	✓	✓
Chenopodiaceae	*Maireana sp. 5*	-	N	-	✓
Chenopodiaceae	*Maireana trichoptera*	Pink-seeded Bluebush	N	✓	✓
Chenopodiaceae	*Maireana triptera*	Three-wing Bluebush	N	-	✓
Chenopodiaceae	*Maireana turbinata*	Satiny Bluebush	N	✓	✓
Chenopodiaceae	*Salsola australis*	Roly-poly	N	-	✓
Chenopodiaceae	*Sclerolaena bicornis*	Goathead Burr	N	✓	✓
Chenopodiaceae	*Sclerolaena birchii*	Galvanized Burr	N	✓	-
Chenopodiaceae	*Sclerolaena muricata*	Black Rolypoly	N	✓	-
Chenopodiaceae	*Sclerolaena obliquicuspis*	Limestone Copperburr	N	✓	✓
Chenopodiaceae	*Sclerolaena patenticuspis*	Spear-fruit Copperburr	N	✓	✓
Convolvulaceae	*Convolvulus clementii*	Desert Bindweed	N	✓	-
Fabaceae	*Acacia brachystachya*	Umbrella Mulga	N	-	✓
Fabaceae	*Acacia colletioides*	Wait-a-while	N	-	✓
Fabaceae	*Medicago sp. 1*	Medic Burr	E	✓	✓
Fabaceae	*Medicago sp. 2*	Medic Burr	E	✓	✓
Fabaceae	*Senna artemisioide*	Cassia	N	✓	-
Geraniaceae	*Erodium carolinianum*	Blue Crowfoot	N	✓	✓
Geraniaceae	*Erodium cicutarium*	Common Crowfoot	E	✓	-
Goodeniaceae	*Goodenia fascicularis*	Goodenia	N	✓	✓
Goodeniaceae	*Goodenia pinnatifida*	Goodenia	N	✓	-
Lamiaceae	*Salvia verbenaca*	Wild Sage, Vervain	E	✓	-
Loranthaceae	*Lysiana sp. 1*	Mistletoe sp. 1 (on Western Rosewood)	N	-	✓

Family name	Scientific name	Common name	Native, Exotic, High Threat Exotic	Study Area 1	Study Areas 2+3
Malvaceae	*Abutilon sp. 1*	-	N	✓	-
Malvaceae	*Sida corrugata*	Corrugated Sida	N	✓	-
Malvaceae	*Sida intricata*	Twiggy Sida	N	✓	✓
Malvaceae	*Sida spodochroma/corrugata*	Limestone Sida	N	✓	-
Poaceae	*Austrostipa nitida*	-	N	✓	✓
Poaceae	*Austrostipa nodosa*	-	N	✓	✓
Poaceae	*Austrostipa spp.*	-	N	✓	✓
Poaceae	*Enneapogon avenaceus*	Bottle Washers	N	✓	-
Poaceae	*Eragrostis sp. 1 (Roger Lembit taken sample)*	-	N?	✓	-
Poaceae	*Poa fax*	Scaly Poa	N	✓	✓
Poaceae	*Rostraria pumila*	Roughtail	E	✓	-
Poaceae		Grass sp. 6	N?	✓	-
Rutaceae	*Geijera parviflora*	Wilga	N	-	✓
Santalaceae	*Exocarpos aphyllus*	Leafless Ballart	N	-	✓
Sapindaceae	*Alectryon oleifolius subsp. canescens*	Western Rosewood	N	✓	✓
Sapindaceae	*Dodonaea viscosa subsp. angustissima*	Narrow-leaved Hopbush	N	✓	-
Scrophulariaceae	*Eremophila sturtii*	Turpentine Bush	N	-	✓
Solanaceae	*Nicotiana spp.*	-	N	-	✓
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	E	✓	-
Zygophyllaceae	*Zygophyllum ammophila*	Sand Twinleaf	N	✓	✓
Zygophyllaceae	*Zygophyllum crenatum*	Lobed Twinleaf	N	✓	✓
Zygophyllaceae	*Zygophyllum ovatum*	Dwarf Twinleaf	N	-	✓

Note: Species to be confirmed are highlighted red.

Table 10-7: Fauna Species Located Within the Study Areas

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type	Study Area 1	Study Areas 2+3
Amphibians						
None found	None found	-	-	-	-	-
Reptiles						
Pogona vitticeps	Central Bearded Dragon	P	-	Sighted	✓	✓
Cryptoblepharus australis	Inland Snake-eyed Skink	P	-	Sighted	✓	-
Ctenotus olympicus	Ctenotus olympicus	P	-	Pitfall/reptile funnel, sighted	✓	✓
Ctenotus regius	Pale-rumped Ctenotus	P	-	Pitfall/reptile funnel	✓	-
Ctenotus schomburgkii	Barred Wedgesnout Ctenotus	P	-	Pitfall/reptile funnel, sighted	✓	✓
Diplodactylus furcosus	Ranges Stone Gecko	P	-	Pitfall/reptile funnel, spotlight	✓	-
Gehyra versicolor	Tree Dtella	P	-	Pitfall/reptile funnel	✓	-
Heterenotia binoei	Bynoe's Gecko	P	-	Pitfall/reptile funnel	✓	-
Lerista punctatovittata	Eastern Robust Slider	P	-	Pitfall	✓	-
Lucasium damaeum	Beaded Gecko	P	-	Pitfall/reptile funnel	✓	-
Menetia greyii	Common Dwarf Skink	P	-	Sighted	-	✓
Pygopus schraderi	Eastern Hooded Scaly-foot	P	-	Reptile funnel, spotlight	✓	-
Rhynchoedura angusta	Border Beaked Gecko	P	-	Pitfall/reptile funnel	✓	-
Tiliqua rugosa	Shingleback	P	-	Sighted	✓	✓
Birds						
Cracticus tibicen	Australian Magpie	P	-	Sighted	✓	✓
Anthus novaeseelandiae	Australian Pipit	P	-	Sighted	✓	✓
Corvus coronoides	Australian Raven	P	-	Sighted	-	✓
Barnardius zonarius	Australian Ringneck	P	-	Sighted	-	✓
Milvus migrans	Black Kite	P	-	Sighted	✓	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	-	Sighted	-	✓
Northiella haematogaster	Blue Bonnet	P	-	Sighted	✓	✓
Falco berigora	Brown Falcon	P	-	Sighted	✓	-
Climacteris picumnus	Brown Treecreeper	P	-	Sighted	-	✓

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type	Study Area 1	Study Areas 2+3
Pomatostomus ruficeps	Chestnut-crowned Babbler	P	-	Sighted	✓	-
Acanthiza uropygialis	Chestnut-rumped Thornbill	P	-	Sighted	✓	✓
Ocyphaps lophotes	Crested Pigeon	P	-	Sighted	✓	-
Epthianura tricolor	Crimson Chat	P	-	Sighted	✓	-
Dromaius novaehollandiae	Emu	P	-	Sighted	-	✓
Eolophus roseicapillus	Galah	P	-	Sighted	✓	-
Cracticus torquatus	Grey Butcherbird	P	-	Sighted	-	✓
Colluricincla harmonica	Grey Shrike-thrush	P	-	Sighted	-	✓
Hieraaetus morphnoides	Little Eagle	V	-	Sighted	-	✓
Corvus mellori	Little Raven	P	-	Sighted	✓	✓
Grallina cyanoleuca	Magpie-lark	P	-	Sighted	-	✓
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Sighted	✓	-
Artamus personatus	Masked Woodswallow	P	-	Sighted	✓	✓
Falco cenchroides	Nankeen Kestrel	P	-	Sighted	✓	-
Epthianura aurifrons	Orange Chat	P	-	Sighted	✓	✓
Anas superciliosa	Pacific Black Duck	P	-	Sighted	✓	-
Cracticus nigrogularis	Pied Butcherbird	P	-	Sighted	-	✓
Petroica goodenovii	Red-capped Robin	P	-	Sighted	✓	-
Gavicalis virescens	Singing Honeyeater	P	-	Sighted	✓	-
Plectorhyncha lanceolata	Striped Honeyeater	P	-	Sighted	-	✓
Petrochelidon nigricans	Tree Martin	P	-	Sighted	✓	✓
Aquila audax	Wedge-tailed Eagle	P	-	Sighted	✓	✓
Haliastur sphenurus	Whistling Kite	P	-	Sighted	-	✓
Artamus superciliosus	White-browed Woodswallow	P	-	Sighted	✓	✓
Malurus leucopterus	White-winged Fairy-wren	P	-	Sighted	✓	-
Lalage sueurii	White-winged Triller	P	-	Sighted	✓	-
Rhipidura leucophrys	Willie Wagtail	P	-	Sighted	-	✓

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type	Study Area 1	Study Areas 2+3
Manorina flavigula	Yellow-throated Miner	P	-	Sighted	✓	✓
Mammals						
Sminthopsis murina	Common Dunnart	P	-	Spotlighted	✓	-
Macropus robustus	Common Wallaroo (Euro)	P	-	Sighted	-	✓
Felis catus	Cat	U	-	Sighted (dead)	-	✓
Capra hircus	Goat	U	-	Sighted	✓	✓
Vulpes vulpes	Fox	U	-	Scat	✓	-
Mus musculus	House Mouse	U	-	Pitfall	✓	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	P	-	Spotlighted	✓	-
Oryctolagus cuniculus	Rabbit	U	-	Scat	-	✓
Macropus rufus	Red Kangaroo	P	-	Sighted	✓	✓
Ovis aries	Sheep (stock)	U	-	Sighted	✓	-
Tachyglossus aculeatus	Short-beaked Echidna	P	-	Scat	-	✓
Macropus fuliginosus	Western Grey Kangaroo	P	-	Sighted	✓	✓

Note: Threatened species are highlighted blue.

[1] Species status (current as at November 2019). P = Protected species, V = Vulnerable species, U = Introduced species.

SNAPPER MINE

Northern Extension Modification

Appendix B

Aboriginal Cultural Heritage Assessment



Snapper Mine Northern Extension Modification

Aboriginal Cultural Heritage Assessment



Report to Tronox Mining Australia Limited

8 November 2019

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Tronox Mining Australia Limited

Snapper Mine Northern Extension Modification

Aboriginal Cultural Heritage Assessment



Landskape

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EXECUTIVE SUMMARY

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]).

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

This Aboriginal Cultural Heritage Assessment (ACHA) has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act. Among other things, the Modification includes the extension of the existing/approved mine path and associated supporting infrastructure outside the approved surface development area at the Snapper Mine (herein referred to as the Modification area). Accordingly, this ACHA has been prepared in consideration of the Modification Area.

This report presents an assessment of the Aboriginal cultural heritage related issues for the Modification area in accordance with the general requirements of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Part 6 National Parks and Wildlife Act* 1974) (DECCW, 2010a), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b), *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011), *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (DEC, 2005), *Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter)* (Australia ICOMOS 1999), NSW National Parks and Wildlife Service *Aboriginal Cultural Heritage: Standards and Guidelines Kit* (NPWS, 1997), the Australian Heritage Commission *Ask First; A Guide to Respecting Indigenous Heritage Places and Values* (AHC 2002) and NSW Minerals Council *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010).

The specific objectives of the cultural heritage assessment were to:

- Consult the local Aboriginal community to identify any concerns they may have (consultation with the Aboriginal community followed *Aboriginal Cultural Heritage Community Consultation Requirements for Proponents* [DECCW, 2010a]).
- Conduct a desktop assessment to delineate areas of known and predicted cultural heritage within the Modification area.
- Undertake an archaeological survey of known and predicted cultural heritage identified in the desktop assessment with representatives of the local Aboriginal community.
- Record any cultural heritage sites within the Modification area and assess their significance.

- Identify the nature and extent of potential impacts of the Modification on cultural heritage.
- Devise options in consultation with the community to avoid or mitigate potential impacts of the development on cultural heritage places and items.

No Aboriginal cultural heritage places or items have previously been recorded in the Modification area. The present survey did not encounter any additional Aboriginal cultural heritage sites.

Based on the results of this cultural heritage investigation and consultation with representatives of the Registered Aboriginal Parties the following is recommended:

- The Modification be allowed to proceed because the Modification area would be located in an area where harm to cultural heritage would be avoided.
- In the unlikely event that human skeletal remains are encountered during the course of activities associated with the Modification, all work in that area must cease. Remains must not be handled or otherwise disturbed except to prevent further disturbance. If the remains are thought to be less than 100 years old, the Police or the State Coroner's Office (tel: 02 9552 4066) must be notified. If there is reason to suspect that the skeletal remains are more than 100 years old and Aboriginal, Tronox should contact the NSW Department of Planning, Industry and Environment – Biodiversity and Conservation Division (BCD) (previously the Office of Environment and Heritage [OEH]) Environmental Line (tel: 131 555) for advice. In the unlikely event that an Aboriginal burial is encountered, strategies for its management would need to be developed with the involvement of the local Aboriginal community.
- The Cultural Heritage Management Plan (CHMP) should continue to remain active for the life of the modified Snapper Mine and define the tasks, scope and conduct of all Aboriginal cultural heritage management activities. If any newly identified Aboriginal cultural heritage sites are discovered during the course of works in the Modification area, the CHMP should be revised in consultation with the local Aboriginal community.
- Tronox should continue to provide training to all on-site personnel regarding the CHMP strategies relevant to their employment tasks.
- Tronox should continue to involve the registered Aboriginal parties and any other relevant Aboriginal community groups or members in matters pertaining to the Modification.

1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (**Figure 1**).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (**Figure 1**):

- the Broken Hill Mineral Separation Plant (MSP), located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

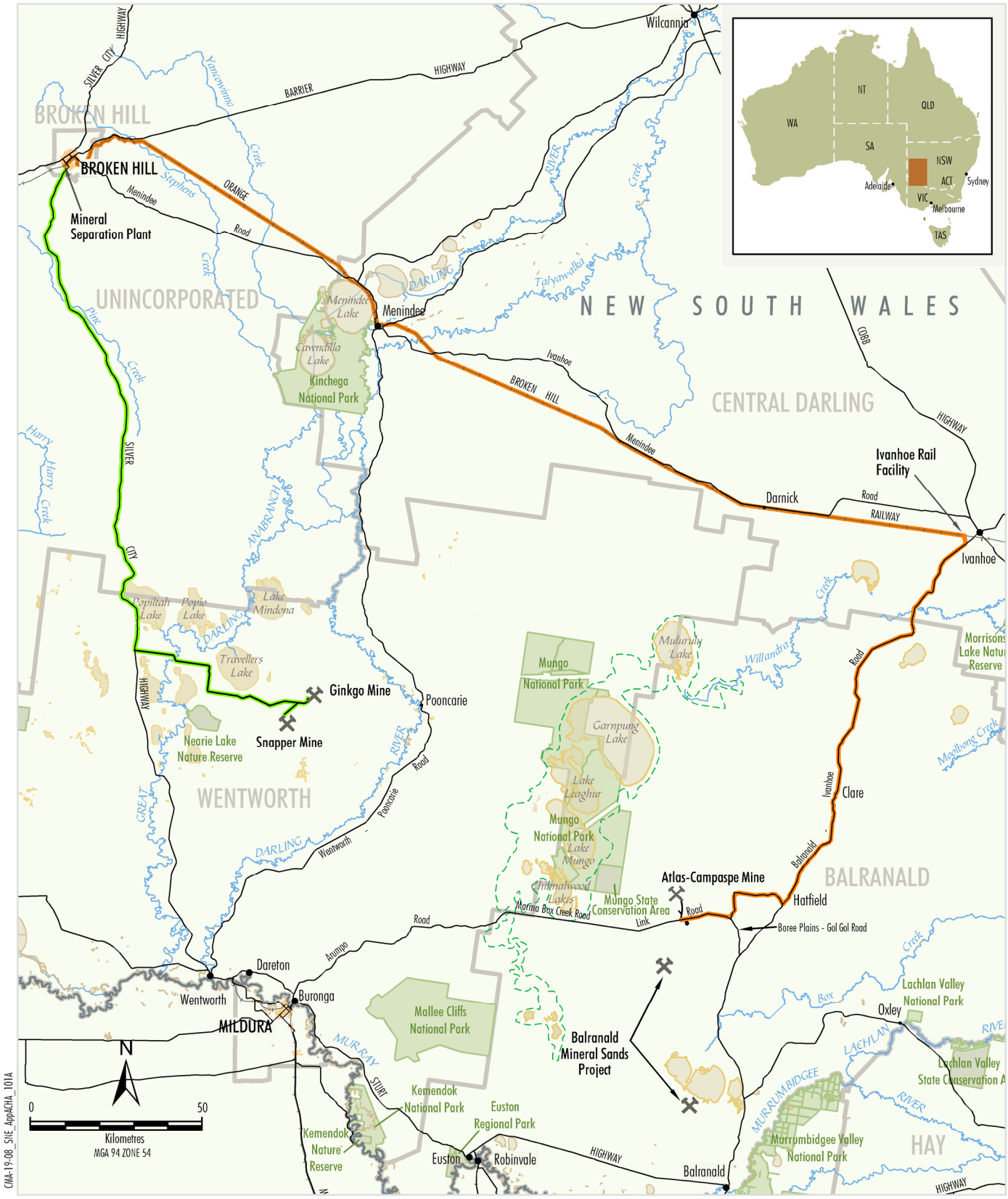
This Aboriginal Cultural Heritage Assessment (ACHA) has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.

Among other things, the Modification includes the extension of the existing/approved mine path and associated supporting infrastructure outside the approved surface development area at the Snapper Mine (herein referred to as the Modification area). Accordingly, this ACHA has been prepared in consideration of the Modification area. A detailed description of the Modification is provided in Section 3.

1.1 AIM AND OBJECTIVES OF THE ASSESSMENT

The objective of this assessment is to provide Tronox with an ACHA to support an approval for the Modification under the EP&A Act and the NSW *Environmental Planning and Assessment Regulation, 2000*.

This investigation provides a description of the context of the Modification and surrounds, identification of heritage places and cultural values within the Modification area, an assessment of the potential impacts to Aboriginal heritage as a result of the Modification, and development of recommendations to minimise, manage and mitigate these potential impacts.



LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: © NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

This assessment has been undertaken in accordance with the relevant requirements of the various advisory documents and guidelines. These guidelines and documents include:

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Part 6 National Parks and Wildlife Act 1974*) (NSW Department of Environment, Climate Change and Water [DECCW] 2010a).
- *Due Diligence Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (NSW Office of Environment and Heritage [OEH], 2011)
- *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation [DEC], 2005).
- The Australia International Council on Monuments and Sites (ICOMOS) Burra Charter (Australia ICOMOS, 1999).
- *Aboriginal Cultural Heritage: Standards and Guidelines Kit* (NSW National Parks and Wildlife Service [NPWS] 1997).
- *Ask First; A Guide to Respecting Indigenous Heritage Places and Values* (Australian Heritage Commission, 2002).
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010).

1.2 STRUCTURE OF THIS REPORT

This report has been prepared in consideration of the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) and as such includes the following specific information:

Section 1: Outlines the Modification and the objectives and structure of this report.

Section 2: Lists the investigators and contributors involved with this report.

Section 3: Provides a summary description of the Modification.

Section 4: Details the consultation and partnership with Indigenous communities.

Section 5: Outlines the landscape context and includes descriptions of land use history, geology and vegetation within the locality of the Modification area.

Section 6: Provides background information relevant to previous archaeological works including relevant ethno-history, the regional archaeological context and previous predictive models for the locality.

Section 7: Describes predictions for the Modification and documents the archaeological survey and data collection, and includes information regarding the method of the survey and a description of the areas surveyed. Lists the results of the survey and provides a discussion and analysis of these results.

Section 8: Assesses the cultural heritage significance of the Modification.

Section 9: Assesses the impact of the Modification on Aboriginal heritage.

Section 10: Lists the recommended management and mitigation measures.

Section 11: Provides a summary of recommendations from this report.

Section 12: Lists the references cited in this report.

A glossary of commonly used terms in the report is provided in **Appendix 1**.

2 INVESTIGATORS

Landskape was commissioned by Tronox in October 2019 to complete the ACHA for the Modification and to prepare this report.

Dr Matt Cupper, a qualified archaeologist and geoscientist with 20 years' experience as a cultural heritage advisor, was Landskape's project archaeologist.

The field investigation for the Modification was completed on 5 November 2019.

Community consultation pursuant to the NSW Department of Planning, Industry and Environment – Biodiversity and Conservation Division (BCD) (previously the OEH) policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (Consultation Guidelines) (DECCW, 2010a) was managed by Tronox.

3 DESCRIPTION OF THE MODIFICATION

As described in Section 1, Tronox proposes to modify Project Approval (06_0168) for the Snapper Mine. The Modification would include:

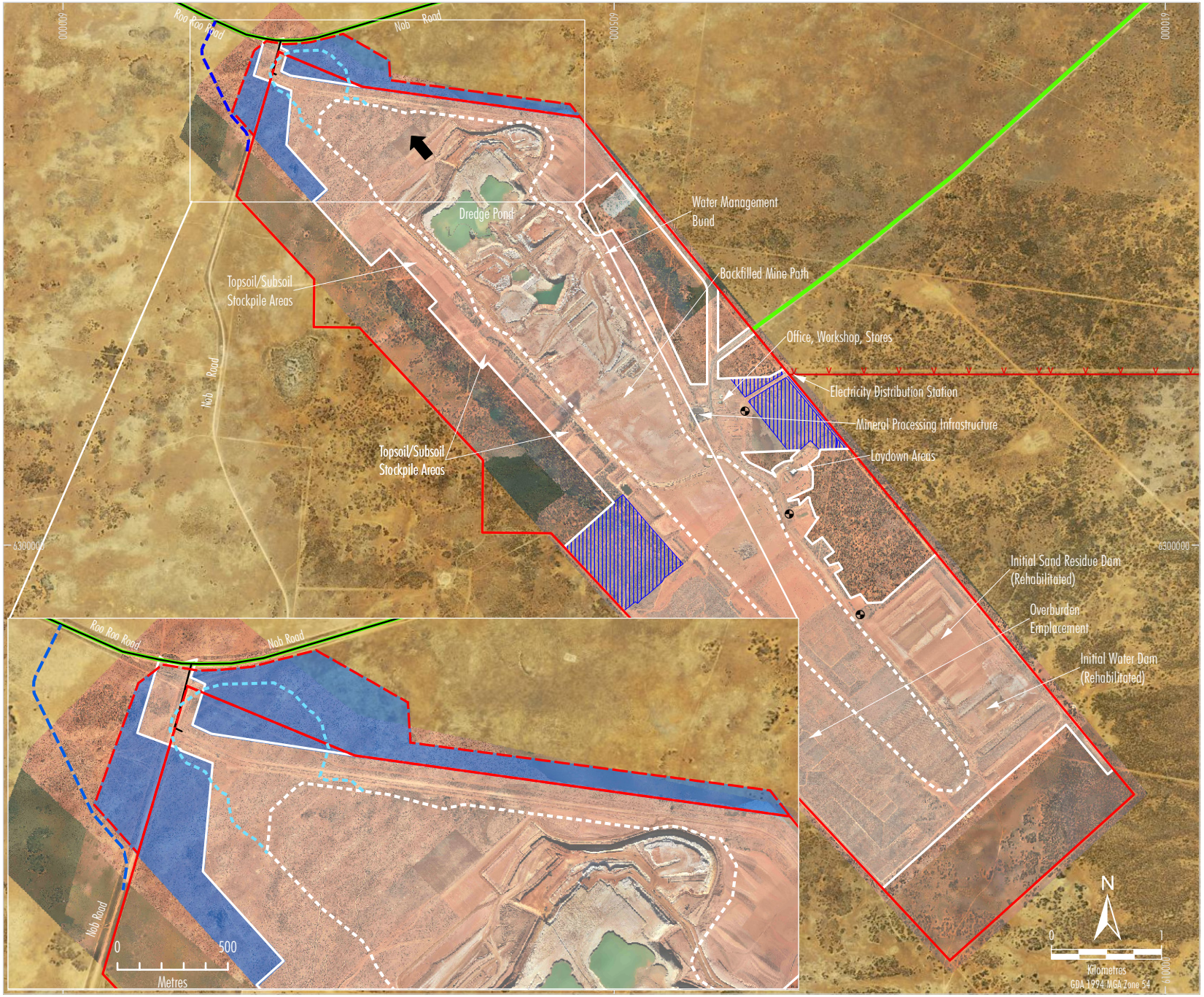
- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The modified general arrangement of the Snapper Mine is shown on **Figure 2**.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.1 and 2 of the Modification Report, respectively.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

S N A P P E R M I N E

Modified Snapper Mine - Indicative General Arrangement

Figure 2

CMA-19-08_SNE_AppACHA_201C

4 ABORIGINAL COMMUNITY CONSULTATION

4.1 INTRODUCTION

In accordance with the Consultation Guidelines (DECCW, 2010a), this assessment has been prepared in consultation with the Aboriginal community (via the Registered Aboriginal Parties [RAPs]).

The following sections describe involvement by the RAPs and demonstrate that the input of the Aboriginal community has been considered when determining and assessing impacts, developing management measures, and making final recommendations relevant to Aboriginal cultural heritage within the Modification area.

4.2 ABORIGINAL COMMUNITY PARTICIPATION

The RAPs were consulted throughout the preparation of this assessment, including:

- review and comment on the Proposed Methodology;
- during the review period for the draft ACHA; and
- encouraged to provide feedback and input throughout the assessment process.

The following sections outline the process and outcomes of the community consultation undertaken during preparation of the assessment, and to ascertain the Aboriginal cultural heritage values, and associated management strategies, of the Modification area.

4.2.1 Identification of Registered Aboriginal Parties

In accordance with Sections 4.1 and 4.2 of the Consultation Guidelines (DECCW, 2010a), the following individuals and organisations have been previously identified as Aboriginal stakeholders for the Snapper Mine:

- Dareton Local Aboriginal Land Council (LALC);
- Barkandji Native Title Group Aboriginal Corporation;
- Mary-Ann Marton;
- Peggy Thomas;
- Wayne Webster;
- Corroboree Aboriginal Corporation; and
- Ginninderra Aboriginal Corporation.

These Aboriginal stakeholder groups with an interest in Aboriginal heritage at the Snapper Mine have been previously identified and Tronox has maintained ongoing consultation and engagement with these groups since their individual expressions of interest.

These Aboriginal stakeholder groups include those parties who registered for the original Snapper and Ginkgo Mines Cultural Heritage Assessments (Landskape, 2007; Witter, 2001) and subsequent Cultural Heritage Assessments (Landskape, 2003, 2010 and 2016; Niche, 2012), and who were consulted during the preparation of the Snapper Mine Heritage Management Plan (HMP) (BEMAX Resources Limited [BEMAX], 2007b) in accordance with Condition 20, Schedule 3 of the Project Approval (06_0168).

Following the distribution of the Stage 1 correspondence to the previously identified RAPs listed above, two additional RAPs registered their interest in the ACHA for the Modification, namely the Muragadi Aboriginal Corporation and Murra Bidgee Aboriginal Corporation.

A consultation log with RAPs is included as **Appendix 2**.

4.2.2 Presentation of Information about the Proposed Modification

Information regarding the Modification was provided in writing to all RAPs on 30 September 2019. The correspondence included an invitation to attend an information session and field survey for the Modification and a copy of the Proposed Methodology was provided for review and comment (**Appendix 3**).

A minimum of 28 days were allowed for RAPs to provide input in regards to the following aspects of the Proposed Methodology:

- The nature of the Proposed Methodology.
- Any Aboriginal objects or places of cultural value within the Modification area, or issues of cultural significance.
- Any restrictions or protocols considered necessary in relation to any information of sensitivity that may be provided.
- Any other factors considered to be relevant to the heritage assessment.

The period for commenting on the Proposed Methodology was open between 30 September 2019 and 1 November 2019.

4.2.3 Aboriginal Cultural Heritage Field Survey

All RAPs were invited to provide a representative for involvement in the field survey for the Modification. No RAPs were available to participate in the survey.

The Aboriginal cultural heritage field survey was completed on 5 November 2019. Further details regarding the survey and survey coverage are provided in Section 7.

It was described in the material provided to all RAPs with the Proposed Methodology and survey invitation, that if any RAP had comments on the Proposed (assessment) Methodology which (subject to agreement by Tronox) would have altered the field survey design/implementation (i.e. pedestrian survey across the Modification area), Tronox would commit to considering those submissions and take reasonable steps to address them, having regard to the survey requirements and the objectives of the Consultation Guidelines (DECCW, 2010a).

As no comments of this nature were received, no additional survey work was undertaken.

4.3 ABORIGINAL COMMUNITY INFORMATION ABOUT CULTURAL SIGNIFICANCE

As part of the review of the Proposed Methodology and during the field survey, the RAPs were asked to contribute their knowledge on the Modification area and surrounds to contribute to the assessment of the cultural heritage significance of the Modification area (Section 8).

4.4 REVIEW OF THE DRAFT ACHA

A draft of this report has been provided to all RAPs for their review and comment in accordance with Sections 4.3 and 4.4 of the Consultation Guidelines (DECCW 2010a). Comments received within the specified time period will be included and considered as necessary prior to finalisation of the report.

5 ENVIRONMENTAL CONTEXT

5.1 INTRODUCTION

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) requires a review of the environmental context to assist in the determination or prediction of the potential of a landscape to have accumulated or preserved objects, the ways Aboriginal people may have used the landscape in the past, with regard to identifiable resources or focal points for activities, and the likely distribution of the material traces of Aboriginal land use based on these factors.

Detailing the landscape context is an integral procedure in modelling potential past Aboriginal land use practices and/or predicting site distribution patterns. The natural environment of an area influences the availability of local resources such as food and raw materials for artefacts, rock platforms for engravings and axe sharpening, and rock outcrops that may provide shelter. The landscape also provides the sediments that may bury objects and archaeological features, as well as the erosive processes that might expose or disperse them.

Geomorphic (land formative) processes may impact upon the type and frequency of archaeological remains. Past climate may also influence the location and types of resources available, which in turn shapes settlement and mobility patterns of past Aboriginal groups in the area. The location of different site-types (such as middens, stone artefact scatters, etc.) are strongly influenced by factors such as these along with a range of other associated features, which are specific to different land systems.

5.2 GEOLOGY

The Modification area is located in the Lower Darling region of the Murray Basin. The surface geology of the region is mostly aeolian (wind-blown) sediments, while underlying sequences within the basin were deposited by shallow seas and lakes over the past 60 million years (Brown and Stephenson, 1991).

5.3 LANDFORMS AND VEGETATION

The Modification area is located in sandplains, aeolian features comprising low, undulating regions of irregular sandy hummocks. The Modification area is vegetated by mosaics of Black Bluebush/Pearl Bluebush low open Shrubland, derived Black Oak - Western Rosewood open Woodland and Narrow-leaved Hopbush – Scrub Turpentine – Senna Shrubland (Biodiversity Monitoring Services [BMS], 2019).

The Modification area falls within the Hatfield sandplain land system (Soil Conservation Service, 1985, 1991) (**Figures 3** to **6**). The features of the Hatfield sandplain land system are provided below:

- *Hatfield land system*: plains of solonized brown soils, red and brown texture-contrast soils and red earths with scattered clumps of Rosewood and Belah; moderately dense Bluebushes and Bladder Saltbush (*Atriplex vesicaria*); dunes of deep brownish sands with clumped White Cypress Pine (*Callitris glaucophylla*), Prickly Wattle (*Acacia victoriae*) and Bluebushes; depressions of grey clays with Dillon Bush and Canegrass (*Eragrostis australasica*).



Figure 3. Derived Rosewood Woodland with Bluebush understorey in the Hatfield land system in the Modification area.



Figure 4. Narrow-Leaved Hopbush in the Hatfield land system in the Modification area.



Figure 5. Pearl Bluebush Shrubland in the Hatfield land system in the Modification area.



Figure 6. Black Bluebush Shrubland in the Hatfield land system in the Modification area.

6 ABORIGINAL CULTURAL HERITAGE CONTEXT

Some of the earliest evidence of human occupation of Australia comes from south-western NSW (Bowler *et al*., 1970, 2003; Thorne *et al*., 1999; Cupper and Duncan, 2006; Olley *et al*., 2006). Stone artefacts found at Lake Mungo, about 100 km to the east of the Modification, have been dated to between 46,000 to 50,000 years ago (Bowler *et al*., 2003). The burials of a male and female at Lake Mungo are 42,000 years old (Olley *et al*., 2006, cf. Thorne *et al*., 1999). People were also at nearby Lake Menindee from 45,000 years ago (Cupper and Duncan, 2006) and at Lake Victoria on the Murray River by around 21,000 years ago (Gill, 1973).

6.1 ETHNO-HISTORIC CONTEXT

Aboriginal people of the Barkandji language group occupied the Lower Darling region at the time of first contact with Europeans (Sturt, 1982 [1833]; 1984 [1844-6]; Mitchell, 1839; Eyre, 1985 [1842]; Krefft, 1865, Allen, 1974; Tindale, 1974; Hardy, 1976; Hercus, 1982, 1993). These tribes shared similar language and kinship systems, notably the division of members into matrilineal moieties (two-part social classification) known as Mukwara (Wedge-tailed Eagle) and Kilpara (Raven) (Tindale, 1974; Hercus, 1982, 1993; Blows, 1995).

At the time of European contact the Barkandji were hunter-fisher-gatherers and appear to have had a semi-sedentary lifestyle. Early accounts by European observers suggest that they lived near more permanent water sources such as along the stream courses and lakes of the Darling River during the warmest months of the year, with people moving into the sandplains to collect food after winter rains (Allen 1974).

Aspects of the initial interaction between Europeans and Barkandji led to violent conflict. Aborigines were shot, poisoned and displaced from their land by pastoral settlers and, in retaliation, sheep and shepherds were speared. Within a decade of the first contact many of the Barkandji were living adjacent to pastoral homesteads, often working as shepherds or engaged in other labouring activities.

6.2 PREHISTORIC CONTEXT

Accounts of Aboriginal land use of the Lower Darling during the late nineteenth and early twentieth centuries provide an insight into possible settlement patterns in the prehistoric period. Allen (1974), using these historical ethnographies and the archaeological record, invoked a subsistence model for the region based on the relationship between occupation of the riverine corridors and sandplains. Large populations of people congregated at the rivers during spring and summer and whenever the systems were high. Following seasonal rains smaller, mobile bands dispersed over the plains exploiting ephemeral resources (Allen, 1974).

The material record of this occupation is preserved in the archaeological sites of the Lower Darling region, most of which date to the period since the last Ice Age (after around 18,000 years ago) (Hope, 1981; Balme and Hope, 1990; Balme, 1995). All that remains at many of these sites are flakes of stone debris from the making and resharpening of stone tools. These were made both at Aboriginal open habitation areas (campsites) or special activity areas such as stone knapping sites. As well as being the sites of manufacture and maintenance of stone implements, open habitation areas usually contain evidence of domestic and other activities such as cooking and food preparation. Campfires or oven hearths are common, marked by calcrete, baked clay, ferricrete, sandstone and silcrete heat retaining stones or hearthstones and charcoal. Organic remains consist of burnt animal bones, Emu and aquatic bird eggshell and freshwater mussel shell.

6.3 TYPES OF ABORIGINAL CULTURAL HERITAGE SITES IN THE REGION

Based on the results and analytical conclusions of previous archaeological surveys in similar landscape contexts in the Lower Darling it is possible to predict the types and topographic contexts of Aboriginal cultural heritage sites in the Modification area. The occurrence and survival of archaeological sites is, however, dependent on many factors including micro-topography and the degree of land surface disturbance.

The types of Aboriginal cultural heritage sites previously recorded in the Lower Darling are described in Sections 6.3.1-6.3.8.

6.3.1 Stone Artefact Scatters

Scatters of stone artefacts exposed at the ground surface are one of the most commonly occurring types of archaeological site in the region (Hope, 1982). The remains of fire hearths may also be associated with the artefacts. In rare instances, sites that were used over a long period of time may accumulate sediments and become stratified. That is, there may be several layers of occupation buried one on top of another.

Stone artefact scatters are almost invariably located near permanent or semi-permanent water sources. Local topography is also important in that open campsites tend to occur on level, well-drained ground elevated above the local water source. In the Lower Darling region they are commonly located on river terraces and along creek-lines and also around the margins of lakes, swamps and claypans.

6.3.2 Hearths

Hearths consist of lumps of burnt clay or stone cobble hearthstones. Sometimes ash and charcoal are preserved. Other materials found in hearths include animal bone, freshwater mussel shell, emu eggshell and stone artefacts. Hearths probably represent the remains of cooking ovens, similar to those described in ethnographic accounts by Major Thomas Mitchell (1839) and Peter Beveridge (1869) (see also Coutts *et al*., 1979). These were lined with baked clay nodules and stone cobbles, possibly to retain heat. Hearths may be isolated or occur in clusters and may be associated with open campsites or middens. They are often located in dune swales, particularly on claypans, near soaks and on floodplain terraces.

6.3.3 Freshwater Shell Middens

Shell middens are deposits of shell and other food remains accumulated by Aboriginal people as food refuse. In inland NSW these middens typically comprise shells of the freshwater lacustrine mussel *Velesunio ambiguus* or the freshwater riverine mussel *Alathyria jacksoni*. Freshwater middens are most frequently found as thin layers or small patches of shell and often contain stone or bone artefacts and evidence of cooking. Such sites are relatively common along the Darling River and its associated lakes and tributaries.

6.3.4 Earth Mounds

Earth mounds may have been used by Aboriginal people as cooking ovens or as campsites. They are common on the plains of southwestern NSW. Originally, they appear to have ranged from 3 metres (m) to 35 m in diameter and from 0.5 m to 2 m in height. Today, however, they may be difficult to recognise because of the effects of ploughing, grazing and burrowing rabbits. Earth oven material, stone artefacts, food refuse and the remains of hut foundations have been exposed in excavated earth mounds.

6.3.5 Quarry Sites

Quarries are locations where Aboriginal people obtained raw material for their stone tools or ochre for their art and decoration. Materials commonly used for making flaked stone tools include chert, silcrete, quartz and quartzite. In the Lower Darling region stone sources are particularly scarce. Silcrete outcrops occur at a number of locations in south-western NSW, including at the Snapper Mine (Landskape, 2007). Chert is found exposed in cliffs incised by the Murray River in South Australia. Most other stone in the Lower Darling region was probably sourced via long-distance trade links with the Barrier Ranges and the south-eastern Australian Highlands.

6.3.6 Modified Trees

Slabs of bark were cut from trees by Aboriginal people and used for a variety of purposes including roofing shelters and constructing canoes, shields and containers. Scars also resulted from the cutting of toeholds for climbing trees to obtain honey or to capture animals such as possums. In the Lower Darling region River Red Gums and Black Box are the most commonly scarred species. The classification of scarred trees as natural, European or Aboriginal is often problematic. However, if the scar is Aboriginal the tree must now be more than ~150 years old.

6.3.7 Stone Arrangements, Ceremonial Rings and Ceremony and Dreaming Sites

Stone arrangements range from cairns or piles of rock to more elaborate arrangements such as stone circles or standing slabs of rock held upright by stones around the base. Some stone arrangements were used in ceremonial activities whilst others may represent sacred or totemic sites. Other features associated with the spiritual aspects of Aboriginal life are those now called ‘ceremony and dreaming’ sites. These can be either stone arrangements or natural features such as rock outcrops, which may be associated with initiation ceremonies or the activities of ancestral creators.

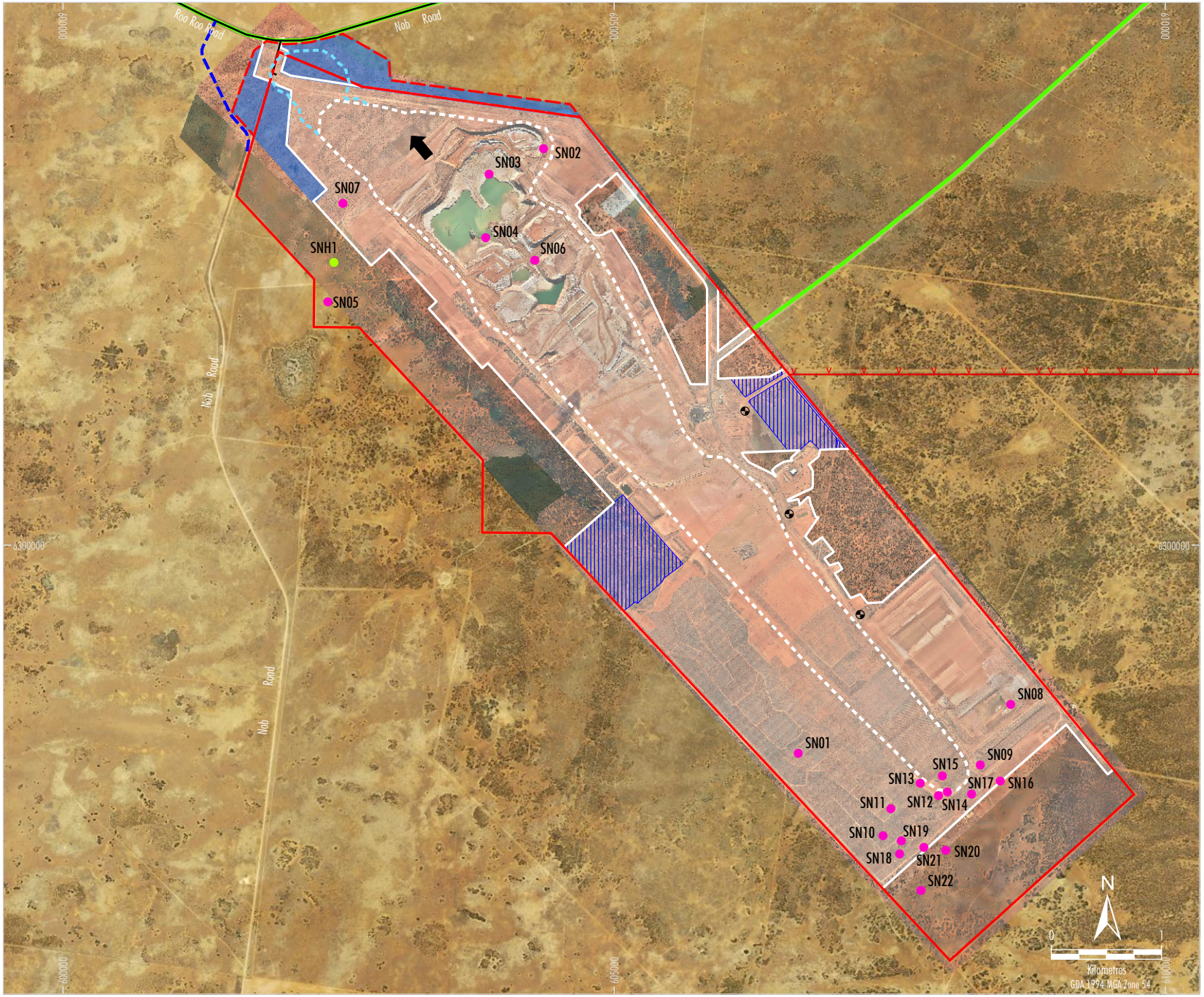
6.3.8 Burials

Aboriginal burial grounds may consist of a single interment or a suite of burials. Burials tend to be in areas of sandy soil that were easy to dig and above floodwaters. Burials are frequently located in source-bordering sand dunes, sand ridges, lunettes and levees along watercourses (Bonhomme, 1993; Hope, 1993). Knowledge of Aboriginal burial grounds is best sought from local Aboriginal communities.

6.4 PREVIOUSLY RECORDED ABORIGINAL CULTURAL HERITAGE SITES IN THE MODIFICATION AREA

There are no previously recorded Aboriginal cultural heritage sites recorded within the Modification area on the BCD Aboriginal Heritage Information Management System (AHIMS) database (AHIMS search 458515; accessed 23 October 2019; **Appendix 5**).

The closest previously recorded sites to the Modification area are 22 Aboriginal cultural heritage sites comprising ten stone artefact scatters, two scatters of stone artefacts with associated hearths, four stone quarries with associated scatters of stone artefacts, four isolated finds of stone artefacts, and two hearth sites (**Figure 7**). These were recorded by Landskape (2007) in the approved surface disturbance area, while three sites were recorded outside of the approved surface development area. The majority of these sites were located in the southern portion of the Snapper Mine, several kilometres from the Modification area (**Figure 7**).



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road
- Aboriginal Cultural Heritage Site
- Historical Cultural Heritage Site

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Aboriginal and Historic Heritage Sites

Figure 7

CMA-19-08_SNE_AppACHA_202C

7 CULTURAL HERITAGE FIELD INVESTIGATION

In accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECC, 2010b), an archaeological design and survey methodology was prepared as a key component of the cultural heritage field assessment. Details of the archaeological design and survey methodology are presented in the following sections.

7.1 OVERVIEW OF PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

The Aboriginal archaeology of the Lower Darling region is known generally from a number of studies, but very little systematic archaeological research has been undertaken in the sandplains of the Lower Darling. Archaeological surveys of developments in these areas are limited to those conducted by McIntyre (1981), Clark (1983), Witter (2001), Landskape (2003, 2007, 2010 and 2016) and Niche Environment and Heritage (2012).

Other areas in south-western NSW that have been archaeologically surveyed include the Darling River and its associated lakes (Hope, 1981; Balme and Hope, 1990; Craib, 1992; Martin *et al.*, 1994; Balme, 1995; Marshall and Smith, 1998; Pardoe and Martin, 2002; Pardoe, 2003), Murray River and Lake Victoria (Bonhomme, 1993; Hope, 1998) and the Willandra Lakes (see Johnston and Clark, 1998). Regional studies and syntheses of the archaeological record of south-western NSW include those of Allen (1974), Hope (1982) and Bonhomme Craib and Associates (1999, 2001).

Landskape has previously surveyed the Snapper Mine (Landskape, 2007; 2010) and ancillary infrastructure routes. Landskape (2007) identified 22 Aboriginal cultural heritage sites within the Snapper Mine Mining Lease (ML 1621) area. These comprised ten stone artefact scatters, two scatters of stone artefacts with associated hearths, four stone quarries with associated scatters of stone artefacts, four isolated finds of stone artefacts, and two hearth sites. The majority of these sites were recorded by Landskape (2007) in the approved surface disturbance area, while five sites were recorded outside of the approved surface development area (**Figure 7**). The majority of these sites are located in the southern portion of the Snapper Mine, several kilometres from the Modification area (**Figure 7**).

Witter (2001) identified 34 sites within the adjacent Ginkgo Mine Mining Lease (ML 1504) area, of which the majority were isolated finds of stone artefacts or heat retainers from hearths (75%, n=27). There were eight stone artefact scatters, some containing hearths, and a stone quarry and stone artefact scatter site complex.

Landskape (2003) located 13 Aboriginal archaeological sites within dunefields and sandplains traversed by the now constructed highway access road and electricity transmission line to the Ginkgo and Snapper Mines. Ten of these sites were isolated finds of stone artefacts, with two hearth sites and a stone artefact scatter with hearths also recorded.

Niche Environment and Heritage (2012) recorded seven Aboriginal cultural heritage sites within the 'Crayfish Deposit' Mining Lease (ML 1735) at the Ginkgo Mine. These comprised two stone artefact scatters, four isolated finds of stone artefacts and a culturally modified tree. All were located in a Black Box depression.

Landskape (2010; 2016) did not identify any additional items of Aboriginal cultural heritage significance within the surveyed areas at the Snapper and Ginkgo Mines.

7.2 CULTURAL HERITAGE SITE PREDICTIVE MODEL

Previous archaeological studies indicate that sandplains of the Lower Darling have a low density of cultural heritage places. Occupation sites are almost invariably located at small ephemeral water sources such as swamps and claypans (McIntyre, 1981; Clark, 1983; Witter, 2001; Landskape, 2003, 2007; Niche Environment and Heritage, 2012). The most frequently recorded Aboriginal sites in the sandplains are stone artefact scatters and hearths (OEH AHIMS site database). Isolated finds of stone artefacts and hearthstones are also represented in the archaeological record. Other Aboriginal cultural heritage site types previously identified in the Lower Darling region are shell middens, stone quarries, ceremonial and dreaming sites, trees scarred by Aboriginal people, burials, earth mounds and stone arrangements (OEH AHIMS site database).

Based on these observations of archaeological site types and their distribution and landscape setting, the following predictive model of site types and locations within the Modification area was developed prior to the survey:

- **Stone artefact scatters**, **hearth** sites and **isolated finds of stone artefacts or hearthstones** have the potential to occur within the Modification area. The density of these types of sites was predicted to be low, given the absence of nearby permanent sources of water. Open occupation sites are typically found within 500 m of water sources, so such sites are most likely to be encountered on level ground adjacent to ephemeral swamps and claypans that intermittently retain surface water following rain.
- **Stone quarry** sites have the potential to occur in the Modification area. Silcrete outcrops noted elsewhere in the Lower Darling region often occur at topographic low points in the landscape such as abandoned lake beds and playa floors (e.g. Hope, 1998; Landskape, 2003).
- **Scars made by Aboriginal people** are unlikely to occur on any of the trees in the Modification area, because River Red Gum and Black Box trees, the taxa typically scarred by Aboriginal people in the region, are absent in the study area.
- The chance of encountering **shell middens** was predicted to be negligible, as they are usually found near permanent water sources, absent from the area, as are **burial** sites. Source-bordering dunes adjacent to rivers and lakes are the landforms most likely to contain human skeletal remains.

- Although **stone arrangements** have been recorded in the Lower Darling region, they are not common and were considered unlikely to be encountered in the area. Stone arrangements tend to occur on level ground, often on elevated landforms such as floodplain terraces.

While predictive studies such as this can be expected to identify areas in which sites associated with economic or subsistence activities may be present, notably open habitation areas, other sites may fall outside such a predictive framework. For example, places associated with spiritual aspects of traditional Aboriginal society such as ceremony and dreaming sites are often located at topographically distinct or unique features, which cannot be identified from an examination of maps or other records. For this reason, it was essential that local Aboriginal communities be consulted so that sites of significance to them can be identified.

7.3 FIELD METHODOLOGY

The archaeological field survey was conducted based on the sampling strategy developed in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and Requirement 5a of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b) and outlined in Section 7.1.

The objective of the field survey was to identify places of Aboriginal cultural significance within the Modification area.

7.3.1 Personnel

The survey was completed by project archaeologist Dr Matt Cupper of Landskape over a period of one day on 5 November 2019 (**Figures 8** and **9**).



Figure 8. Survey member inspecting the Modification area.



Figure 9. Survey member inspecting the Modification area.

7.3.2 Survey Methods

The Modification area was inspected on foot by the project archaeologist. The ground surface was examined for any archaeological traces such as stone artefacts, hearths, hearthstones, shells, bones and mounds. All mature trees in the areas of proposed disturbance were inspected for scarring or carving by Aboriginal people.

Particular attention was paid to areas with high ground surface visibility such as along stock and vehicle tracks and in scalds, gullies and other eroded areas.

The project archaeologist walked across the surveyed areas in a series of closely spaced transects. These were evenly distributed over the areas of proposed disturbance and approximately 20 m apart. Due to the general openness of the landscape it was usually possible to identify likely site locations from at least 20 m and deviate from the transects to make closer inspections.

Survey units and descriptions of the visibility conditions for each survey unit are provided in **Table 1** and **Figure 10**.

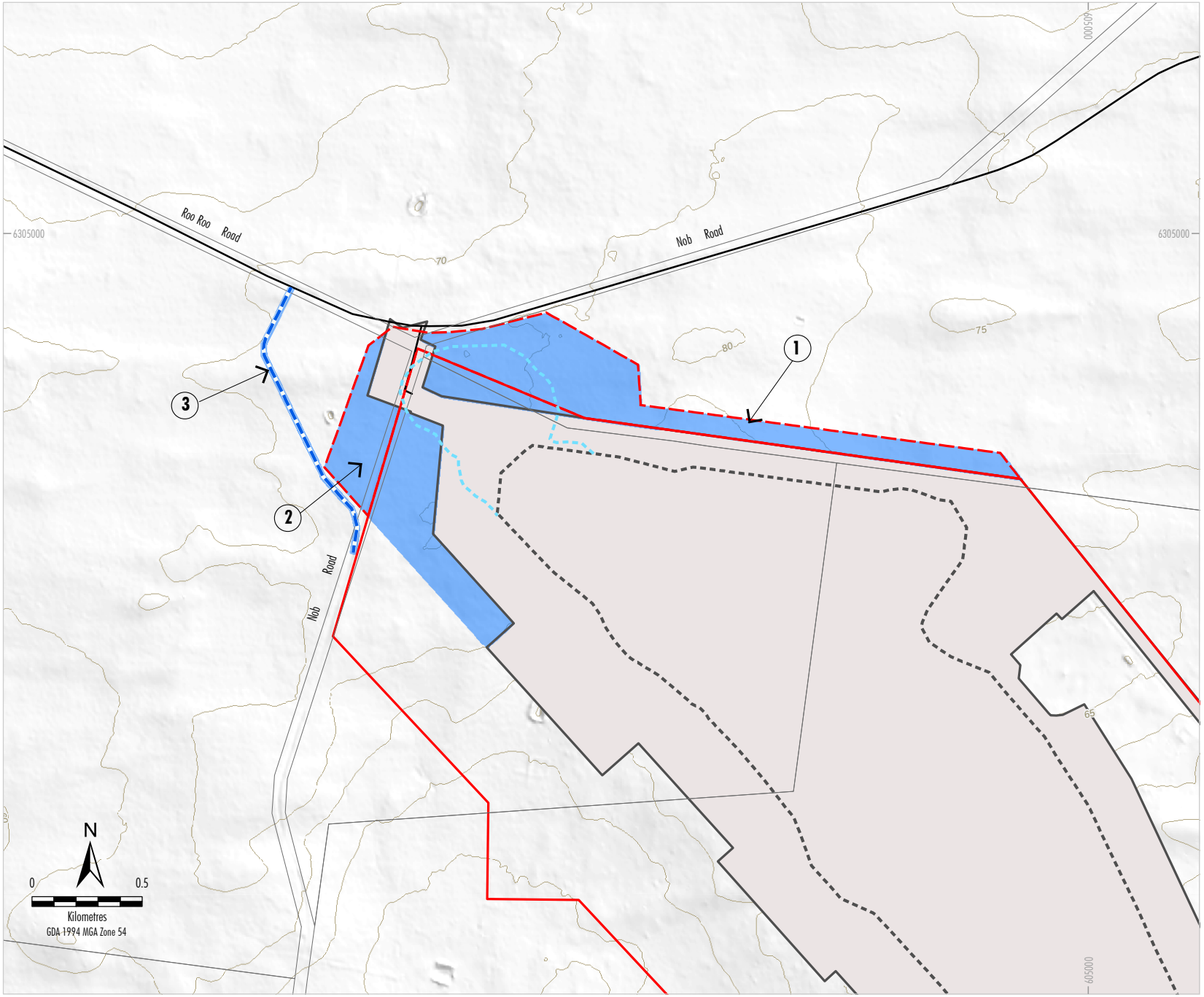
Table 1. Visibility Conditions at the Modification.

Survey Unit	Landforms	Vegetation	Exposures	Visibility	Survey Method
1	Sandplain	Derived Rosewood woodland, Bluebush low shrubland	Animal tracks, Vehicle tracks, Scalds	80 %	Pedestrian
2	Sandplain	Bluebush low shrubland, Narrow-leaved Hopbush	Animal tracks, Vehicle tracks, Scalds	80 %	Pedestrian
3	Sandplain	Bluebush low shrubland	Animal tracks, Vehicle tracks, Scalds	80 %	Pedestrian

7.4 SURVEY COVERAGE DATA

7.4.1 Conditions of Visibility

Conditions of ground surface visibility affect how many sites are located. Visibility may also skew the results of a survey. If, for example, conditions of ground surface visibility vary dramatically between different environments, then this would be reflected in the numbers of sites reported for each area. The area with the best visibility may be reported as having the most sites (because they are visible on the ground) while another area with less visibility but perhaps more sites would be reported as having very little occupation. It is important therefore to consider the nature of ground surface visibility as part of any archaeological investigation.



LEGEND

- Mining Lease Boundary (ML 1621)
- Mining Lease Application Boundary (MLA 1)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Highway Access Road
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Survey Units

Figure 10

CMA-19-08_SNE_AppACHA_203A

Conditions of ground surface visibility were typically around 80 % (**Table 1**). Grass and herbaceous plant growth was very low and the ground surface was exposed by erosion by scalding and stock and vehicular traffic (**Figures 11-14**).



Figure 11. Example of surface exposure at the Modification area.



Figure 12. Example of surface exposure at the Modification area.



Figure 13. Example of surface exposure at the Modification area.



Figure 14. Example of surface exposure at the Modification area.

7.4.2 Coverage Analysis

Coverage analysis is a useful measurement to allow cultural resource managers to assess surveys from adjacent areas and it also allows some meaningful calculation of the actual sample size surveyed. The *actual* or *effective* area surveyed by a study depends on the conditions of ground surface visibility. Conditions of surface visibility are affected by vegetation cover, geomorphic processes such as sedimentation and erosion rates and the abundance of natural rock that may obscure the remains of cultural activities.

All of the Modification area was inspected on foot. The areas covered during the survey are outlined in **Table 2** and summarised by landform in **Table 3**. Survey coverage was high, given the intensive nature of the survey.

Table 2. Coverage of the Modification Area.

Survey Unit	Landform	Area (km^2)	Coverage (km^2)	Visibility (%)	Effective Cover (km^2)	Effective Cover (%)	No. Sites
1	Sandplain	0.54	0.30	80	0.24	44	-
2	Sandplain	0.44	0.20	80	0.16	36	-
3	Sandplain	0.03	0.02	80	0.02	53	-
Total		**1.01**	**0.52**	**80**	**0.42**	**42**	**-**

Table 3. Landform Summary of Sampled Areas of the Modification Area.

Landform	Landform Area (km^2)	Area Effectively Covered (km^2)	Landform Effectively Surveyed (%)	No. Sites
Sandplain	1.01	0.42	42	-
Total	**1.01**	**0.42**	**42**	**-**

Survey unit 1 consisted of the eastern portion additional surface development area, survey unit 2 consisted of the western portion of the additional surface development area, while survey unit 3 consisted of the Nob Road realignment.

7.5 SURVEY RESULTS AND DISCUSSION

No Aboriginal cultural heritage sites were located in the Modification area, despite the intensive nature of the survey. This negative result is despite the excellent conditions of surface visibility and high survey coverage. It is attributable to the landscape setting of the Modification area, which is unlikely to contain Aboriginal cultural heritage sites.

Modified trees were not identified because no River Red Gum or Black Box, the most commonly scarred types of tree, grow in the Modification area. Nevertheless, all mature trees in the Modification were inspected. Quarry sites are also definitely not represented in the Modification area as rock outcrop is lacking. Landforms such as lunettes or source-bordering sand dunes that might contain sensitive sub-surface archaeological material such as burials do not occur in the Modification area. The sediments of the Modification area had been well enough exposed by pastoral activities, vehicular traffic and wind and water erosion to determine that no archaeological material was present on the surface nor is likely to be buried beneath the soil.

No non-Aboriginal sites were recorded in the Modification area.

7.6 IDENTIFIED ABORIGINAL CULTURAL VALUES

As described in earlier sections, this assessment has been prepared in accordance with the Consultation Guidelines (DECCW, 2010a) and the NSW *National Parks and Wildlife Regulation 2009*.

The cultural values assessment undertaken to date has been based on the following:

- review of background resources including previous archaeological investigations for the surrounding region and the approved Snapper Mine (e.g. Landskape, 2007; 2010);
- historical research;
- discussions with RAPs during past field surveys and community information sessions;
- requests for comments during the review period for the Proposed Methodology; and,
- specific meetings with RAPs upon request.

These points of consultation provided the opportunity for the Aboriginal community to have direct input into the management of Aboriginal cultural heritage values (both tangible and intangible) in the Modification area.

The RAPs did not identify any specific locations within the Modification area or wider surrounds as being of high or specific cultural significance.

8 CULTURAL HERITAGE VALUES

8.1 ABORIGINAL SOCIAL AND CULTURAL INFORMATION ABOUT THE MODIFICATION AREA

Aboriginal people of the Lower Darling region are generally concerned about any development that might impact upon Aboriginal cultural heritage and other values on land that is traditionally theirs. All land has high cultural significance for individual Aboriginal people and for the Aboriginal community collectively. It should also be noted that any development upon, or disturbance of land is contrary to principal Aboriginal beliefs regarding land, its values and its inherent cultural significance.

Aboriginal community representatives involved in this cultural heritage assessment were invited to provide specific information about the social and cultural values of the Modification area. The RAPs did not have any specific information pertaining to the Modification area regarding Aboriginal cultural heritage.

9 POTENTIAL IMPACTS OF THE MODIFICATION ON ABORIGINAL CULTURAL HERITAGE

No Aboriginal cultural heritage was identified in the Modification area, so no known Aboriginal cultural heritage sites, items or values would be potentially impacted by the Modification. The potential for previously unidentified Aboriginal cultural heritage to occur in the Modification area is however considered in Section 9.1.

In accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011), the principles of ecologically sustainable development were considered in assessing the likely harm of the Modification to Aboriginal cultural heritage sites.

9.1 POTENTIAL FOR PREVIOUSLY UNIDENTIFIED ABORIGINAL CULTURAL HERITAGE TO OCCUR IN THE MODIFICATION AREA

Although the Modification area was sufficiently surveyed, there remains the potential for Aboriginal cultural heritage sites to be located within this area (e.g. sites that may have been obscured by grass or soil at the time of survey). Such previously unidentified features, should they occur, would probably be isolated finds or low-density concentrations of stone artefacts (based on the predictive model outlined in Section 7.1 and informed by the results of the current survey, summarised in Section 7.4).

The shallow soils of the Modification area, coupled with past disturbance from pastoralism and track and fence construction, means that significant *in situ* subsurface cultural deposits are highly improbable. The Modification area does not contain culturally sensitive landforms such as lunettes or source-bordering sand dunes where subsurface Aboriginal cultural deposits (e.g. burials) have been recorded previously.

A strategy for managing any newly identified Aboriginal objects during the life of the Modification is outlined in Section 10.

9.2 FLEXIBILITY OF THE MODIFICATION DESIGN

The potential area of disturbance associated with the Modification is relatively inflexible. Engineering constraints mean that avoiding disturbance to any newly identified Aboriginal cultural heritage sites during the course of works in the Modification area would be unfeasible.

9.3 POTENTIAL CUMULATIVE IMPACTS

Given that no Aboriginal cultural heritage has been identified in the Modification, coupled with the very low potential for such heritage to occur, the Modification would not increase cumulative impacts to Aboriginal cultural heritage in the region.

10 MANAGEMENT STRATEGIES FOR CULTURAL HERITAGE

As no known Aboriginal cultural heritage sites, items or values would be impacted by the Modification, no change to the management and mitigation measures described in the original Snapper Mine Cultural Heritage Assessment (Landskape, 2007) would be required for the Modification.

10.1 GENERAL RECOMMENDATIONS

10.1.1 Heritage Management Plan

In accordance with Condition 20, Schedule 3 of the Project Approval (06_0168), a HMP (BEMAX, 2007a), which outlines the management and mitigation measures for Aboriginal cultural heritage, was previously prepared for the Snapper Mine in consultation with the Aboriginal community and the OEH (Section 4.2.1).

Subsequent to this, the Snapper Mine HMP, and the *Ginkgo Mine Aboriginal Heritage Management Plan* (BEMAX, 2006) were consolidated into one document, namely the *Murray Basin Mineral Sands Mines Cultural Heritage Management Plan* (CHMP) (GHD, 2015).

The CHMP should continue to remain active for the life of the modified Snapper Mine and define the tasks, scope and conduct of all Aboriginal cultural heritage management activities. If any newly identified Aboriginal cultural heritage sites are discovered during the course of works in the Modification area, the CHMP should be revised in consultation with the local Aboriginal community.

The measures presented below are considered best practice in the mining industry. Their effectiveness and reliability is demonstrated by their continued use and inclusion in management plans and strategies developed in consultation with the RAPs and to the satisfaction of BCD.

10.1.2 Role of the Local Aboriginal Community

Tronox is committed to involving the local Aboriginal community as an integral participant in the management of any newly identified Aboriginal cultural heritage sites discovered during the course of works in the Modification area.

The recording, collection, curation, storage and replacement of any newly identified Aboriginal objects should occur with the invited participation of local Aboriginal community representatives.

10.1.3 Site Management and Cultural Awareness Training

The effective application of the CHMP and its strategies will be dependent on an appreciation of its content and function by on-site staff and employees. Tronox should continue to provide training to all on-site personnel regarding the CHMP strategies relevant to their employment tasks.

11 SUMMARY RECOMMENDATIONS

Based on the results of this cultural heritage investigation and consultation with representatives of the RAPs the following is recommended:

- The Modification be allowed to proceed because the Modification area would be located in an area where harm to cultural heritage would be avoided;
- In the unlikely event that human skeletal remains are encountered during the course of activities associated with the Modification, all work in that area must cease. Remains must not be handled or otherwise disturbed except to prevent further disturbance. If the remains are thought to be less than 100 years old, the Police or the State Coroner's Office (tel: 02 9552 4066) must be notified. If there is reason to suspect that the skeletal remains are more than 100 years old and Aboriginal, Tronox should contact the BCD's Environmental Line (tel: 131 555) for advice. In the unlikely event that an Aboriginal burial is encountered, strategies for its management would need to be developed with the involvement of the local Aboriginal community.
- The CHMP should continue to remain active for the life of the Modified Snapper Mine and define the tasks, scope and conduct of all Aboriginal cultural heritage management activities. If any newly identified Aboriginal cultural heritage sites are discovered during the course of works in the Modification area, the CHMP should be revised in consultation with the local Aboriginal community.
- Tronox should continue to provide training to all on-site personnel regarding the CHMP strategies relevant to their employment tasks.
- Tronox should continue to involve the RAPs and any other relevant Aboriginal community groups or members in matters pertaining to the Modification.

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APPENDICES

Appendix 1 Glossary

Appendix 2 Consultation Log

Appendix 3 Correspondence to Aboriginal Community Stakeholders

Appendix 4 Correspondence from Aboriginal Community Stakeholders

Appendix 5 AHIMS Register Search

Appendix 6 Cadastre Information

APPENDIX 1: GLOSSARY

Archaeological site - A place with evidence of past human activity. This evidence may include Aboriginal and/or historic artefacts, features, structures or organic traces.

Artefact scatter - A surface scatter of Aboriginal or historic cultural material. Scatters of stone artefacts are a common archaeological site type. These scatters may also contain charcoal, discarded animal bones, shell and ochre.

Assemblage - A collection of artefacts from a single archaeological site.

Burial site - A place with a concentration of human remains. Ochre, stone tools, charcoal and grave goods may be associated with burials. Most burial sites are found in sand dunes but dead trees, caves and rock shelters were also used.

Ceremonial ground - Place that may be associated with initiation ceremonies, meetings or sacred rituals. Stone arrangements may be present, including cairns, stone circles or standing slabs of rock.

Chert - A fine-grained opaline rock ranging in colour from white to black, but most often grey, brown, greyish brown and light green to rusty red.

Core - A piece of stone from which flakes have been removed. They usually have negative flake scares that have resulted from the removal of flakes.

Cultural material - Any material remains or objects resulting from human activity.

Debitage - Any waste material including flakes and cores produced during the manufacture of chipped stone tools.

Flake - A piece of stone detached from a core that typically displays a striking platform, bulb of percussion and flake scars on the ventral surface.

Flaked piece - Small fragments of stone resulting from the manufacture of stone tools. A striking platform or bulb of percussion may not be evident.

Formalised tools - An artefact that has been deliberately shaped by flaking, retouch or grinding to produce a predetermined tool type.

Ground surface visibility - The amount of bare ground exposed, usually expressed as a percentage.

Hearth - The remains of a campfire containing charcoal, discoloured soil, and possibly, hearthstones, heat retainers or the remains of animals or shellfish cooked and consumed at the campsite.

Hearthstone – Stone cobble placed in a campfire to retain heat for cooking. The types of stone used as hearthstones in western Victoria includes calcrete and sandstone.

Heat retainer - Nodule of baked clay, thought to have been placed in campfires to retain heat for cooking.

in situ - An artefact or other feature that has not been disturbed from its original position.

Mound - Raised areas of earth ranging from 3 to 35m in diameter and from 0.5m to 2m in height. Earth oven material, stone artefacts, food refuse and the remains of hut foundations have been recovered from excavated earth mounds in the central and western parts of Victoria.

Ochre - Soft varieties of the iron oxides goethite, limonite or haematite usually coloured red or yellow and used as pigment for painting.

Quarry - An outcrop of stone or ochre where Aboriginal people have extracted the raw material for use or trade. Stone quarries are identifiable by a dense scatter of broken stone and flakes or consist of pits or hollows where material has been dug out of the ground.

Quartz – A silica mineral resistant to weathering because of its hardness. It is commonplace in the landscape as a consequence.

Quartzite - A metamorphic rock formed by the re-crystallisation of quartz.

Retouch - A stone artefact with fine, secondary flaking along one or more edges.

Scarred tree - A tree with a scar on its trunk caused by bark removal.

Shell midden - A surface scatter or heap of discarded shell often with charcoal, animal bones and stone artefacts. Middens may be found near coastlines, rivers, creeks, swamps and ancient lakes.

Silcrete - A hard, fine-grained rock composed of silica cement.

Stone feature - Cairns, rock wells, grinding groves, stone structures, fish traps and stone arrangements are examples of stone features.

Stratified deposit - Material that has been laid down over time forming a sequence of events.

Subsurface testing - A method of excavation used for detecting cultural material below the ground surface. Testing is commonly by shovel, trowel or hand auger.

Survey - An inspection of land either by foot or vehicle for the purpose of identifying archaeological sites.

Transect - A predetermined area or a path that directs the course of a survey.

APPENDIX 2: CONSULTATION LOG

DATE	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	NATURE OF CONSULTATION	TIME
20-Sep-19	Dareton Local Aboriginal Land Council, Barkandji Native Title Aboriginal Corporation, Corroboree Aboriginal Corporation, Ginninderaa Aboriginal Corporation, Mary-Ann Marton and Peggy Thomas	Phone	Tronox	No successful contact. Called with the intention of confirming the current email address and postal address on file.	11:00 AM
20-Sep-19	NTSCORP	Phone	Tronox	Called to confirm current email on file for NTSCORP contact.	11:00 AM
20-Sep-19	Dareton Local Aboriginal Land Council, Barkandji Native Title Aboriginal Corporation, Corroboree Aboriginal Corporation and Ginninderaa Aboriginal Corporation	Email	Tronox	Stage 1 letter notifying the RAPs of the Modification and to provide an opportunity to update their contact details.	3:00 PM
20-Sep-19	Mary-Ann Marton, Peggy Thomas and Wayne Webster	Mail	Tronox	Stage 1 letter notifying the RAPs of the Modification and to provide an opportunity to update their contact details.	
21-Sep-19	Tronox	Email	Krystle Carroll Elliott	Provision of updated contact details for the Ginninderra Aboriginal Corporation.	4:30 PM
23-Sep-19	Tronox	Email	Ryan Carroll Johnson	Registering their organisations (the Murra Bidgee Aboriginal Corporation) interest in the ACHA for the Modification.	2:30 PM
24-Sep-19	Tronox	Email	Jesse Carroll Johnson	Registering their organisations (the Muragadi Aboriginal Corporation) interest in the ACHA for the Modification.	3:00 PM
26-Sep-19	NSW Biodiversity and Conservation Division of the Department of Planning, Industry and Environment and the Dareton Local Aboriginal Land Council.	Email	Tronox	Notification letters detailing the RAPs that were contacted regarding the ACHA for the Modification.	4:00 PM
30-Sep-19	Dareton Local Aboriginal Land Council, Barkandji Native Title Aboriginal Corporation, Corroboree Aboriginal Corporation and Ginninderaa Aboriginal Corporation, Muragadi Aboriginal Corporation, Murra Bidgee Aboriginal Corporation	Email	Tronox	Stage 3 letter containing information regarding the proposed methodology for the Modification ACHA, the information session and field survey of the Modification area. Comments on the proposed methodology were requested by 1 November 2019.	4:00 PM
30-Sep-19	Mary-Ann Marton, Peggy Thomas and Wayne Webster	Mail	Tronox	Stage 3 letter containing information regarding the proposed methodology for the Modification ACHA, the information session and field survey of the Modification area. Comments on the proposed methodology were requested by 1 November 2019.	
8-Oct-19	Tronox	Email	James MacLeod (NTSCORP)	Requesting that any future correspondence to the Barkandji Native Title Group Aboriginal Corporation be addressed to Mr Derek Hardman (CEO).	1:45 PM
8-Oct-19	Tronox	Email	Ryan Carroll Johnson (Murra Bidgee Aboriginal Corporation)	Indicating satisfaction with the Proposed ACHA Methodology.	1:30 PM
10-Oct-19	Tronox	Mail	Wayne Webster	Returned mail (copy of Stage 3 letter) - no longer resides at address on file. No alternative contact details on file.	
1-Nov-19	Dareton Local Aboriginal Land Council	Email	Landskape	Querying whether the Dareton Local Aboriginal Land Council were going to be attending the information sessiosn and field survey.	6:30 AM
1-Nov-19	Landskape	Email	Pam Handy (Dareton Local Aboriginal Land Council)	Indictaing that the Dareton Local Aboriginal Land Council were unable to attend the information session and field survey.	9:00 AM
5-Nov-19	Registered Aboriginal Parties	Field Survey	Tronox, Landskape	A field survey of the Modification area was undertaken to allow representatives of the RAPs to inspect the area and any Aboriginal Heritage sites which may be located within or in immediate proximity to the area. No RAPs attended the field survey.	
8-Nov-19	Registered Aboriginal Parties	Email/Post	Tronox, Landskape	Copies of the draft ACHA were provided to the RAPs for review and Comment. Comments on the report were requested by Friday 12 December 2019. Hard copies only were provided to Mary-Ann Marton, Peggy Thomas and Wayne Webster.	

APPENDIX 3: CORRESPONDENCE TO ABORIGINAL COMMUNITY STAKEHOLDERS

STAGE 1 LETTERS

NOTIFICATION OF MODIFICATION

20 September 2019

Barkandji Native Title Group Aboriginal Corporation
Unit 2/17 Lockside Avenue
MILDURA VIC 3502

Attention: Jenny Wynman

Via email: Barkindjiwoman@gmail.com, cc. gtonna@ntscorp.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Wynman,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

Tronox is seeking environmental approvals under the EP&A Act for a proposed modification to the Snapper Mine (the Modification).

The Modification would include:

- extension of the approved mine path and associated supporting infrastructure (e.g. soil stockpiles) into a new Mining Lease; and
- re-alignment of a portion of Nob Road.

The Modification would change the approved surface development area at the Snapper Mine. As part of the Modification application, Tronox will be preparing an Aboriginal Cultural Heritage Assessment to identify ways to avoid or minimise potential harm to Aboriginal objects. The subject area of the Modification and any such application is depicted as the "Area of Interest" as shown on Figure 1.

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Community consultation is an important part of this process. In accordance with the requirements as set out in the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) (Consultation Guidelines) issued by the NSW Biodiversity and Conservation Division (within the NSW Department of Planning, Industry and Environment), Tronox is required to conduct a community consultation process with relevant Aboriginal people to assist in the preparation of the Aboriginal Cultural Heritage Assessment. This includes:

- Contacting various government organisations and requesting a list of any Aboriginal persons or groups who may hold cultural knowledge relevant to, or who have a right or interest in, determining the cultural heritage significance of Aboriginal objects and/or places in the "Area of Interest".
- Writing to the Aboriginal persons or groups identified by the above process to notify them of the Modification and invite them to register an interest in the community consultation process.

Due to your previous involvement with Aboriginal cultural heritage matters at the Snapper Mine and/or Ginkgo Mine, you have been automatically registered for the consultation process associated with the Modification. You do NOT need to contact Tronox to re-register for the Modification.

However, Tronox would appreciate if you could please provide updated contact details for the Modification. Could you please complete the attached form and return to Tronox via the contact details provided below.

Tronox advises that the details of any Aboriginal person or group who registers an interest in the Modification will be forwarded to the NSW Biodiversity and Conservation Division and the Dareton Local Aboriginal Land Council in accordance with Section 4.1.5 of the Consultation Guidelines, unless they specify that they do not want their details released.

Should you have any queries regarding your registration, require any further clarification, or wish to discuss the Modification further please do not hesitate to contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



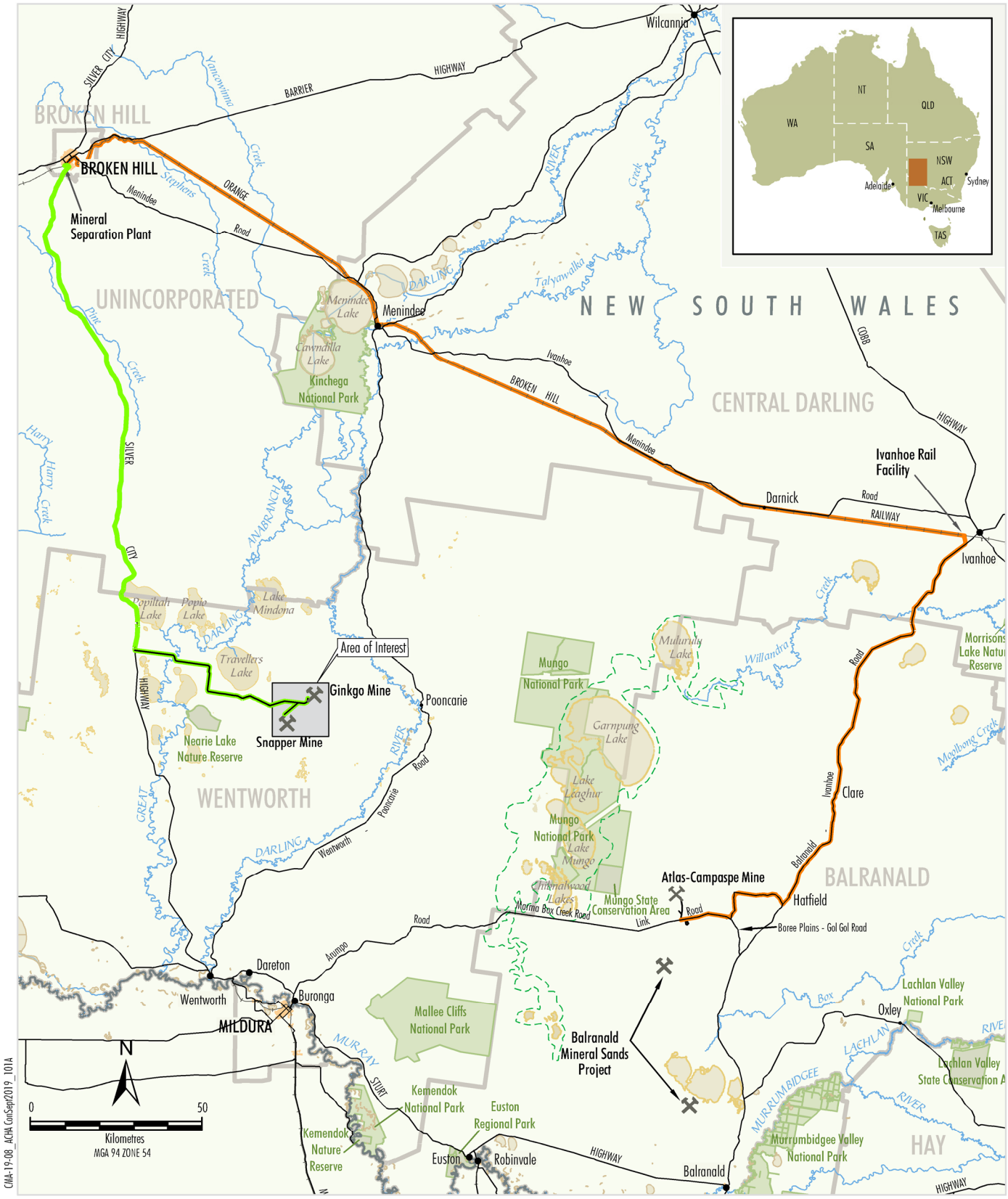
Haakon Nielssen

Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

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375-381 Benetook Avenue
MILDURA, VIC 3500, Australia

T +61 3 5025 4600 • F +61 3 5022 0100
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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:
_____

Date:
_____

20 September 2019

Dareton Local Aboriginal Land Council
14 Menindee Road
New Merinee-Namatjira Avenue
DARETON NSW 2717

Attention: Pam Handy

Via email: pam.handy@daretonlalc.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Handy,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

Tronox is seeking environmental approvals under the EP&A Act for a proposed modification to the Snapper Mine (the Modification).

The Modification would include:

- extension of the approved mine path and associated supporting infrastructure (e.g. soil stockpiles) into a new Mining Lease; and
- re-alignment of a portion of Nob Road.

The Modification would change the approved surface development area at the Snapper Mine. As part of the Modification application, Tronox will be preparing an Aboriginal Cultural Heritage Assessment to identify ways to avoid or minimise potential harm to Aboriginal objects. The subject area of the Modification and any such application is depicted as the "Area of Interest" as shown on Figure 1.

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Community consultation is an important part of this process. In accordance with the requirements as set out in the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) (Consultation Guidelines) issued by the NSW Biodiversity and Conservation Division (within the NSW Department of Planning, Industry and Environment), Tronox is required to conduct a community consultation process with relevant Aboriginal people to assist in the preparation of the Aboriginal Cultural Heritage Assessment. This includes:

- Contacting various government organisations and requesting a list of any Aboriginal persons or groups who may hold cultural knowledge relevant to, or who have a right or interest in, determining the cultural heritage significance of Aboriginal objects and/or places in the "Area of Interest".
- Writing to the Aboriginal persons or groups identified by the above process to notify them of the Modification and invite them to register an interest in the community consultation process.

Due to your previous involvement with Aboriginal cultural heritage matters at the Snapper Mine and/or Ginkgo Mine, you have been automatically registered for the consultation process associated with the Modification. You do NOT need to contact Tronox to re-register for the Modification.

However, Tronox would appreciate if you could please provide updated contact details for the Modification. Could you please complete the attached form and return to Tronox via the contact details provided below.

Tronox advises that the details of any Aboriginal person or group who registers an interest in the Modification will be forwarded to the NSW Biodiversity and Conservation Division and the Dareton Local Aboriginal Land Council in accordance with Section 4.1.5 of the Consultation Guidelines, unless they specify that they do not want their details released.

Should you have any queries regarding your registration, require any further clarification, or wish to discuss the Modification further please do not hesitate to contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



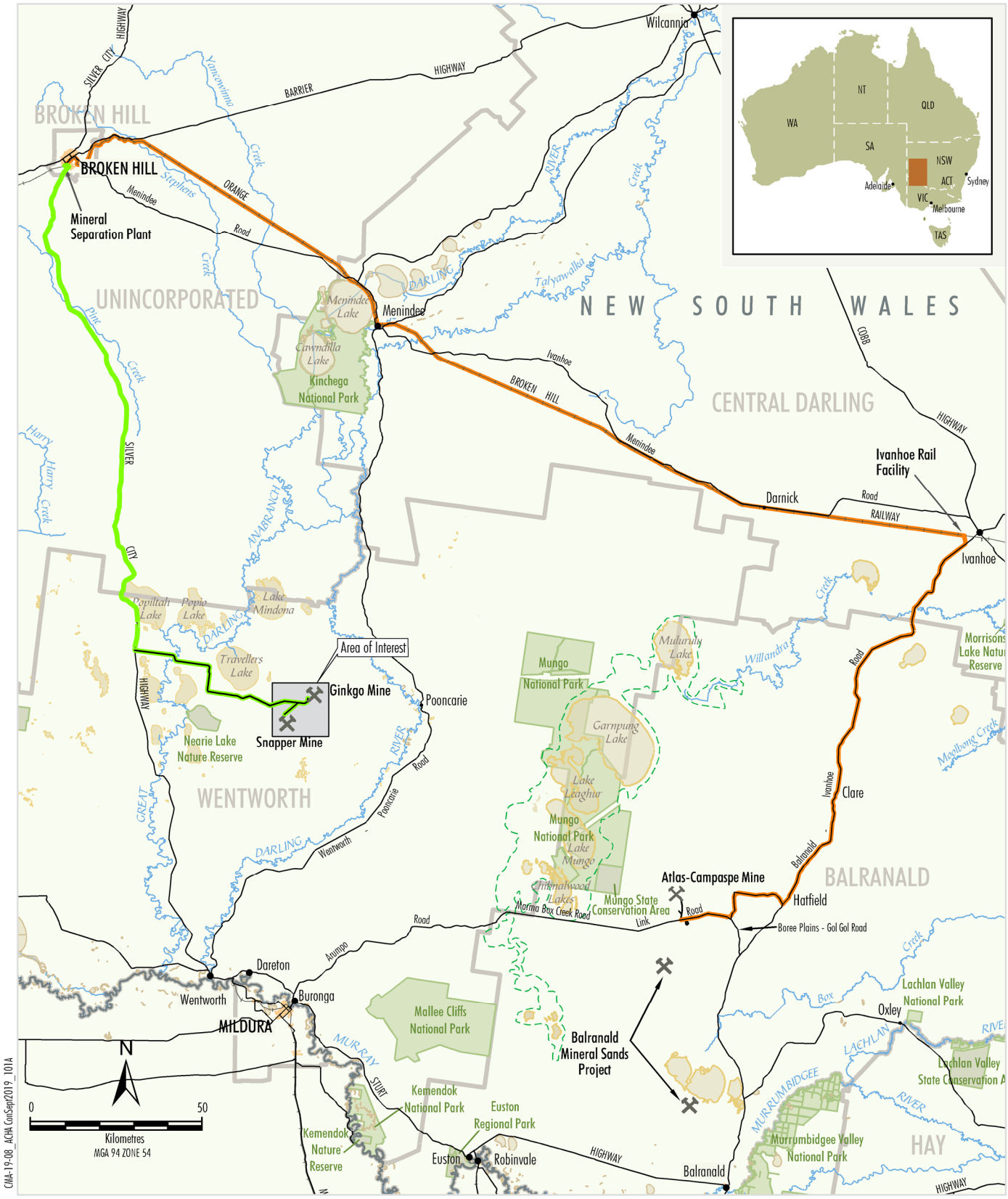
Haakon Nielssen

Manager Environment AUS-Murray Basin

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:

_____

Date:

_____

TRONOX

20 September 2019

Corroboree Aboriginal Corporation
PO Box 3340
ROUSE HILL NSW 2155

Attention: Steve Johnson

Via email: corroboreecorp@bigpond.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Johnson,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

Tronox is seeking environmental approvals under the EP&A Act for a proposed modification to the Snapper Mine (the Modification).

The Modification would include:

- extension of the approved mine path and associated supporting infrastructure (e.g. soil stockpiles) into a new Mining Lease; and
- re-alignment of a portion of Nob Road.

The Modification would change the approved surface development area at the Snapper Mine.

As part of the Modification application, Tronox will be preparing an Aboriginal Cultural Heritage Assessment to identify ways to avoid or minimise potential harm to Aboriginal objects. The subject area of the Modification and any such application is depicted as the “Area of Interest” as shown on Figure 1.

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Due to your previous involvement with Aboriginal cultural heritage matters at the Snapper Mine and/or Ginkgo Mine, you have been automatically registered for the consultation process associated with the Modification. You do NOT need to contact Tronox to re-register for the Modification.

However, Tronox would appreciate if you could please provide updated contact details for the Modification. Could you please complete the attached form and return to Tronox via the contact details provided below.

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Should you have any queries regarding your registration, require any further clarification, or wish to discuss the Modification further please do not hesitate to contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



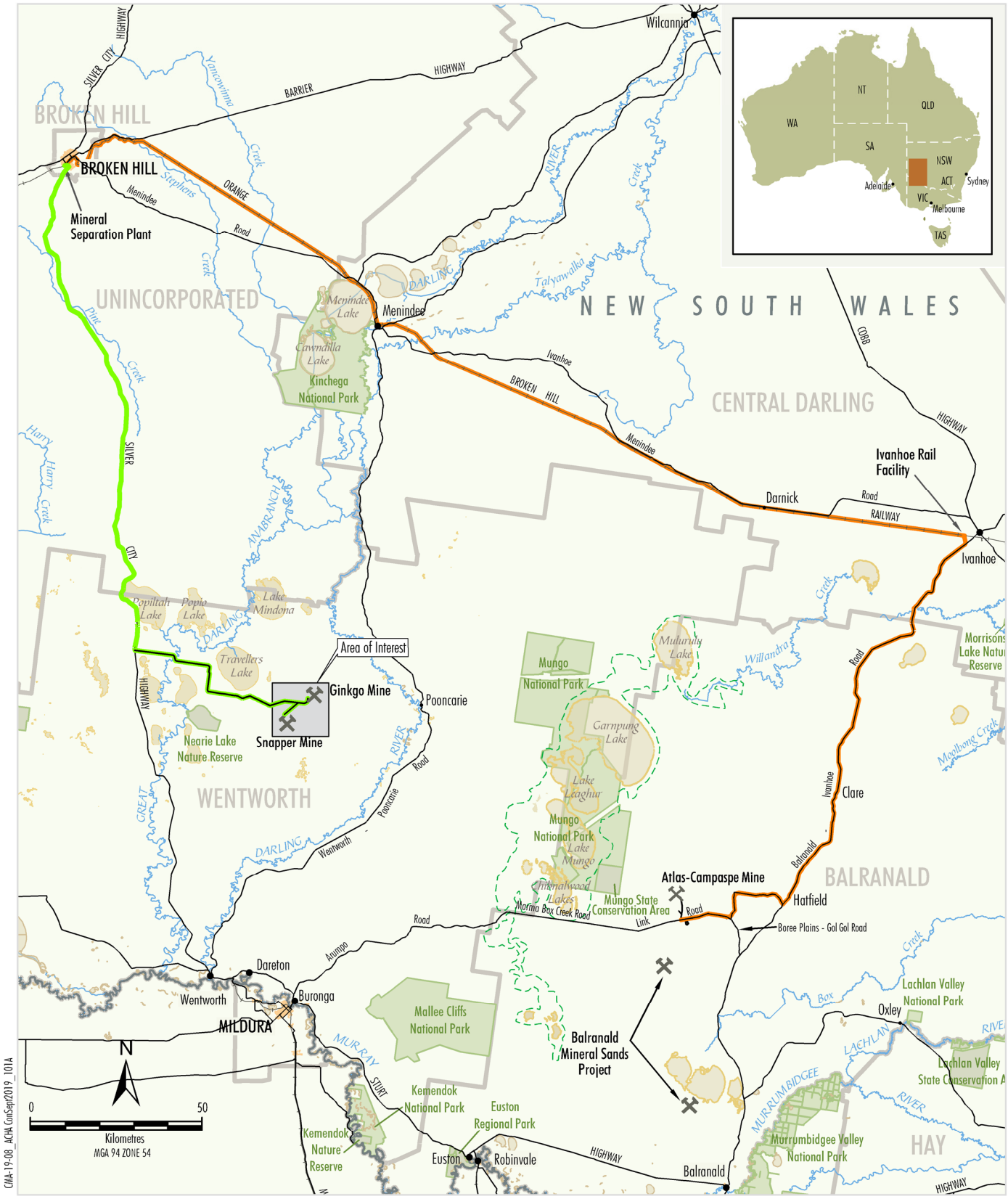
Haakon Nielssen

Manager Environment AUS-Murray Basin

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:
_____

Date:
_____

TRONOX

20 September 2019

Ginninderra Aboriginal Corporation
PO Box 3340
ROUSE HILL NSW 2155

Attention: Lisa Green

Via email: ginninderra.corp@gmail.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Green,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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As part of the Modification application, Tronox will be preparing an Aboriginal Cultural Heritage Assessment to identify ways to avoid or minimise potential harm to Aboriginal objects. The subject area of the Modification and any such application is depicted as the “Area of Interest” as shown on Figure 1.

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Due to your previous involvement with Aboriginal cultural heritage matters at the Snapper Mine and/or Ginkgo Mine, you have been automatically registered for the consultation process associated with the Modification. You do NOT need to contact Tronox to re-register for the Modification.

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Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



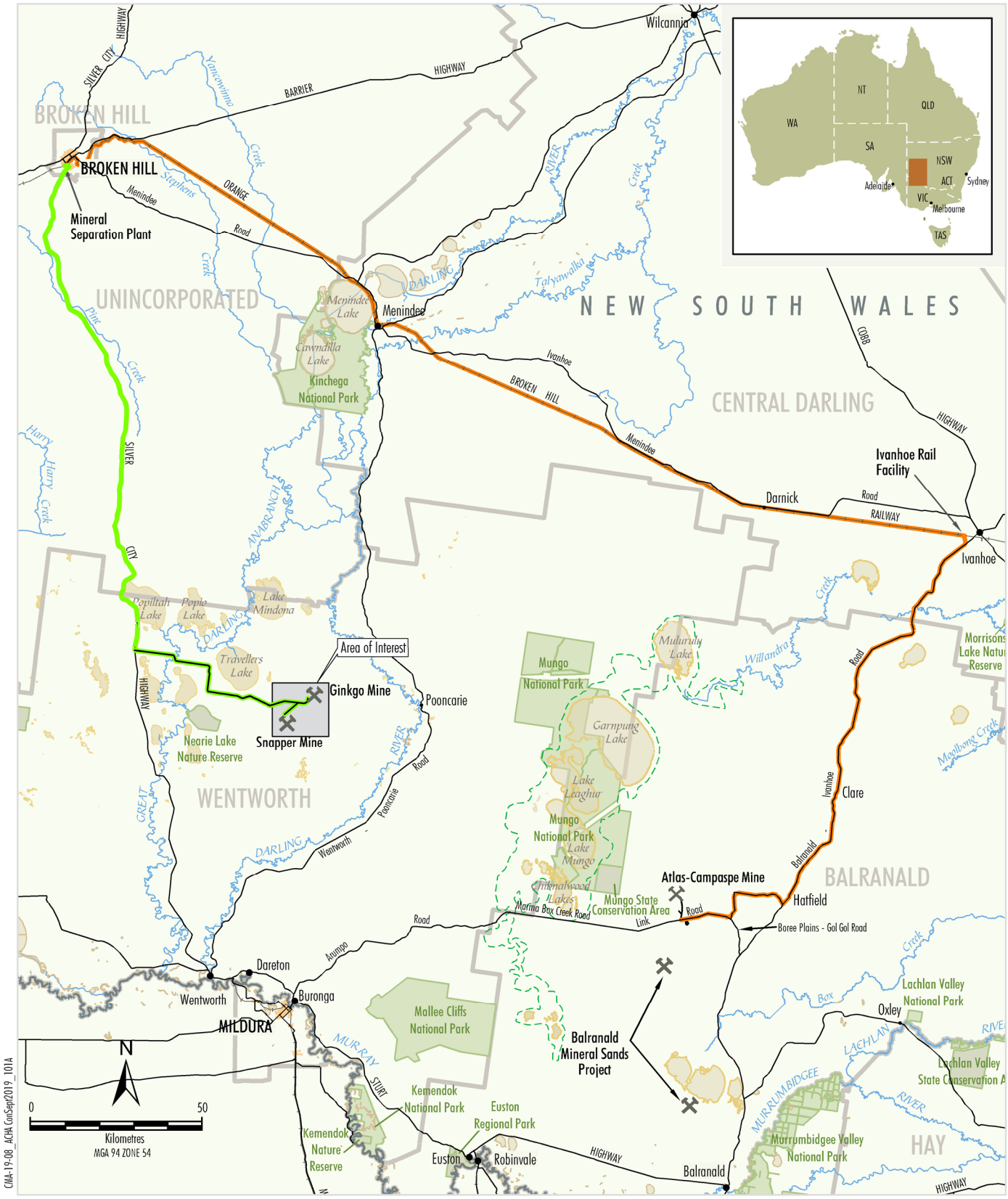
Haakon Nielssen

Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

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375-381 Benetook Avenue
MILDURA, VIC 3500, Australia

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:

_____

Date:

_____

TRONOX

20 September 2019

Mary-Ann Marton
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Marton,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

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Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



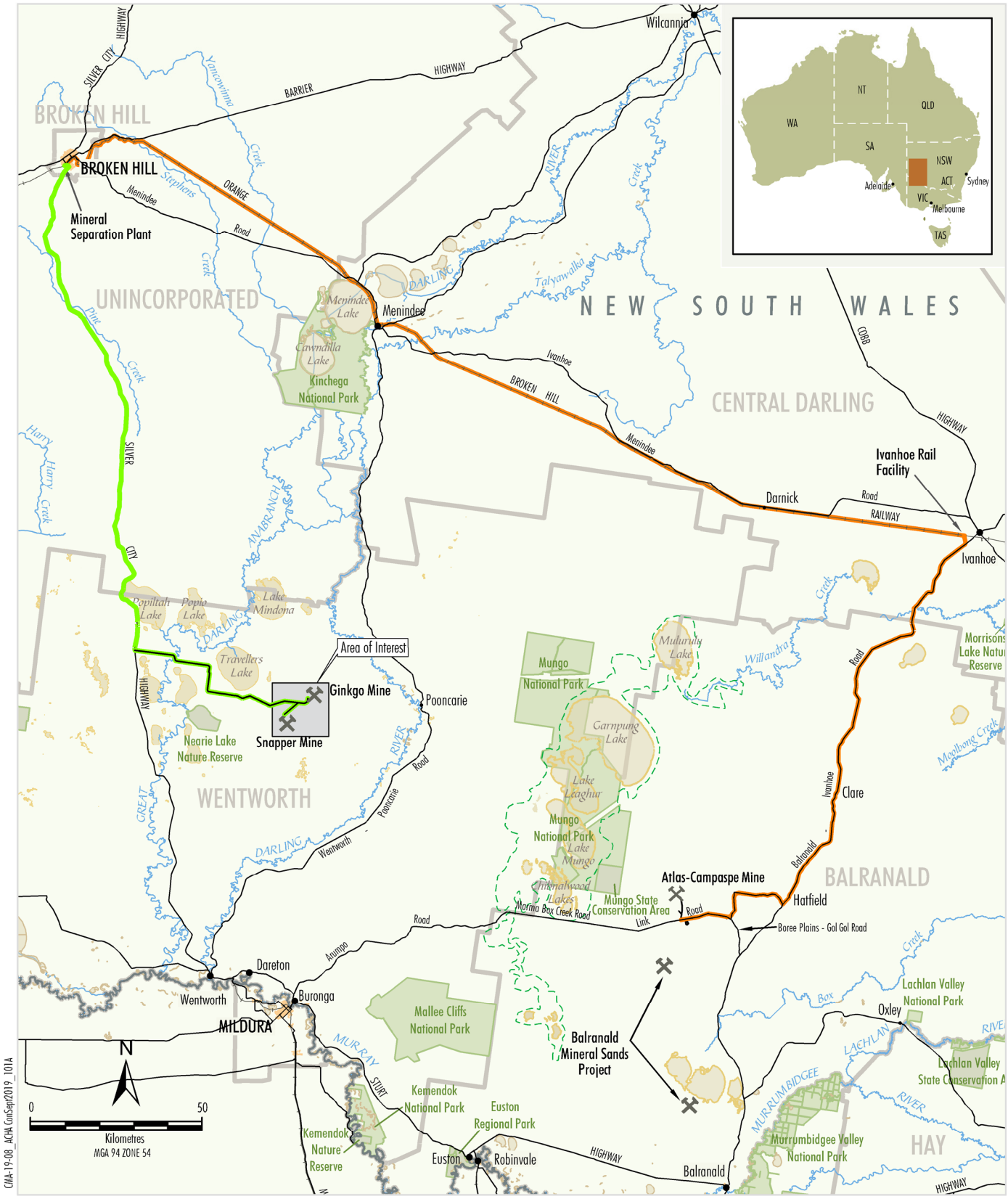
Haakon Nielssen

Manager Environment AUS-Murray Basin

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:

_____

Date:

_____

TRONOX

20 September 2019

Peggy Thomas
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Thomas,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



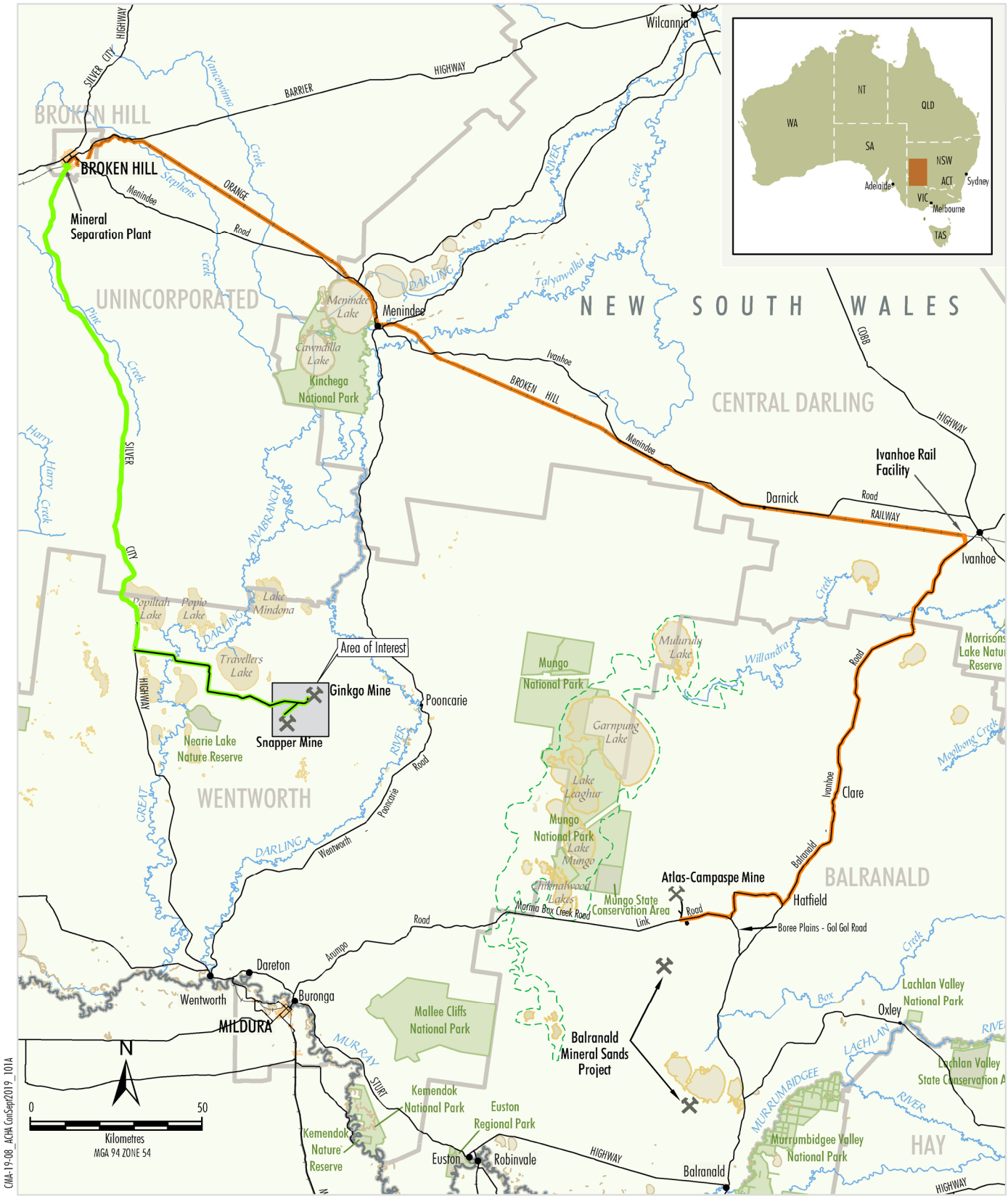
Haakon Nielssen

Manager Environment AUS-Murray Basin

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
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- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:

_____

Date:

_____

TRONOX

20 September 2019

Wayne Webster
331 Morgan Lane
BROKEN HILL NSW 2880

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Webster,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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- extension of the approved mine path and associated supporting infrastructure (e.g. soil stockpiles) into a new Mining Lease; and
- re-alignment of a portion of Nob Road.

The Modification would change the approved surface development area at the Snapper Mine. As part of the Modification application, Tronox will be preparing an Aboriginal Cultural Heritage Assessment to identify ways to avoid or minimise potential harm to Aboriginal objects. The subject area of the Modification and any such application is depicted as the “Area of Interest” as shown on Figure 1.

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Community consultation is an important part of this process. In accordance with the requirements as set out in the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) (Consultation Guidelines) issued by the NSW Biodiversity and Conservation Division (within the NSW Department of Planning, Industry and Environment), Tronox is required to conduct a community consultation process with relevant Aboriginal people to assist in the preparation of the Aboriginal Cultural Heritage Assessment. This includes:

- Contacting various government organisations and requesting a list of any Aboriginal persons or groups who may hold cultural knowledge relevant to, or who have a right or interest in, determining the cultural heritage significance of Aboriginal objects and/or places in the "Area of Interest".
- Writing to the Aboriginal persons or groups identified by the above process to notify them of the Modification and invite them to register an interest in the community consultation process.

Due to your previous involvement with Aboriginal cultural heritage matters at the Snapper Mine and/or Ginkgo Mine, you have been automatically registered for the consultation process associated with the Modification. You do NOT need to contact Tronox to re-register for the Modification.

However, Tronox would appreciate if you could please provide updated contact details for the Modification. Could you please complete the attached form and return to Tronox via the contact details provided below.

Tronox advises that the details of any Aboriginal person or group who registers an interest in the Modification will be forwarded to the NSW Biodiversity and Conservation Division and the Dareton Local Aboriginal Land Council in accordance with Section 4.1.5 of the Consultation Guidelines, unless they specify that they do not want their details released.

Should you have any queries regarding your registration, require any further clarification, or wish to discuss the Modification further please do not hesitate to contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



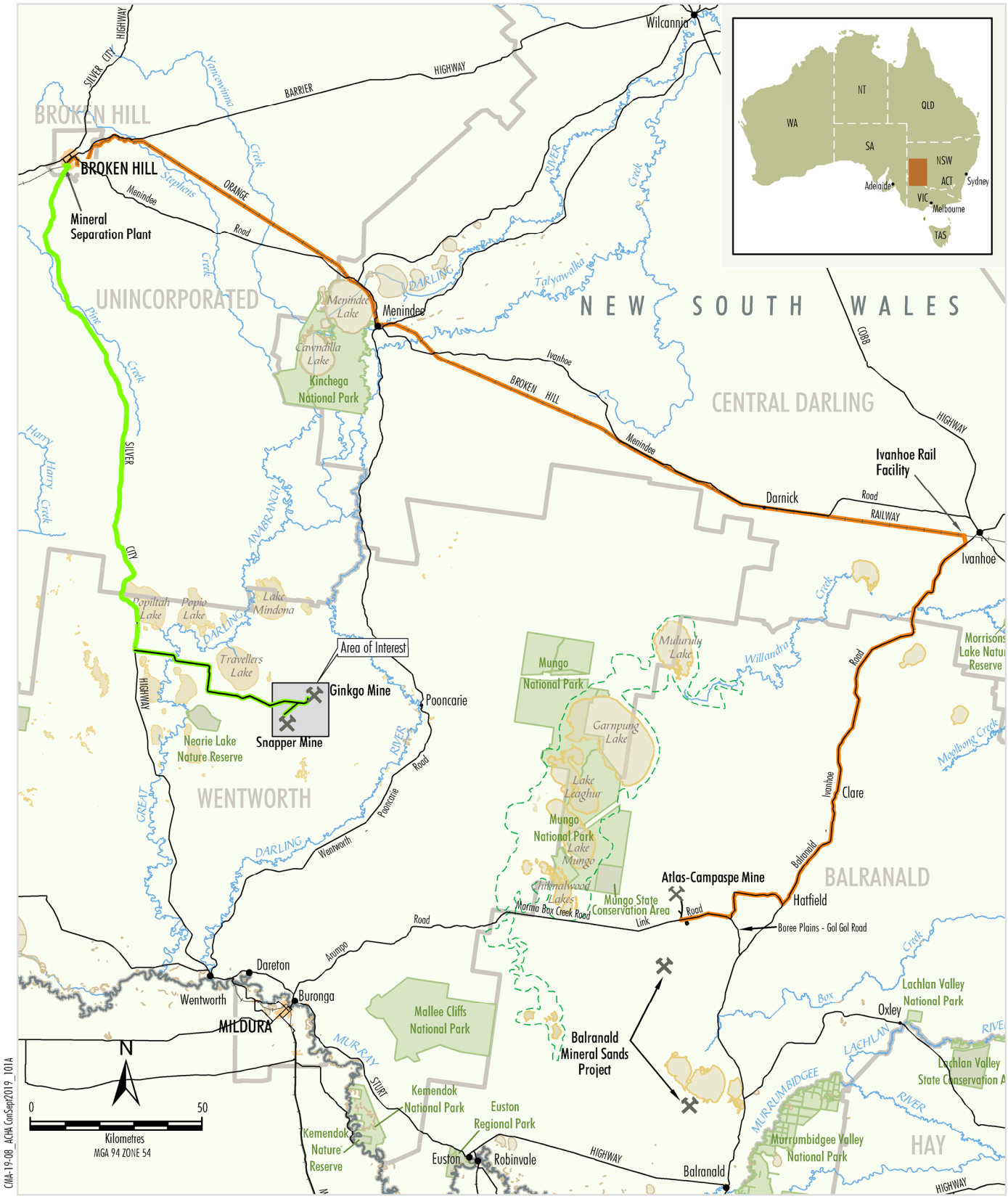
Haakon Nielssen

Manager Environment AUS-Murray Basin

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LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Area of Interest
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

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SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

SNAPPER NORTHERN EXTENSION MODIFICATION
UPDATED CONTACT DETAILS

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Name	
Registered Aboriginal Party (if different from above)	
Address	
Postal Address (if different from above)	
Telephone Number	
Email Address	

Signed:

_____

Date:

_____

STAGE 2/3 LETTERS

MODIFICATION INFORMATION AND PROPOSED METHODOLOGY

TRONOX

30 September 2019

Barkandji Native Title Group Aboriginal Corporation
Unit 2/17 Lockside Avenue
MILDURA VIC 3502

Attention: Jenny Wynman

Via email: Barkindjiwoman@gmail.com, cc. gtonna@ntscorp.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Wynman,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

If you wish to provide input on the following, please provide feedback to Tronox (via the contact details provided at the end of this letter) by **5:00 pm Friday 1 November 2019**:

- The nature of the Proposed Methodology.
- Any Aboriginal objects or places of cultural value within the Modification area, or issues of cultural significance, that you are aware of.

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- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

All comments received will be taken into consideration as the Methodology is finalised.

Information Session

An information session with all Registered Aboriginal Parties, the consulting archaeologist and Tronox representatives will be held on **Tuesday 5 November 2019** to discuss the Modification and the Proposed Methodology. The information session will be held at the Ginkgo Mine Administration Building (Nob Road, Pooncarrie), and will commence at 8:00 am and conclude at approximately 9:00 am. Note that the proposed field survey (described below) will be held following the information session.

At the information session, Tronox will provide a presentation on the nature and scale of the Modification, an overview of the impact assessment process and will discuss the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information.

The information session will also provide Registered Aboriginal Parties with an opportunity to raise any cultural issues or comments/perspectives regarding the Modification or the Proposed Methodology. Note that issues can also be raised at any point during the consultation process.

Light refreshments and drinks will be provided.

Tronox will pay out of pocket travel expenses for Aboriginal representatives, from their home address to the meeting location and return (note that Tronox will pay 75 cents per kilometre, up to a maximum of $300 per Registered Aboriginal Party). Registered Aboriginal Parties seeking to claim payment will need to provide proof of transport and sign a payment declaration form.

Tronox will arrange for payment to be made via direct deposit after the meeting. Bank account details must be supplied to Tronox (with confirmation of details from the bank and/or the Registered Aboriginal Party prior to payment). However, please note that Tronox will not be paying for attendance at the information session.

Can you please indicate whether you are interested in attending the information session by **5:00 pm Wednesday 23 October 2019** via the contact details provided below.

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Field Survey

As part of the Aboriginal Cultural Heritage Assessment for the Modification, Tronox will be facilitating a field survey of the Modification area, to allow representatives of the Registered Aboriginal Parties to inspect the area and any Aboriginal heritage sites which may be located within or in immediate proximity to the area.

Regardless of participation in the surveys, all Registered Aboriginal Parties will be invited by Tronox to attend a site inspection of the Modification area and a selection of the recorded sites following completion of the field surveys.

Please find enclosed the survey application form for completion and return by **5:00 pm Wednesday 23 October 2019**, for those Registered Aboriginal Parties who are seeking consideration for paid involvement in the field investigation associated with the Modification.

In order to be considered for paid involvement in the field surveys, Registered Aboriginal Parties will need to complete the attached Field Survey Application Form (Enclosure B) and provide it to Tronox by the closing date.

Tronox will pay Aboriginal representatives selected for participation in the field survey a **set amount of $450**. Tronox will arrange for payment to be made via direct deposit after the field survey. Bank account details must be supplied to Tronox (with confirmation of details from the bank and/or the Registered Aboriginal Party prior to payment).

Aboriginal representatives will be selected by Tronox based upon the merits of the application with respect to the selection criteria, which are indicated by the questions in the application form. Applications will be assessed against all criteria including cultural knowledge of the Modification area, the representation of others within the community and experience in providing cultural heritage advice.

Where a response is not received by 5:00 pm Wednesday 23 October 2019, it will be assumed that you do not wish to seek consideration for paid involvement in the field investigation. Incomplete applications may not be accepted by Tronox. Please note that Tronox reserves the right to request any further information/clarification or supporting documentation from you in respect to your application.

Assistance in the completion of the application form can be provided to you upon request. Please use the contact details provided below.

The field survey is expected to take place from **9:30 am Tuesday 5 November 2019** (i.e. following the Information Session). Further details will be provided to the successful applicants as soon as possible.

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Contact Details

To provide any feedback with respect to the Proposed Methodology and/or to indicate your attendance at the information session, please contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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SNAPPER MINE NORTHERN EXTENSION MODIFICATION

PROPOSED METHODOLOGY
FOR THE
ABORIGINAL CULTURAL HERITAGE ASSESSMENT



SEPTEMBER 2019
Project No. CMA-19-08
Document No. 999118

1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2007.

The Snapper Mine operations integrate with the following Tronox mineral sands mining and processing operations located in the Murray-Darling Basin, in western NSW (Figure 1):

- Broken Hill Mineral Separation Plant (MSP) – located approximately 170 km north-west of the Snapper Mine;
- Ginkgo Mine – located approximately 10 km to the north-east of the Snapper Mine; and
- Atlas-Campaspe Mine (not yet commenced) – located approximately 105 km south-east of the Snapper Mine

1.1 Approved Snapper Mine

The main activities associated with the Snapper Mine include:

- clearance of vegetation and stripping of soils on a campaign basis ahead of the advancing mine operation;
- overburden stripping, slurrying and direct placement;
- predominantly dredge mining of ore by a conventional floating bucket wheel dredge located in the dredge pond;
- ore concentration in the primary gravity concentration unit to produce heavy mineral concentrate (HMC);
- stockpiling of HMC;
- HMC separation via the WHIMS circuit either at the Snapper Mine or at the MSP, to produce three types of mineral concentrates (i.e. ilmenite-rich, leucoxene-rich and non-magnetic [rutile-rich and zircon-rich] concentrates);
- transport of HMC and/or mineral concentrates to the MSP;
- placement of wastes from the primary gravity concentration unit (i.e. sand residues) at the rear of the dredge pond as mining advances;
- transport and placement of backloaded process waste from the MSP;
- replacement of overburden on top of sand residues; and
- staged replacement of soils and progressive rehabilitation.

1.1 Northern Extension Modification

Tronox proposes to modify Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act. The Modification would include:

- extension of the approved mine path and associated supporting infrastructure (e.g. soil stockpiles) into a new Mining Lease;
- approved surface development areas no longer required for the Snapper Mine operations will be foregone (i.e. they will no longer be able to used for Snapper Mine operations) resulting in a net reduction in surface development area; and
- re-alignment of a local road.

The indicative location of additional surface development areas associated with the Modification are shown on Figure 2.

Tronox are seeking to engage with the Aboriginal community as part of the preparation for an Aboriginal Cultural Heritage Assessment (ACHA). Consultation with Aboriginal people and communities will be guided by the NSW Office of Environmental and Heritage's (OEH) *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water [DECCW], 2010).

1.2 Structure of this Document

Section 2 of this document describes the previous archaeological investigations undertaken for the Snapper and Ginkgo Mines, while Section 3 outlines the Proposed Methodology for the cultural and archaeological assessment of Aboriginal objects, places and/or Aboriginal cultural heritage values within the Modification area.

Section 4 outlines the sensitive cultural information management protocol and Section 5 provides further information on the preparation of the ACHA report. Relevant personnel and critical timeframes for the assessment are outlined in Sections 6 and 7, respectively.

2 PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

Two Cultural Heritage Assessments have been undertaken for the Snapper Mine to date (Landskape, 2007; 2010). The survey undertaken for Snapper Mine Environmental Assessment by Landskape (2007) identified 22 Aboriginal cultural heritate sites within or surrounding the Snapper Mine (Figure 2). Of these sites, 10 were scatters of stone artefacts, four were stone quarries with associated scatters of stone artefacts, four were isolated finds of stone artefacts, two were scatters of stone artefacts with associated hearths and two were hearth sites (Landskape, 2007).

The 2010 Cultural Heritage Assessment for the Snapper Mine did not record any additional Aboriginal cutlural heritage sites (Landskape, 2010).

In addition to the above, Aboriginal heritage assessments have been undertaken for the Ginkgo Mine (located approximately 10 km north-east of the Snapper Mine) in 2001, 2003, 2012 and 2016 by Witter (2001), Landskape (2003; 2016) and Niche Environment and Heritage (2012). These surveys recorded Aboriginal heritage sites within and surrounding the Ginkgo Mine, however none are located in close proximity to the Snapper Mine.

3 PROPOSED ASSESSMENT METHODOLOGY

The Proposed Methodology for the cultural and archaeological assessment for the ACHA is as follows:

- Conduct a desktop assessment to delineate areas of known and predicted Aboriginal objects, places and/or Aboriginal cultural heritage values, including a detailed review of the previous assessments prepared by Landskape (2007; 2010).
- Identify the Aboriginal cultural heritage values associated with the relevant area through consulting with Aboriginal people with cultural knowledge or responsibilities for Country in which the Modification occurs, utilising written, oral research and field investigations.
- The conduct of a cultural and archaeological assessment with representatives of the local Aboriginal community, to identify Aboriginal objects, places and/or Aboriginal cultural heritage values. The field investigation would be carried out by the project archaeologist with the assistance of Aboriginal representatives.
- Record/document any Aboriginal objects, places and/or Aboriginal cultural heritage values within the relevant area and assessment of their significance with representatives of the Registered Aboriginal Parties (RAPs).
- In consultation with the RAPs, develop recommended management and mitigation measures for Aboriginal objects, places and/or Aboriginal cultural heritage values, including documentation (where relevant) of previous management and mitigation measures described for the approved Snapper Mine (Landskape, 2007; 2010).
- Provide a consideration of the potential impacts of the Modification on Aboriginal objects, places and/or Aboriginal cultural heritage values within the Modification area.
- Describe and justify the outcomes and alternatives.
- Document the Aboriginal cultural heritage impact assessment and the recommendations to minimise potential impacts on Aboriginal cultural heritage.
- Provide a copy of the draft ACHA to the RAPs for their review and feedback.
- Documentation of feedback received as part of the cultural assessment from RAPs for presentation in the final ACHA report (subject to the sensitivity of the information provided).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010), Tronox requests that RAPs provide, where relevant during the conduct of the ACHA, cultural information regarding:

- whether there are any Aboriginal sites/objects of cultural value to Aboriginal people in the relevant area or surrounds; and
- whether there are any places of cultural value to Aboriginal people in the relevant area or surrounds.

This may include places of social, spiritual and cultural value, historic places with cultural significance, and potential places/areas of historic, social, spiritual and/or cultural significance.

4 SENSITIVE CULTURAL INFORMATION – MANAGEMENT PROTOCOL

In the event that a RAP has sensitive or restricted public access information, it is proposed that Tronox would manage this information (if provided by the Aboriginal community) in accordance with a sensitive cultural information management protocol.

It is anticipated that the protocol would include making note of and managing the material in accordance with the following key limitations/requirements as advised by the relevant RAP at the time of the information being provided:

- any restrictions on access to the material;
- any restrictions on communication of the material;
- any restrictions on the location/storage of the material;
- any cultural recommendations on handling the material;
- any contextual information;
- any names and contact details of persons authorised by the relevant Aboriginal party to make decisions concerning the Aboriginal material and the degree of authorisation;
- any details of any consent given in accordance with customary law;
- the level of confidentiality to be accorded to the material; and
- any access and use by the RAP, of the cultural information in the material.

All RAPs should be aware of the mandatory requirement that all feedback provided must be documented in the final ACHA (DECCW, 2010), including copies of any submissions received and the proponents response to the issues raised.

5 ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Following consultation on the Proposed Methodology of the cultural and archaeological assessment, and undertaking any required field components, a draft ACHA report will be prepared. The draft ACHA will be provided to all RAPs for their review and comment, and will include:

- details of the Aboriginal objects, places and/or Aboriginal cultural heritage values within the Modification area and how they will be impacted by the Modification;
- details of the consultation undertaken and how comments received at various times were considered; and
- management and mitigation recommendations drawing on information provided by RAPs and the results of the cultural and archaeological assessments.

6 PERSONNEL

Project Archaeologist: Dr Matt Cupper would be the project archaeologist. Matt has a wide range of experience in cultural and natural heritage management and an academic background in archaeology, geology and botany, including a PhD in the palaeoecology and early Aboriginal occupation of the Darling River. His particular area of expertise is the interaction of Aboriginal people and arid ecosystems in the interior of Australia. As a consultant archaeologist he has been engaged in many management and research-oriented studies of the Murray Darling Basin for industry and government. These have included investigation of the cultural heritage of the dunefields of western NSW for petroleum and mineral sands developments (including the Snapper Mine), and archaeological surveys of water supply and irrigation infrastructure along the Lachlan, Murray and Darling Rivers.

Aboriginal Field Representatives: It is anticiapted that Aboriginal field representatives would be engaged by Tronox for the duration of the cultural heritage field survey (although this number may be subject to change based on the extent of the area requiring survey or due to workplace health and safety constraints). Aboriginal field representatives (including community leaders and Elders attending community consultation meetings) would invoice and, where appropriate, negotiate with Tronox directly in relation to engagement for the field surveys. Aboriginal field personnel may be engaged on a rotational basis (e.g. a different team of representatives each day) as required.

7 CRITICAL TIMEFRAMES

Critical timeframes for the ACHA are outlined below:

1. Collation of cultural significant information – ongoing throughout process until the end of the draft ACHA review period.
2. Provision of comments on the Proposed Methodology to Tronox – to 31 October 2019.
3. Field survey – anticipated to occur in November 2019 (noting that survey dates will be confirmed with relevant representatives of the RAPs as required).
4. Provision of a draft ACHA (including proposed management and mitigation measures) to RAPs for review and comment – anticipated to occur in early November 2019 (following field survey).
5. Provision of comments from RAPs on draft ACHA to Tronox – anticipated to occur in November 2019.
6. Finalise ACHA in consideration of comments received – November/December 2019.

8 REFERENCES

Department of Environment, Climate Change and Water (2010) *Aboriginal cultural heritage consultation requirements for proponents 2010*.

Landskape (2003) *Archaeological and Aboriginal heritage survey: modified proposed ancillary infrastructure, Ginkgo Mineral Sands Project*. Report for BEMAX Resources NL.

Landskape (2007) *Snapper Mineral Sands Project Cultural Heritage Assessment.* Report to BEMAX Resources Limited.

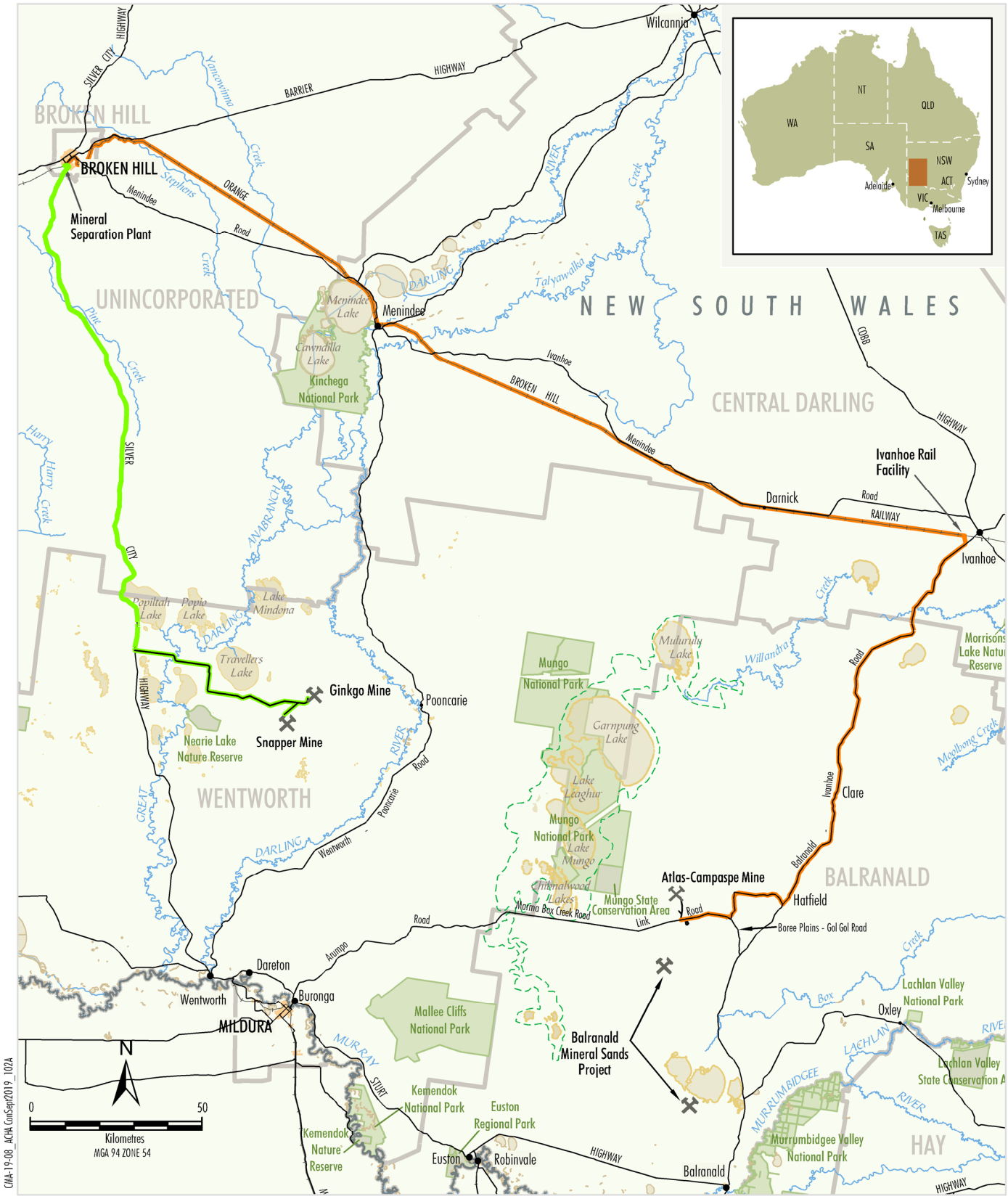
Landskape (2010) *Snapper Mine Modification Aboriginal Cultural Heritage Assessment.* Report to BEMAX Resources Limited.

Landskape (2016) *Ginkgo Mineral Sands Mine Southern Extension Modification Aboriginal Cultural Heritage Assessment.* Report prepared for Cristal Mining Australia Limited.

Niche (2012) *Aboriginal Cultural Heritage Assessment Report Ginkgo Mineral Sands Modification Project "Crayfish Deposit".* Report prepared for Cristal Mining Australia Limited.

Witter, D.C. (2001) *Ginkgo Mineral Sands Project: Archaeological and Aboriginal Heritage Assessment.* Report for BEMAX Resources NL.

FIGURES



LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: © NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)

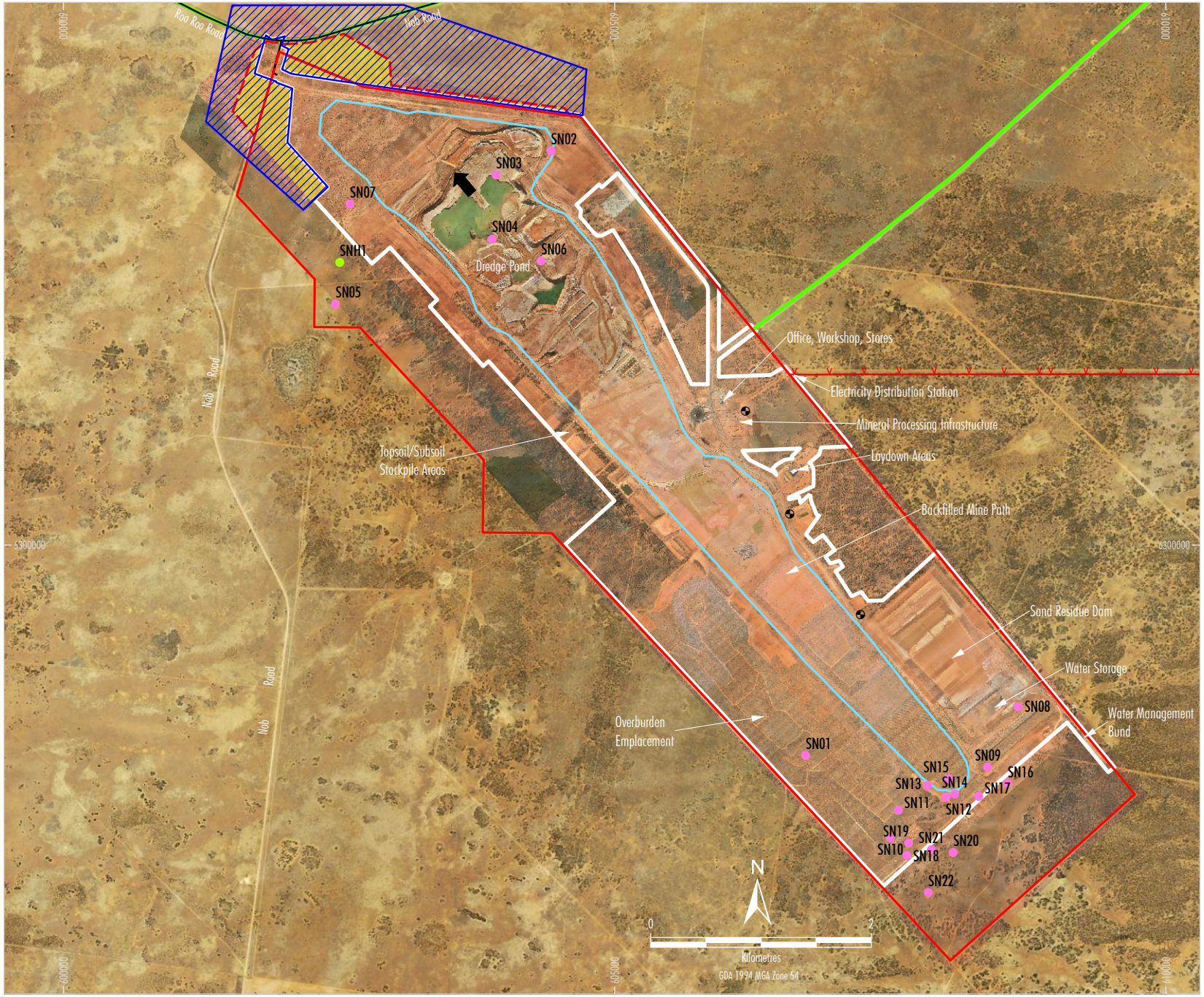
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SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Electricity Transmission Line
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Indicative Additional Surface Development Extent
- Indicative Survey Area
- Aboriginal Cultural Heritage Site
- Historical Cultural Heritage Site

Source: NSW Spatial Services (2019)
Orthophoto: Tronox (2018)

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SNAPPER MINE

Modified Snapper Mine
Indicative General Arrangement and Aboriginal Heritage Sites

Figure 2

CMA-19-08_BS ACHA_201A

ENCLOSURE B

FIELD SURVEY APPLICATION FORM

Tronox Mining Australia Limited ABN 60 009 247 858
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ATTACHMENT 1
FIELD SURVEY ENGAGEMENT APPLICATION FORM

If you wish to be considered for paid participation in any field surveys, please address the following criteria which will be used to determine field survey engagement.

1. Are you a member of the Barkandji Native Title Group Aboriginal Corporation?

   ☐ Yes ☐ No

2. Are you a member of any of the Dareton Local Aboriginal Land Council?

   ☐ Yes ☐ No

3. Do you have any specific cultural knowledge of the Snapper Mine Northern Extension Modification area or of any Aboriginal place(s) or object(s) within it?

   ☐ Yes ☐ No

   If yes, please provide further details:

   _____

   _____

   _____

4. How many adult members does your Registered Aboriginal Party represent?

   _____

5. Please provide documented verification of your response to Question 4 (above) (e.g. please list all adult members).

   _____

   _____

   _____

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6. How many years of experience does each of your proposed fieldworker(s) have in Aboriginal cultural heritage surveys? Please provide the corresponding name and projects previously involved in.

_____

_____

_____

_____

_____

7. Does your proposed fieldworker(s) have any specialist skills or knowledge which might assist in the investigation?

☐ Yes ☐ No

If yes, please specify:

_____

_____

_____

8. Is your proposed fieldworker(s) 'fit for duty', including the ability to survey rugged terrain, all day in various weather conditions?

☐ Yes ☐ No

(Please note that Tronox may require a medical certificate if Tronox considers that an individual may not be fit for work).

9. Are your proposed fieldworker(s) willing to undertake random Drug and Alcohol testing (including the provision of mouth swabs and urine samples) at their induction and/or at any time during the field survey?

☐ Yes ☐ No

10. Do you hold the following Certificates of Currency (if yes, please attach them to your application):

☐ Public Liability ☐ Workers Compensation

(Please note that registered groups will need to provide Certificates of Currency for both public liability and workers compensation. Registered individuals will only need to provide a Certificate of Currency for public liability).

Please provide any further details below that you think may be relevant to your selection to participate in the field surveys:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Responses must be received by 5.00 pm Wednesday 23 October 2019 via the contact details provided below. Please contact Tronox via the contact details below if you require assistance completing this form.

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

TRONOX

30 September 2019

Dareton Local Aboriginal Land Council
14 Menindee Road
New Merinee-Namatjira Avenue
DARETON NSW 2717

Attention: Pam Handy

Via email: pam.handy@daretonlalc.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Handy,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

If you wish to provide input on the following, please provide feedback to Tronox (via the contact details provided at the end of this letter) by **5:00 pm Friday 1 November 2019**:

- The nature of the Proposed Methodology.
- Any Aboriginal objects or places of cultural value within the Modification area, or issues of cultural significance, that you are aware of.

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- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

All comments received will be taken into consideration as the Methodology is finalised.

Information Session

An information session with all Registered Aboriginal Parties, the consulting archaeologist and Tronox representatives will be held on **Tuesday 5 November 2019** to discuss the Modification and the Proposed Methodology. The information session will be held at the Ginkgo Mine Administration Building (Nob Road, Pooncarrie), and will commence at 8:00 am and conclude at approximately 9:00 am. Note that the proposed field survey (described below) will be held following the information session.

At the information session, Tronox will provide a presentation on the nature and scale of the Modification, an overview of the impact assessment process and will discuss the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information.

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Can you please indicate whether you are interested in attending the information session by **5:00 pm Wednesday 23 October 2019** via the contact details provided below.

Tronox Mining Australia Limited ABN 60 009 247 858
375-381 Benetook Avenue
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Field Survey

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Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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FIELD SURVEY APPLICATION FORM

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TRONOX

30 September 2019

Corroboree Aboriginal Corporation
PO Box 3340
ROUSE HILL NSW 2155

Attention: Steve Johnson

Via email: corroboreecorp@bigpond.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Mr Johnson,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

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PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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TRONOX

30 September 2019

Ginninderra Aboriginal Corporation
PO Box 3143
GROSE VALE NSW 2753

Attention: Krystle Carroll Elliott

Via email: Ginninderra.corp@gmail.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Elliott,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

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Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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FIELD SURVEY APPLICATION FORM

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TRONOX

30 September 2019

Mary-Ann Marton
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Marton,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

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Yours sincerely,

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Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

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TRONOX

30 September 2019

Peggy Thomas
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Thomas,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

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Tronox will pay Aboriginal representatives selected for participation in the field survey a **set amount of $450**. Tronox will arrange for payment to be made via direct deposit after the field survey. Bank account details must be supplied to Tronox (with confirmation of details from the bank and/or the Registered Aboriginal Party prior to payment).

Aboriginal representatives will be selected by Tronox based upon the merits of the application with respect to the selection criteria, which are indicated by the questions in the application form. Applications will be assessed against all criteria including cultural knowledge of the Modification area, the representation of others within the community and experience in providing cultural heritage advice.

Where a response is not received by 5:00 pm Wednesday 23 October 2019, it will be assumed that you do not wish to seek consideration for paid involvement in the field investigation. Incomplete applications may not be accepted by Tronox. Please note that Tronox reserves the right to request any further information/clarification or supporting documentation from you in respect to your application.

Assistance in the completion of the application form can be provided to you upon request. Please use the contact details provided below.

The field survey is expected to take place from **9:30 am Tuesday 5 November 2019** (i.e. following the Information Session). Further details will be provided to the successful applicants as soon as possible.

Tronox Mining Australia Limited ABN 60 009 247 858
375-381 Benetook Avenue
MILDURA, VIC 3500, Australia

T +61 3 5025 4600 • F +61 3 5022 0100
www.tronox.com

Contact Details

To provide any feedback with respect to the Proposed Methodology and/or to indicate your attendance at the information session, please contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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ENCLOSURE B

FIELD SURVEY APPLICATION FORM

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TRONOX

30 September 2019

Wayne Webster
331 Morgan Lane
BROKEN HILL NSW 2880

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Mr Webster,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

If you wish to provide input on the following, please provide feedback to Tronox (via the contact details provided at the end of this letter) by **5:00 pm Thursday 31 October 2019**:

- The nature of the Proposed Methodology.
- Any Aboriginal objects or places of cultural value within the Modification area, or issues of cultural significance, that you are aware of.
- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

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All comments received will be taken into consideration as the Methodology is finalised.

Information Session

An information session with all Registered Aboriginal Parties, the consulting archaeologist and Tronox representatives will be held on **Tuesday 5 November 2019** to discuss the Modification and the Proposed Methodology. The information session will be held at the Ginkgo Mine Administration Building (Nob Road, Pooncarrie), and will commence at 8:00 am and conclude at approximately 9:00 am. Note that the proposed field survey (described below) will be held following the information session.

At the information session, Tronox will provide a presentation on the nature and scale of the Modification, an overview of the impact assessment process and will discuss the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information.

The information session will also provide Registered Aboriginal Parties with an opportunity to raise any cultural issues or comments/perspectives regarding the Modification or the Proposed Methodology. Note that issues can also be raised at any point during the consultation process.

Light refreshments and drinks will be provided.

Tronox will pay out of pocket travel expenses for Aboriginal representatives, from their home address to the meeting location and return (note that Tronox will pay 75 cents per kilometre, up to a maximum of $300 per Registered Aboriginal Party). Registered Aboriginal Parties seeking to claim payment will need to provide proof of transport and sign a payment declaration form.

Tronox will arrange for payment to be made via direct deposit after the meeting. Bank account details must be supplied to Tronox (with confirmation of details from the bank and/or the Registered Aboriginal Party prior to payment). However, please note that Tronox will not be paying for attendance at the information session.

Can you please indicate whether you are interested in attending the information session by **5:00 pm Wednesday 23 October 2019** via the contact details provided below.

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Field Survey

As part of the Aboriginal Cultural Heritage Assessment for the Modification, Tronox will be facilitating a field survey of the Modification area, to allow representatives of the Registered Aboriginal Parties to inspect the area and any Aboriginal heritage sites which may be located within or in immediate proximity to the area.

Regardless of participation in the surveys, all Registered Aboriginal Parties will be invited by Tronox to attend a site inspection of the Modification area and a selection of the recorded sites following completion of the field surveys.

Please find enclosed the survey application form for completion and return by **5:00 pm Wednesday 23 October 2019**, for those Registered Aboriginal Parties who are seeking consideration for paid involvement in the field investigation associated with the Modification.

In order to be considered for paid involvement in the field surveys, Registered Aboriginal Parties will need to complete the attached Field Survey Application Form (Enclosure B) and provide it to Tronox by the closing date.

Tronox will pay Aboriginal representatives selected for participation in the field survey a **set amount of $450**. Tronox will arrange for payment to be made via direct deposit after the field survey. Bank account details must be supplied to Tronox (with confirmation of details from the bank and/or the Registered Aboriginal Party prior to payment).

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Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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ENCLOSURE B

FIELD SURVEY APPLICATION FORM

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TRONOX

30 September 2019

Jesse Carroll Johnson
Muragadi Aboriginal Corporation

Via email: muragadi@yahoo.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Ms Johnson,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

If you wish to provide input on the following, please provide feedback to Tronox (via the contact details provided at the end of this letter) by **5:00 pm Friday 1 November 2019**:

- The nature of the Proposed Methodology.
- Any Aboriginal objects or places of cultural value within the Modification area, or issues of cultural significance, that you are aware of.

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Information Session

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At the information session, Tronox will provide a presentation on the nature and scale of the Modification, an overview of the impact assessment process and will discuss the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information.

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Field Survey

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Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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ENCLOSURE B

FIELD SURVEY APPLICATION FORM

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TRONOX

30 September 2019

Ryan Carroll Johnson
Murrabidgee Aboriginal Corporation

Via email: murrabidgeemullangari@yahoo.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION - ABORIGINAL CULTURAL HERITAGE ASSESSMENT PROPOSED METHODOLOGY, INFORMATION SESSION AND FIELD SURVEY

Dear Mr Johnson,

Thank you or registering an interest in the Aboriginal consultation process for the Snapper Mine Northern Extension Modification (the Modification) Aboriginal Cultural Heritage Assessment. As you are aware, Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Project (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW) (Figure 1).

Proposed Methodology

Please find enclosed for your review, a copy of the Proposed Methodology for the Aboriginal Cultural Heritage Assessment for the Modification (Enclosure A).

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) issued by the NSW Biodiversity and Conservation Division (BCD) (within the Department of Planning, Industry and Environment), we have provided the Proposed Methodology for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the Proposed Methodology.

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All comments received will be taken into consideration as the Methodology is finalised.

Information Session

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Assistance in the completion of the application form can be provided to you upon request. Please use the contact details provided below.

The field survey is expected to take place from **9:30 am Tuesday 5 November 2019** (i.e. following the Information Session). Further details will be provided to the successful applicants as soon as possible.

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Contact Details

To provide any feedback with respect to the Proposed Methodology and/or to indicate your attendance at the information session, please contact Tronox via the following contact details:

Haakon Nielssen
Manager Environment
Tronox Mining Australia Limited
0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Manager Environment AUS-Murray Basin

Tronox Mining Australia Limited

ENCLOSURE A

PROPOSED METHODOLOGY FOR THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT FOR THE MODIFICATION

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STAGE 4 LETTERS

DRAFT ACHA REPORT DISTRIBUTION

8 November 2019

Barkandji Native Title Group Aboriginal Corporation
C/- NTSCORP
PO Box 2015,
STRAWBERRY HILLS NSW 2012

Attention: Derek Hardman, Chief Executive Officer

Via email: barkandjiceo@gmail.com, cc. gtonna@ntscorp.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Hardman,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

Draft Aboriginal Cultural Heritage Assessment

Please find enclosed for your review, a copy of the draft Aboriginal Cultural Heritage Assessment (ACHA) for the Modification.

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010), we have provided the draft ACHA for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the draft ACHA.

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If you wish to provide input on the following, please make a submission to Tronox by 5.00 pm Thursday 12 December 2019 (via the contact details provided below):

- Identification of issues.
- Any aboriginal objects or places of cultural value within the investigation area, or issues of cultural significance, that you are aware of.
- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

All comments received will be taken into consideration as the draft ACHA is finalised.

Please submit any feedback regarding the draft ACHA to Tronox via the following contact details by 5.00 pm Thursday 12 December 2019:

Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

8 November 2019

Corroboree Aboriginal Corporation
PO Box 3340
ROUSE HILL NSW 2155

Attention: Steve Johnson

Via email: corroboreecorp@bigpond.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Johnson,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

8 November 2019

Dareton Local Aboriginal Land Council
14 Menindee Road
New Merinee-Namatjira Avenue
DARETON NSW 2717

Attention: Pam Handy

Via email: pam.handy@daretonlalc.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Handy,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

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Tronox Mining Australia Limited ABN 60 009 247 858
375-381 Benetook Avenue
MILDURA, VIC 3500, Australia

T +61 3 5025 4600 • F +61 3 5022 0100
www.tronox.com

If you wish to provide input on the following, please make a submission to Tronox by 5.00 pm Thursday 12 December 2019 (via the contact details provided below):

- Identification of issues.
- Any aboriginal objects or places of cultural value within the investigation area, or issues of cultural significance, that you are aware of.
- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

All comments received will be taken into consideration as the draft ACHA is finalised.

Please submit any feedback regarding the draft ACHA to Tronox via the following contact details by 5.00 pm Thursday 12 December 2019:

Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

TRONOX

8 November 2019

Ginninderra Aboriginal Corporation
PO Box 3143
GROSE VALE NSW 2753

Attention: Krystle Carroll Elliott

Via email: Ginninderra.corp@gmail.com

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Elliott,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

Draft Aboriginal Cultural Heritage Assessment

Please find enclosed for your review, a copy of the draft Aboriginal Cultural Heritage Assessment (ACHA) for the Modification.

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010), we have provided the draft ACHA for your review and feedback. Your feedback may include the identification of issues or areas of cultural significance that may be used to affect, inform or refine the draft ACHA.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

8 November 2019

Mary-Ann Marton
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Marton,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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- Any aboriginal objects or places of cultural value within the investigation area, or issues of cultural significance, that you are aware of.
- Any restrictions or protocols you may consider necessary in relation to any information of sensitivity that you may provide.
- Any other factors you consider to be relevant to the heritage assessment.

All comments received will be taken into consideration as the draft ACHA is finalised.

Please submit any feedback regarding the draft ACHA to Tronox via the following contact details by 5.00 pm Thursday 12 December 2019:

Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

TRONOX

8 November 2019

Peggy Thomas
11 Logan Avenue
MILDURA VIC 3500

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Thomas,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

TRONOX

8 November 2019

Wayne Webster
131 Morgan Lane
BROKEN HILL NSW 2880

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Webster,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,

Haakon Nielssen



Environmental Approvals Manager

Tronox Mining Australia Limited

8 November 2019

Jesse Carroll Johnson
Muragadi Aboriginal Corporation

Via email: muragadi@yahoo.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Ms Johnson,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

TRONOX

8 November 2019

Ryan Carroll Johnson
Murrabidgee Aboriginal Corporation

Via email: murrabidgeemullangari@yahoo.com.au

RE: SNAPPER MINE NORTHERN EXTENSION MODIFICATION – DRAFT ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Dear Mr Johnson,

Tronox Mining Australia Limited (Tronox) is the proponent of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth in western New South Wales (NSW).

Project Approval (06_0168) for the Snapper Mine was issued under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

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Haakon Nielssen
Environmental Approvals Manager
Tronox Mining Australia Limited
M: 0427 419 273
PO Box 4032, Mildura VIC 3502
haakon.nielssen@tronox.com

Yours sincerely,



Haakon Nielssen

Environmental Approvals Manager

Tronox Mining Australia Limited

APPENDIX 4: CORRESPONDENCE FROM ABORIGINAL COMMUNITY STAKEHOLDERS

From: Ginninderra Aboriginal Corporation <ginninderra.corp@gmail.com>
Sent: Saturday, 21 September 2019 4:32 PM
To: Haakon Nielssen < >
Subject: RE: Snapper Mine Northern Extension - Aboriginal Cultural HeritageAssessment

Good afternoon Haakon,

Thank you for the opportunity to consult on this project. Our updated details are as follows:-
Contact person: Krystle Carroll-Elliott
Contact email:
Contact address: PO BOX 3143 Grose Vale NSW 2753

Kind regards,

Krystle Carroll Elliott
Ginninderra Aboriginal Corporation
E:

We acknowledge the Traditional Custodians of Country in which we live and work, and pay our respects to them, our culture and our Elders past, present and future

---

From: Haakon Nielssen
Sent: Friday, 20 September 2019 3:46 PM
To: ginninderra.corp@gmail.com
Subject: Snapper Mine Northern Extension - Aboriginal Cultural HeritageAssessment

Dear Ms Green,

Please see attached correspondence from Tronox Mining Australia Limited regarding the Snapper Mine Northern Extension Modification Aboriginal Cultural Heritage Assessment.

Please do not hesitate to contact me if you have any queries.

Kind regards,

Haakon Nielssen
Manager Environment
AUS – Murray Basin
Tronox Holdings plc
M:
E:

-----Original Message-----
From: Ryan Johnson <murrabidgeemullangari@yahoo.com.au>
Sent: Monday, 23 September 2019 2:34 PM
To: Haakon Nielssen <Haakon.Nielssen@tronox.com>
Subject: Registration : Snapper Mine Northern Extension - Aboriginal Cultural Heritage Assessment

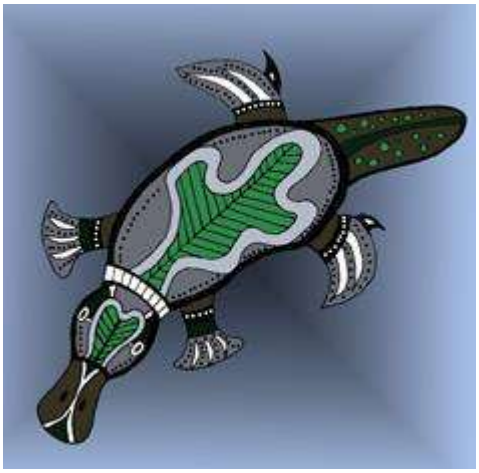
Hi
Could you please register our corporation for the above project. Our family and members hold the cultural knowledge relevant to identifying aboriginal objects and or places in the project area.
Kind regards
Ryan Carroll Johnson
0475565517

Sent from my iPhone

From: Ryan Johnson <_____>
Sent: Tuesday, 8 October 2019 1:28 PM
To: Haakon Nielssen <_____>
Subject: RE: Snapper Mine Northern Extension Modification - Aboriginal Cultural Heritage Assessment

CAUTION: This email originated outside of Tronox. Do not click links or open attachments unless you recognize the sender. If unsure, forward the message as an attachment (hit CTRL+ALT+F) to _____

Hi Haakon,
I have read the ACHA for the above project, I endorse the recommendations made.
Kind regards
Ryan Johnson | **Murra Bidgee Mullangari**



Aboriginal Corporation Cultural Heritage

A: PO Box 246, Seven Hills, NSW, 2147
E: murrabidgeemullangari@yahoo.com.au
ICN: 8112

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From: Haakon Nielssen [_____]
Sent: Monday, 30 September 2019 4:13 PM
To: murrabidgeemullangari@yahoo.com.au
Cc: Joseph Flanagan <_____>
Subject: Snapper Mine Northern Extension Modification - Aboriginal Cultural Heritage Assessment

Dear Mr Johnson,

Please see attached correspondence from Tronox Mining Australia Limited regarding the Snapper Mine Northern Extension Modification Aboriginal Cultural Heritage Assessment Proposed Methodology, Information Session and Surveys.

Please do not hesitate to contact me if you have any queries.

Kind regards,

Haakon Nielssen
Manager Environment
AUS – Murray Basin
Tronox Holdings plc

E:

From: James MacLeod <_____>
Sent: Tuesday, 8 October 2019 1:43 PM
To: Haakon Nielssen <_____>
Subject: Snapper Mine Northern Extension

CAUTION: This email originated outside of Tronox. Do not click links or open attachments unless you recognize the sender. If unsure, forward the message as an attachment (hit CTRL+ALT+F) to

Dear Mr Nielssen

I refer to your letter to the Barkandji Native Title Group Aboriginal Corporation dated 30 September 2019. I have been requested by the chairman of the Corporation that future correspondence to the Corporation be addressed to Mr Derek Hardman, CEO (_____), and not to Ms Jenny Wynman, who is no longer a director of the Corporation.

Many thanks

James

James MacLeod | Senior Solicitor

ntscorp

NTSCORP proudly acknowledge that our office is situated on the country of the Gadigal People of the Dharug Nation. We also acknowledge and pay our respect to their Elders past and present.

t **f** 02 9310 4177
d **m**
e _____ | **w** _____
Level 1, 44-70 Rosehill Street, Redfern, NSW 2016 Australia



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Please consider the environment before printing this email

From: Matt Cupper <landskape@telstra.com>
Sent: Friday, 1 November 2019 5:05 PM
To: Haakon Nielssen
Cc: Joseph Flanagan
Subject: Fwd: Snapper Mine cultural heritage assessment

Begin forwarded message:

From: Pam Handy <pam.handy@daretonlalc.com.au>
Subject: Re: Snapper Mine cultural heritage assessment
Date: 1 November 2019 at 8:49:27 am AEDT
To: Matt Cupper <_____>

Matt.

Short notice. Can't do this monitoring next week. Sorry.

Can you organize someone and pay them. Next time lalc can be involved.

Pam Handy
CEO
Dareton LALC.

Sent from my SAMSUNG Galaxy S6 on the Telstra Mobile Network

-------- Original message --------
From: Matt Cupper <_____>
Date: 1/11/19 6:48 am (GMT+10:00)
To: Pam Handy <pam.handy@daretonlalc.com.au>
Cc: Haakon Nielssen <_____>
Subject: Snapper Mine cultural heritage assessment

Dear Pam,

You would have received an invitation from Tronox Mining for the Land Council to provide a representative to survey of a small modification to their Snapper Mine west of Pooncarie.

I am just following up with the details, which include meeting at the Ginkgo Mine at **8 am next Tuesday 5 November 2019** for information session and induction and field survey of the modification area at 9:30 am.

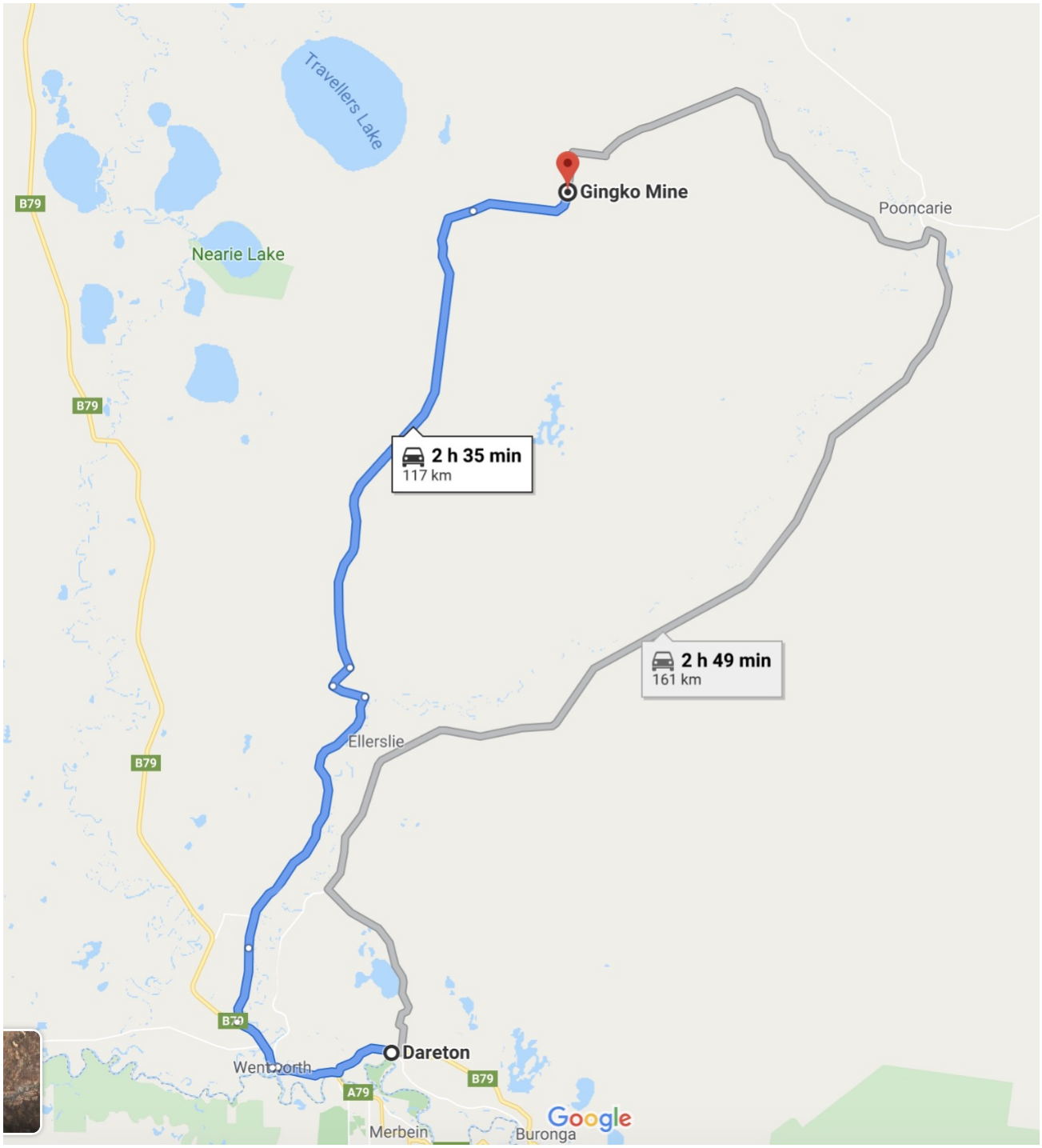
Could the Land Council representative for the survey bring long legged/sleeved trousers and shirt and steel capped boots (or provide shoe size so Tronox can provide), please?

Please feel free to contact me with any queries.

All the best,
Matt

Dr Matt Cupper
Principal
Landskape

Tel: 0408 006 690



APPENDIX 5: AHIMS REGISTER SEARCH

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Snapper

Client Service ID : 458515

LandSkape - Natural & Cultural Heritage Management

P O Box 246
Merbein Victoria 3505

Attention: Matt Cupper

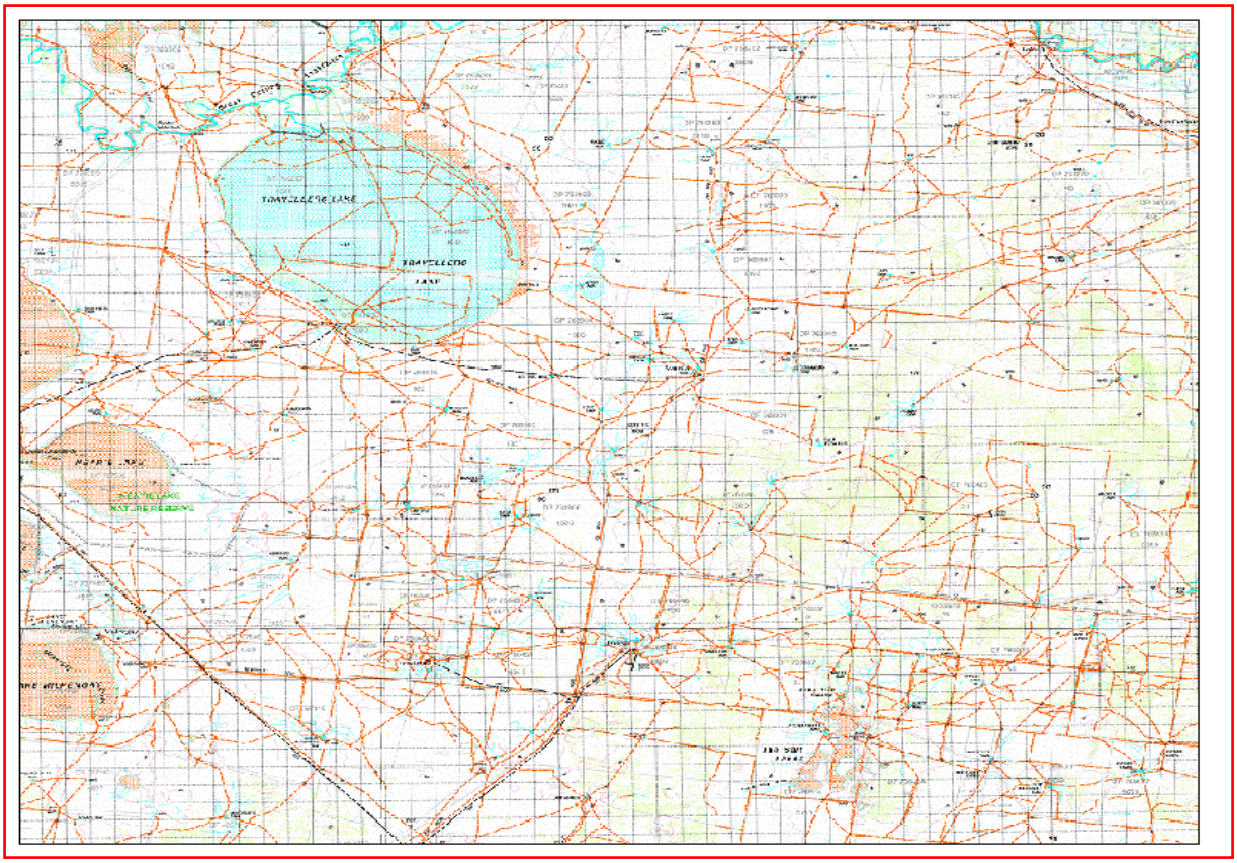
Email: landskape@telstra.com

Date: 23 October 2019

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -33.6, 141.9 - Lat, Long To : -33.2, 142.3 with a Buffer of 1000 meters, conducted by Matt Cupper on 23 October 2019.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

106	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Snapper

Client Service ID : 458515

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
39-6-0003	Keleen 2S-15 Pooncarie	AGD	54	603738	6288835	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0004	Keleen 2S-14 Pooncarie	AGD	54	604195	6288561	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0005	Keleen 2S-13 Pooncarie	AGD	54	605566	6288561	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0006	Keleen 2S-12 Pooncarie	AGD	54	609222	6286276	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0007	Keleen 2S-11 Pooncarie	AGD	54	612147	6285362	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0008	Keleen 2S-10 Pooncarie	AGD	54	612421	6285088	Open site	Valid	Artefact : -	Open Camp Site	346,436
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0010	Keleen 2S-8 Pooncarie	AGD	54	612421	6285819	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0012	Keleen 2S-1 Pooncarioe	AGD	54	613792	6284448	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-6-0014	Keleen 2S-2 Pooncarie	AGD	54	618819	6282620	Open site	Valid	Artefact : -	Open Camp Site	346
	Contact	**Recorders**	ASRSYS					**Permits**		
39-2-0030	tra1;Travellers Lake;	AGD	54	587900	6322200	Open site	Valid	Artefact : -, Shell : -, Burial : -	Burial/s,Midden,Open Camp Site	1352
	Contact	**Recorders**	Jane Balme					**Permits**		
39-2-0031	tra 2;Travellers Lake;	AGD	54	589000	6322800	Open site	Valid	Artefact : -, Shell : -	Midden,Open Camp Site	1352
	Contact	**Recorders**	Jane Balme					**Permits**		
39-3-0025	Ginkgo Isolated Find 1	AGD	54	611585	6308752	Open site	Destroyed	Artefact : -		
	Contact	**Recorders**	Dan Witter					**Permits**	1810,1811	
39-3-0026	Ginkgo Isolated Find 2	AGD	54	612029	6308944	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	**Recorders**	Dan Witter					**Permits**	1810,1811	
39-3-0027	Ginkgo Isolated Find 3	AGD	54	612230	6309389	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Dan Witter					**Permits**		
39-3-0028	Ginkgo Isolated Find 4	AGD	54	612499	6309351	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Dan Witter					**Permits**		
39-3-0029	Ginkgo Isolated Find 5	AGD	54	612301	6309206	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Dan Witter					**Permits**		
39-3-0030	Ginkgo Isolated Find 6	AGD	54	612087	6308507	Open site	Destroyed	Artefact : -		

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Additional Info : Identify previously registered sites in study area. Number of Aboriginal sites and Aboriginal objects found is 106

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0031	Ginkgo Isolated Find 7	AGD	54	612047	6308384	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0032	Ginkgo Isolated Find 8	AGD	54	611845	6308357	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0033	Ginkgo Isolated Find 9	AGD	54	612895	6308849	Open site	Valid	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0034	Ginkgo Isolated Find 10	AGD	54	611810	6309519	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0035	Ginkgo Isolated find 11	AGD	54	611760	6309332	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0051	GI6	AGD	54	617180	6304170	Open site	Valid	Artefact : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0052	GI5	AGD	54	611540	6308260	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0053	GI3	AGD	54	616780	6304730	Open site	Valid	Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0009	Ginko-6	AGD	54	613037	6308519	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0010	Ginko-5	AGD	54	612230	6300058	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0013	Ginko-2	AGD	54	611264	6308787	Open site	Destroyed	Artefact : -, Hearth : -, Shell : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0014	Ginko-1	AGD	54	612360	6308774	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0036	Ginkgo Isolated Find 12	AGD	54	610694	6310602	Open site	Valid	Artefact : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0037	Ginkgo Isolated Find 13	AGD	54	610494	6310314	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0038	Ginkgo Isolated Find 14	AGD	54	615964	6306603	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0039	Ginkgo Isolated Find 15	AGD	54	615249	6306053	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0040	Ginkgo Isolated Find 16	AGD	54	611987	6308041	Open site	Destroyed	Artefact : -		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0041	Ginkgo Isolated Find 17	AGD	54	616000	6305575	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0042	Ginkgo Isolated Find 18	AGD	54	616011	6305127	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0043	Ginkgo Isolated Find 19	AGD	54	613050	6307550	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0044	Ginkgo Isolated Find 20	AGD	54	611680	6308770	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0045	Ginkgo Isolated Find 21	AGD	54	611730	6308780	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0046	Ginkgo Isolated Find 22	AGD	54	611830	6308770	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0047	Ginkgo Isolated Find 23	AGD	54	611980	6308800	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0048	Ginkgo Isolated Find 24	AGD	54	612160	6308740	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-2-0038	Roo Roo Station/cane grass swap-5	AGD	54	588309	6308831	Open site	Valid	Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-2-0039	Roo Roo Station/canegrass swamp-4	AGD	54	588358	6308740	Open site	Valid	Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-2-0040	Roo Roo Station/canegrass swamp-3	AGD	54	588153	6308806	Open site	Valid	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-2-0041	Roo Ro Station/canegrass swamp-2	AGD	54	587110	6308928	Open site	Valid	Artefact : -		
	Contact	Recorders	Dan Witter					Permits		
39-2-0042	Roo Roo Station/canegrass swamp-1	AGD	54	587832	6309424	Open site	Valid	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0023	Ginko-8	AGD	54	613450	6308620	Open site	Valid	Artefact : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0011	Ginko-4	AGD	54	612793	6308315	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0012	Ginko-3	AGD	54	612803	6308659	Open site	Destroyed	Hearth : -, Artefact : 1		
	Contact	Recorders	Dan Witter					Permits	1810,1811	
39-3-0022	Ginko-7	AGD	54	613189	6308575	Open site	Valid	Artefact : -		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Dan Witter					Permits		
39-3-0024	Ginko-9	AGD	54	614737	6305265	Open site	Valid	Hearth : -, Artefact : -		
	Contact	Recorders	Dan Witter					Permits		
39-3-0054	GS18	AGD	54	614620	6304110	Open site	Valid	Artefact : -, Hearth : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-3-0055	GS17	AGD	54	614070	6304970	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0043	GS13	AGD	54	589000	6307760	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0044	GS12	AGD	54	588780	6307800	Open site	Valid	Artefact : -, Hearth : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0045	GS11	AGD	54	585050	6308310	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0046	GS10	AGD	54	583560	6308990	Open site	Valid	Artefact : -, Hearth : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0047	GS09	AGD	54	583810	6311170	Open site	Valid	Artefact : -, Hearth : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-2-0048	GS08	AGD	54	584260	6314690	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-3-0056	GS36	AGD	54	614380	6304690	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-3-0057	GS35	AGD	54	614520	6304460	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-3-0058	GS34	AGD	54	614790	6304070	Open site	Valid	Artefact : -		98400
	Contact	Recorders	Doctor.Matt Cupper					Permits		
39-3-0059	DA57	AGD	54	620089	6325812	Open site	Valid	Shell : -, Artefact : 1		
	Contact Searle	Recorders	Doctor.Matt Cupper					Permits	2331	
39-3-0066	DA81	AGD	54	599268	6305663	Open site	Valid	Artefact : 100		
	Contact Searle	Recorders	Doctor.Matt Cupper					Permits		
39-2-0069	DA51	AGD	54	592171	6324852	Open site	Valid	Artefact : 2		
	Contact S Scanlon	Recorders	Doctor.Matt Cupper					Permits	3020	
39-3-0060	DA53	AGD	54	593612	6325980	Open site	Valid	Artefact : 2		
	Contact S Scanlon	Recorders	Doctor.Matt Cupper					Permits		
39-3-0061	DA54	AGD	54	593872	6326102	Open site	Valid	Artefact : 4		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact S Scanlon	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0062	DA55	AGD	54	594106	6326231	Open site	Valid	Artefact : 5		
	Contact S Scanlon	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-2-0100	DA129	AGD	54	587021	6322193	Open site	Valid	Artefact : 5		
	Contact Searle	**Recorders**	Doctor.Matt Cupper					**Permits**	3020	
39-2-0101	DA130	AGD	54	586557	6322872	Open site	Valid	Artefact : 1		
	Contact Searle	**Recorders**	Doctor.Matt Cupper					**Permits**	3020	
39-2-0102	DA138	AGD	54	586952	6322182	Open site	Valid	Artefact : 1		
	Contact Searle	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0074	KB3	GDA	54	602270	6326171	Open site	Valid	Hearth : 1		
	Contact T Russell	**Recorders**	Mr.John Gilding					**Permits**		
39-2-0103	DA52	GDA	54	592171	6324852	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0075	Snapper (SN) 01	AGD	54	606719	6298095	Open site	Valid	Artefact : 11		101230
	Contact Gerry Saals	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0076	Snapper (SN) 02	GDA	54	604405	6303587	Open site	Valid	Hearth : 2, Artefact : 11		101230
	Contact Gerry Saals	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0077	Snapper (SN) 03	GDA	54	603910	6303359	Open site	Valid	Artefact : 1		101230
	Contact Gerry Saals	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0078	Snapper (SN) 04	GDA	54	603877	6302784	Open site	Valid	Hearth : 1		
	Contact Gerry Saals	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0079	Snapper (SN) 05	GDA	54	602450	6302194	Open site	Valid	Artefact : 1		
	Contact Gerry Saals	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-2-0108	DA 203	AGD	54	586384	6320945	Open site	Valid	Hearth : -		
	Contact Searle	**Recorders**	Ms.Leslie Bennett					**Permits**		
39-2-0110	DA 205	GDA	54	586414	6323833	Open site	Valid	Hearth : -		
	Contact Searle	**Recorders**	Ms.Leslie Bennett					**Permits**		
39-3-0083	WOODLANDS HEARTH TWO AND THREE DA233	GDA	54	593908	6325412	Open site	Valid	Hearth : 2		
	Contact Searle	**Recorders**	Mark Sutton					**Permits**		
39-2-0120	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			
	Contact Searle	**Recorders**	Mark Sutton					**Permits**		
39-3-0082	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			
	Contact Searle	**Recorders**	Ms.Leslie Bennett					**Permits**		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
39-2-0121	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			
	Contact Searle	**Recorders**	Mark Sutton					**Permits**		
39-2-0126	DA241	GDA	54	586596	6322028	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	Contact Searle	**Recorders**	Ms.Leslie Bennett					**Permits**		
39-2-0127	DA242	GDA	54	586573	6322065	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	Contact Searle	**Recorders**	Ms.Leslie Bennett					**Permits**		
39-3-0093	Snapper (SN) 15	GDA	54	608021	6297888	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0094	Snapper (SN) 16	GDA	54	608552	6297840	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0095	Snapper (SN) 17	GDA	54	608289	6297727	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0096	Snapper (SN) 18	GDA	54	607637	6297187	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0097	Snapper (SN) 19	GDA	54	607650	6297301	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0098	Snapper (SN) 20	GDA	54	608055	6297218	Open site	Valid	Artefact : 1		100390
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0099	Snapper (SN) 21	GDA	54	607860	6297247	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0100	Snapper (SN) 22	GDA	54	607833	6296849	Open site	Valid	Artefact : 1		100390
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0084	Snapper (SN) 06	GDA	54	604319	6302578	Open site	Valid	Hearth : 1		100390
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0085	Snapper (SN) 07	GDA	54	602578	6303097	Open site	Valid	Hearth : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Snapper

Client Service ID : 458515

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
39-3-0086	Snapper (SN) 08	GDA	54	608646	6298543	Open site	Valid	Hearth : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0087	Snapper (SN) 09	GDA	54	608367	6297995	Open site	Valid	Hearth : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0088	Snapper (SN) 10	GDA	54	607489	6297350	Open site	Valid	Hearth : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0089	Snapper (SN) 11	GDA	54	607559	6297599	Open site	Valid	Hearth : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0090	Snapper (SN) 12	GDA	54	607992	6297720	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0091	Snapper (SN) 13	GDA	54	607819	6297834	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
39-3-0092	Snapper (SN) 14	GDA	54	608074	6297746	Open site	Valid	Artefact : 1		100390,101230
	Contact	**Recorders**	Doctor.Matt Cupper					**Permits**		
31-6-0033	KAL5	AGD	54	612700	6308000	Open site	Valid	Artefact : -	Open Camp Site	1352
	Contact	**Recorders**	Doctor.Jeannette Hope					**Permits**		
39-2-0146	Nearie - Southern Blow-out A	GDA	54	582924	6299168	Open site	Valid	Artefact : 40, Burial : 1, Hearth : 3		
	Contact	**Recorders**	Ms.Rita Enke					**Permits**		

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APPENDIX 6: CADASTRE INFORMATION



LEGEND

- Mining Lease Boundary (ML 1621)
- Mining Lease Application Boundary (MLA 1)
- ExistingApproved/Approximate Extent of Surface Development
- Highway Access Road
- Cadastral Boundary
- Additional Surface Development Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Cadastral Information

Figure A6

CMA-19-08_SNE_AppACHA_204A

SNAPPER MINE

Northern Extension Modification

Appendix C

Air Quality Review

TRONOX



katestone
www.katestone.global

21 November 2019

Attn: Haakon Nielssen

Tronox Mining Australia Limited
PO Box 4032
MILDURA VIC 3502

Re: Air Quality Review for the Snapper Mine Northern Extension Modification

Dear Haakon,

Katestone has prepared an Air Quality Review for the proposed Snapper Mine Northern Extension Modification (the Modification). The Air Quality Review considers the potential air quality impacts of the Modification based on:

- A review of the existing air quality monitoring in the vicinity of the Snapper Mine.
- A qualitative assessment of the emissions for the currently approved mine and those likely to occur during mining in the Modification area.

The review has found the following:

- Given that the Modification would result in a reduction in total dust emissions from the Snapper Mine (due to the approximate 30% reduction in overburden haulage distances), it is expected that the modified Snapper Mine would continue to comply with the relevant air quality criteria at all sensitive receivers surrounding the Snapper Mine.
- Given the Modification would result in a reduction in total dust emissions from the Snapper Mine, it is considered there would be no change to the approved potential cumulative air quality impacts as a result of the Modification.

Please contact the undersigned on (07) 3369 3699 if you would like to discuss the review.

Yours sincerely,

Tania Haigh – Senior Air Quality Consultant

Ground Floor, 16 Marie St, Milton, QLD.
PO Box 2217, Milton, QLD. 4064, Australia
ABN 92 097 270 276

www.katestone.global
Ph +61 7 3369 3699

1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (Figure 1):

- the Broken Hill Mineral Separation Plant, located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north-east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

This Air Quality Review has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.

2 OVERVIEW OF THE MODIFICATION

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

The Modification would include:

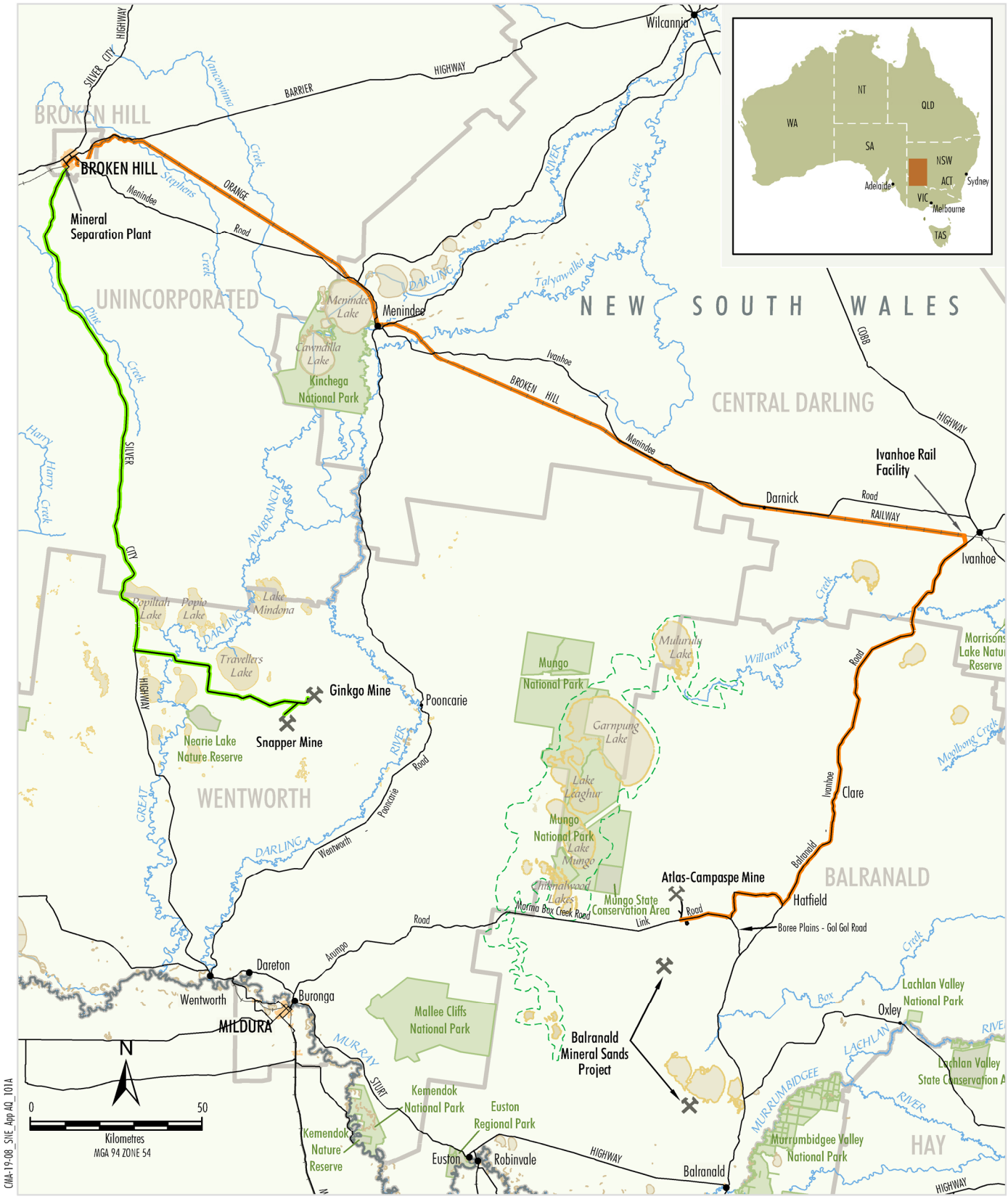
- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The indicative general arrangement of the modified Snapper Mine is shown on Figure 2.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.2 and 2 of the Modification Report, respectively.



Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

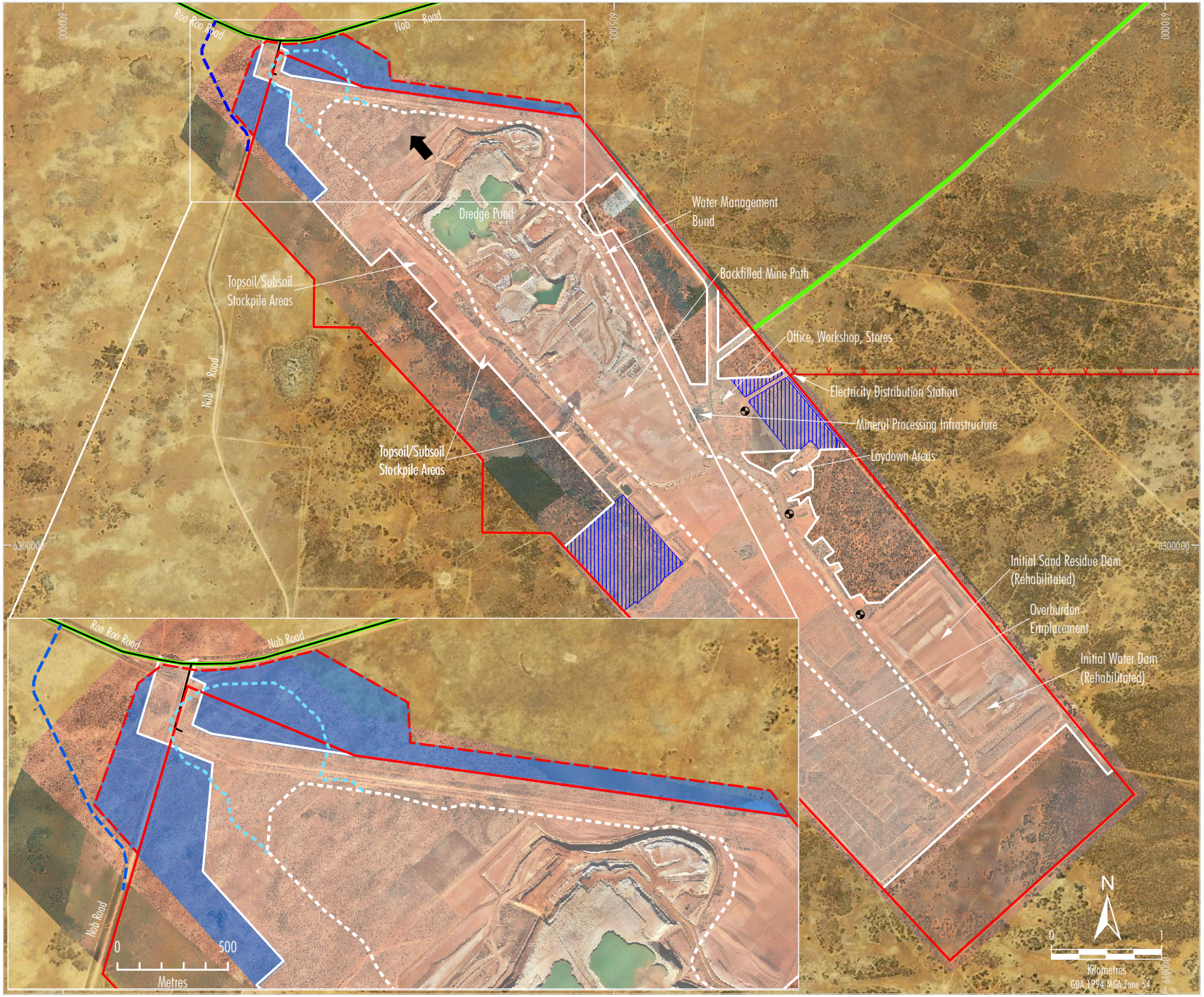
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SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

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Modified Snapper Mine - Indicative General Arrangement

Figure 2

CMA-19-08_SNE_App AQ_202C

3 RELEVANT AIR QUALITY CRITERIA AND PERFORMANCE MEASURES

3.1 Relevant Air Quality Guidelines

Previous Air Quality Assessments for the Snapper Mine (Section 6) were prepared in accordance with the (now) superseded *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW Department of Environment and Conservation, 2005) (Section 6).

Subsequent to the grant of Project Approval (06_0168) in 2007, the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Environment Protection Authority [EPA], 2017) (Approved Methods) was introduced. The Approved Methods list the statutory methods and air quality criteria that are to be used to model and assess emissions and impacts of air pollutants from activities in NSW. The Approved Methods (EPA, 2017) introduced criteria for particulate matter (PM) less than 2.5 micrometres in diameter ($PM_{2.5}$), and a reduced annual average criterion of 25 micrograms per cubic metre (µg/m^3) for PM less than 10 micrometres in diameter (PM_{10}). The Approved Methods did not change the total suspended particulates (TSP) criterion of 90 µg/m^3. This review has assessed the potential air quality impacts of the Modification against the impact assessment criteria in the Approved Methods, which are presented in Table 1.

Table 1 Approved Methods impact assessment criteria for particulate matter

PM metric	Averaging period	Concentration (µg/m3)
TSP	Annual	90
PM_{10}	24-hour	50
	Annual	25
$PM_{2.5}$	24-hour	25
	Annual	8

Ambient air quality in each state in Australia must be monitored and reported against the standards and goals defined in the *National Environment Protection (Ambient Air Quality) Measure 1998* (Air NEPM) (National Environment Protection Council, 2016). Whilst these standards exist to evaluate ambient air quality, rather than the potential impact of an individual project, they have been considered here for completeness.

3.2 Project Approval

Air quality impact assessment criteria are provided in Condition 13, Schedule 3 of Project Approval (06_0168). These conditions are reproduced below:

> ***Air Quality Impact Assessment Criteria***
>
> *The Proponent shall ensure that dust generated by the project does not cause additional exceedances of the criteria listed in Tables 1 to 3 at any residence on non-Proponent-held land.*
>
> *Table 1: Long term impact assessment criteria for particulate matter*

Pollutant	*Averaging Period*	*Criterion*
Total suspended particulate (TSP) matter	*Annual*	*90 µg/m^3*
Particulate matter < 10 µm (PM_{10})	*Annual*	*30 µg/m^3*

Table 2: Short term impact assessment criterion for particulate matter

Pollutant	Averaging Period	Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3

Table 3: Long term impact assessment criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.

Monitoring

The Proponent shall prepare and implement an Air Quality Monitoring Program for the project to the satisfaction of the Secretary. This program must:

a) be prepared in consultation with the EPA;
b) be submitted to the Secretary for approval prior to carrying out any development on the site; and
c) use dust deposition gauges to monitor the performance of the project.

3.3 Environment Protection Licence 12799

Tronox holds Environment Protection Licence (EPL) 12799 issued under the NSW *Protection of the Environment (Operations) Act 1997* (PoEO Act) for the Snapper Mine.

Condition P1.1 of EPL 12799 identifies four dust monitoring locations (DG01, DG02, DGW and DGT), corresponding with the Manilla, Woodlands, Waukeroo and Trelega Homesteads, respectively (Figure 3)[1]. Condition M2 of EPL 12799 requires that deposited dust be measured on a monthly basis at locations DG01, DG02, DGW and DGT in accordance with Australian Standard 3580.10.1-2003.

Operating conditions for the Snapper Mine relevant to air quality are provided in Condition O3 of EPL 12799:

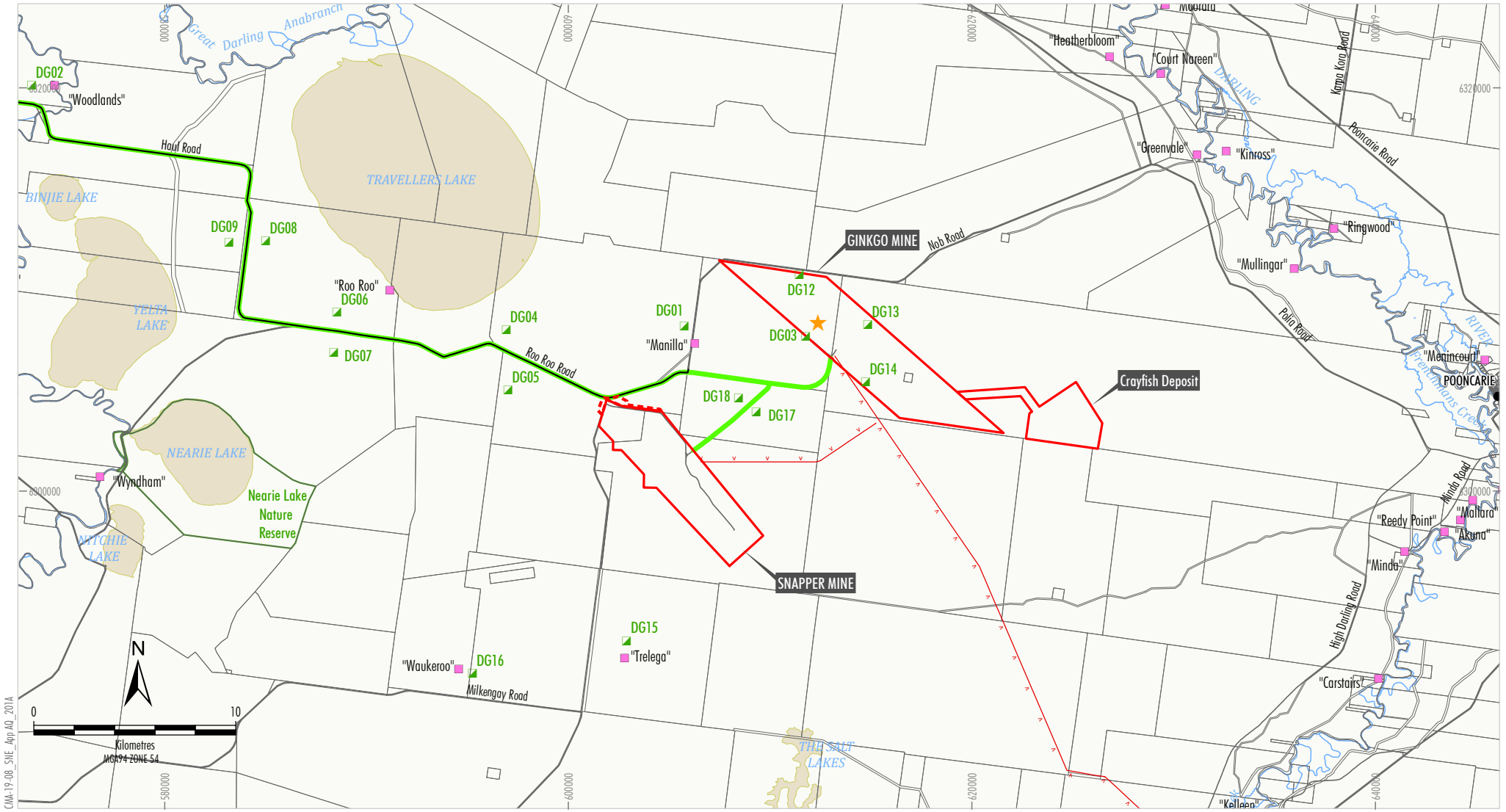
O3 Dust

O3.1 All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.

O3.2 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O3.3 Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading or whilst transporting HMC between Snapper and Gingko sites only.

[1] Dust monitoring sites DGW and DGT listed in Condition P1.1 of EPL 12799 correspond with dust monitoring sites DG16 and DG15 on Figure 3, respectively.



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA1)
- Cadastral Boundary
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line
- Dwelling
- Dust Gauge
- Meteorological Station

Source: NSW Spatial Services (2019); Tronox (2019)

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Sensitive Receiver and Air Quality Monitoring Locations

Figure 3

3.4 Summary of Air Quality Criteria

Air quality criteria that are relevant to the Snapper Mine and considered in this Air Quality Review are reproduced in Table 2.

Table 2 Particulate matter and dust deposition criteria for the Snapper Mine

Pollutant	Averaging Period	Criterion	Source
TSP	Annual	90 µg/m^3	Project Approval, Approved Methods
PM_{10}	24-hour	50 µg/m^3	Project Approval, Approved Methods, Air NEPM
	Annual	30 µg/m^3	Project Approval
	Annual	25 µg/m^3	Approved Methods, Air NEPM
$PM_{2.5}$	24-hour	25 µg/m^3	Approved Methods, Air NEPM
	Annual	8 µg/m^3	Approved Methods, Air NEPM
Deposited dust	Annual	2 g/m^2/month (incremental)	Project Approval, Approved Methods
	Annual	4 g/m^2/month (total)	Project Approval, Approved Methods

4 EXISTING AIR QUALITY MANAGEMENT

Air quality management at the Snapper Mine is undertaken in accordance with the *Murray Basin Mineral Sands Mines Air Quality Management Plan* (AQMP) (GHD, 2015). The AQMP was prepared in accordance with Condition 14, Schedule 3 of Project Approval (06_0168) and includes measures to:

- minimise the amount of dust generated during drilling and mining operations;
- minimise the amount of surface disturbance ahead of mining operations;
- rehabilitate surface disturbance areas no longer required as soon as practicable;
- minimise the generation of dust along haulage routes; and
- maintain plant and equipment to increase efficiency and minimise emissions.

Tronox has advised that no air quality related complaints have been received to date.

5 EXISTING AIR QUALITY ENVIRONMENT

5.1 Sensitive Receivers

As shown on Figure 3, the area surrounding the Snapper and Ginkgo Mines includes a number of privately-owned residences (i.e. sensitive receivers). The closest sensitive receivers to the Snapper Mine are located approximately 4 km to the north (Manilla homestead) and 7 km to the south (Trelega homestead). The Manilla Homestead would be the closest sensitive receiver to activities associated with the Modification.

The closest sensitive receiver to the Highway Access Road (HAR) is the Woodlands homestead, which is located approximately 800 m north of the HAR (Figure 3).

5.2 Air Quality Monitoring

Particulate Monitoring

Project Approval (06_0168) does not require Tronox to undertake TSP or PM_{10} monitoring for the Snapper Mine. Notwithstanding, in accordance with the approved AQMP (GHD, 2015), high volume suspended particulate sampling is undertaken at sensitive receivers as required in response to complaints, community concern or incidents.

Dust Deposition Monitoring

In accordance with Condition 14, Schedule 3 of Project Approval (06_0168), Tronox operates a network of 18 dust deposition gauges (DG01 to DG18) in the vicinity of the Snapper and Ginkgo Mines and along the mineral concentrate transport route/HAR (Figure 3). Dust deposition gauges DG01, DG02, DG15 and DG16 were located to monitor dust deposition levels at the nearest sensitive receivers to the Snapper Mine and HAR, namely the Manilla, Trelega, Waukeroo and Woodlands homesteads (DG01, DG15, DG16 and DG02, respectively).

Figure 4 presents the annual average dust deposition monitoring records at the closest sensitive receivers to the Snapper Mine and HAR between 2005 and 2019, and rainfall recorded at Tronox's meteorological monitoring station at the Ginkgo Mine (Figure 3). Mining commenced at the Ginkgo Mine in 2005 and at the Snapper Mine in 2010.

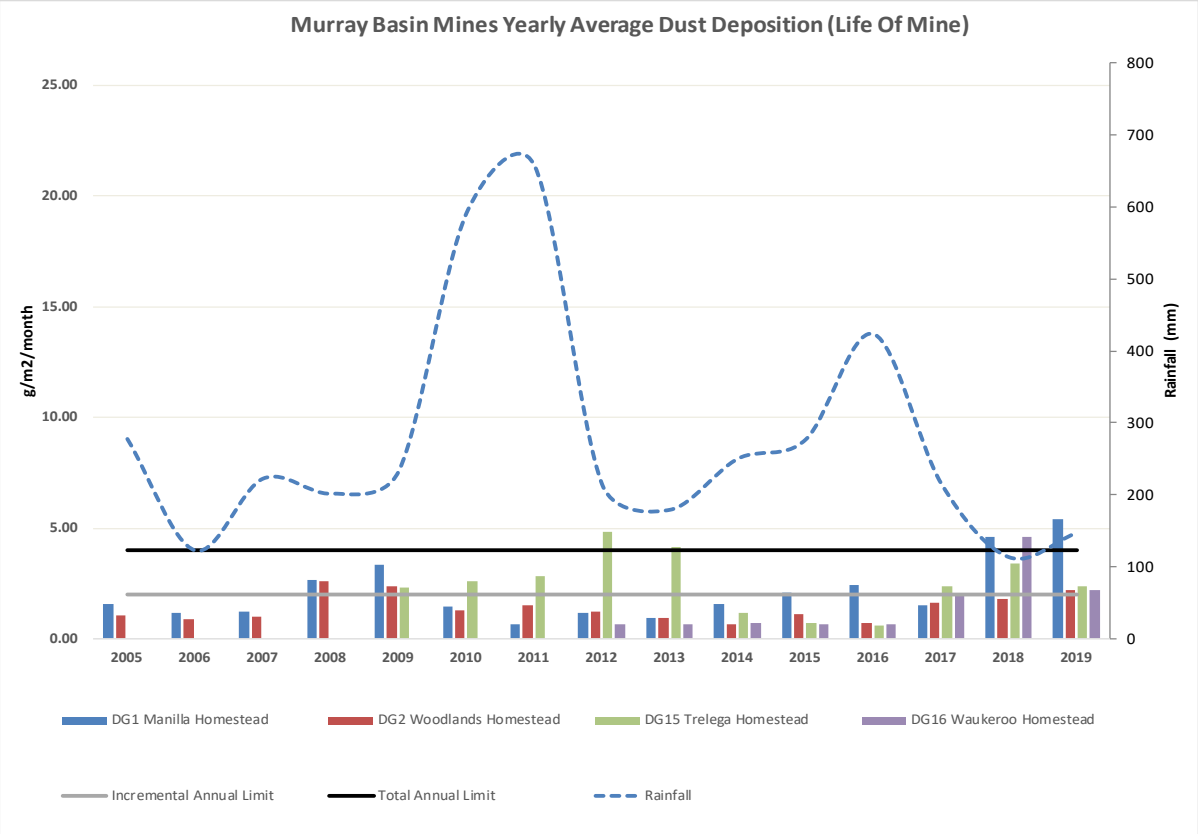


Figure 4 Annual average dust deposition monitoring results, 2005 to 2019

Annual average dust deposition rates recorded in the area have generally complied with the Project Approval (06_0168) annual average air quality criteria of 4 g/m^2/month since the commencement of operations at the Ginkgo and Snapper Mines (Figure 4), with the exception of the following:

- 2012 and 2013 at the Trelega homestead;
- 2018 at the Waukeroo and Manilla homesteads; and
- 2019 at the Manilla homestead (average of the eight months of data collected from January to September, not an annual average).

The elevated dust deposition measurements for 2012 and 2013 recorded at the Trelega Homestead are not considered representative of ambient dust deposition rates in the area. Pacific Environment Limited (PEL) (2014) noted that elevated dust deposition measurements for January, March and June 2012 and February 2013 contained contamination (e.g. bird droppings). The average dust deposition rates for 2012 and 2013 calculated after excluding these monthly results comply with the air quality criteria of 4 g/m^2/month.

During 2018 and 2019, dust deposition measurements greater than 4 g/m^2/month were recorded at all dust deposition gauges in the Snapper and Ginkgo Mines and HAR network (Figures 3 and 5), with the exception of sites DG14 and DG17 (located proximal to the Snapper and Ginkgo Mines). Given the spatial extent of the dust deposition monitoring network, this data indicates that dust levels were elevated throughout the region, and is considered to be due to the warm and dry conditions widespread throughout NSW. 2018 had the lowest annual rainfall since dust deposition monitoring commenced in 2005, while total monthly rainfall from January to October 2019 was at least 60% below average in all months except May and June (BOM, 2019).

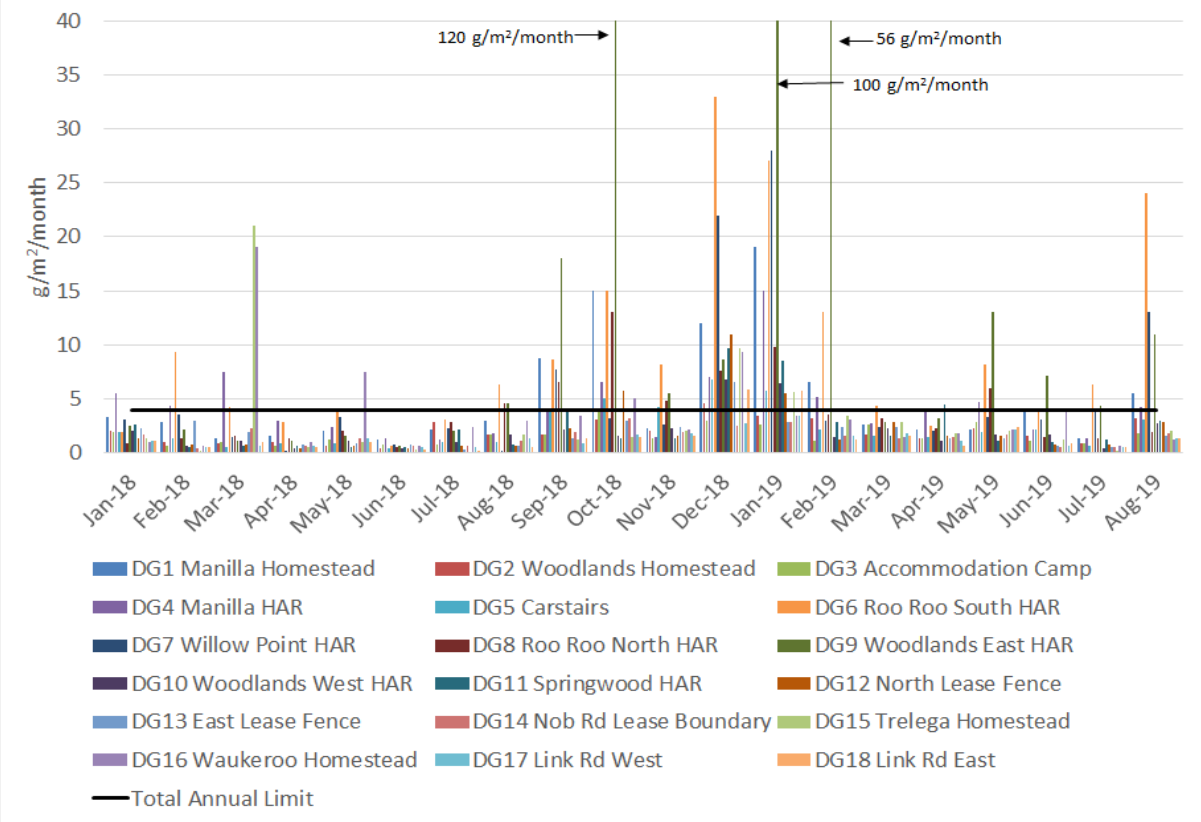


Figure 5 Monthly deposition rates measured during 2018 and 2019

As reported in Katestone (2019), 24-hour PM measurements exceeding the PM_{10} criterion of 50 µg/m^3 were also recorded in late 2018 at monitoring sites surrounding the Atlas-Campaspe Mine site, where construction activities are currently taking place more than 18 km from the closest sensitive receiver. Katestone (2019) concluded that sources other than the Atlas-Campaspe Mine, such as wind-blown dust, were contributing to the elevated particulate levels during this period.

Furthermore, dust storms occurred regularly throughout 2018 and 2019, including at Broken Hill during October[2] and November[3] 2018, at Mildura during May 2019[4], and across large parts of NSW during February 2019[5].

The persistent warm and dry conditions would have contributed to elevated ambient dust levels in the region, and it is likely that the dust deposition measurements recorded during 2018 and 2019 were primarily due to regional dust sources and not operations at the Snapper or Gingko Mines.

2 https://www.abc.net.au/news/2018-10-03/broken-hill-dust-story/10334764
3 https://www.abc.net.au/news/2018-11-21/dust-storms-hit-regional-nsw-turning-rain-to-mud/10517442
4 https://www.abc.net.au/news/2019-05-07/mildura-dust-storm-turns-day-into-night/11089088
5 https://www.theguardian.com/australia-news/2019/feb/13/dust-storms-blanket-nsw-and-act-as-air-quality-reaches-hazardous-levels

5.3 Background Levels

The following background dust levels determined by Holmes Air Sciences (HAS) (2007) for the Snapper Mine Environmental Assessment Air Quality Assessment will be adopted for this review:

- Annual average background TSP – 54 µg/m^3;
- Annual average background PM_{10} – 22 µg/m^3; and
- Annual average background dust deposition – 2.4 g/m^2/month.

These background concentrations adopted by HAS (2007) were derived from the highest average of deposited dust recorded at the time (from a dust gauge on the Ginkgo Mine in 2006), and were therefore considered to be conservative. PAE Holmes (2010) subsequently reviewed the background dust levels adopted by HAS (2007) in consideration of more recent dust deposition monitoring data, and concluded that the background dust levels adopted by HAS (2007) were still considered to be conservative.

6 OVERVIEW OF PREVIOUS AIR QUALITY ASSESSMENTS

A number of air quality assessments have been conducted for the Snapper Mine to date, namely:

- the Air Quality Assessment undertaken for the Snapper Mineral Sands Project Environmental Assessment (EA) (HAS, 2007);
- the Air Quality Assessment undertaken for the 2010 Snapper and Ginkgo Mines Modification (PAE Holmes, 2010); and
- the Air Quality Review undertaken for the 2014 Snapper Mine Production Increase Modification (PEL, 2014).

The previous air quality assessments assessed the potential air quality impacts at the nearest sensitive receivers to the Snapper Mine operations and HAR.

PEL (2014) concluded that no exceedances of the relevant air quality criteria (Section 3.2) were predicted at the nearest sensitive receivers to the Snapper Mine, however non-mine related sources of PM_{10} such as bushfires and dust storms could result in occasional exceedances of the 24-hour average criterion for PM_{10} at sensitive receivers.

7 POTENTIAL AIR QUALITY IMPACTS DUE TO THE MODIFICATION

7.1 Mining Operations

To assess the potential air quality impacts of the Modification, this review has considered the operation of the modified Snapper Mine in comparison with the estimated emission rates predicted by PEL (2014) for Year 9 of the approved Snapper Mine (i.e. the maximum case scenario for estimated emissions and proximity to the Manilla homestead). The dispersion modelling results from the 2010 Modification Air Quality Assessment (PAE Holmes, 2010) have also been considered in this review.

The extension of the existing/approved mine path and associated supporting infrastructure into MLA 1, and changes to overburden haulage distances, have the potential to change the dust emissions generated by operations at the Snapper Mine.

The estimated emissions data presented in PEL (2014) for the approved Snapper Mine are reproduced in Table 3.

Table 3 Estimated Snapper Mine Emission Rates (reproduced from PEL, 2014)

Activity	Emissions of TSP kg/yr
Bucket Scoop/Scraper loading, transporting and unload topsoil	39,463
Dozers stripping overburden	101,250
Loading haul trucks	6,175
Haul trucks transporting overburden	1,556,548
Emplacement at overburden dumps	6,175
Dozers on overburden areas	134,999
Grading roads and open areas	21,566
Wind erosion from topsoil stockpiles	62,021
Wind erosion from overburden dumps	22,601
Wind erosion from disturbed area around mine	28,908
Wind erosion from product stockpiles	6,132
Total Estimated Emissions	**1,985,839**

Note:
kg/yr = kilograms per year

PEL (2014) estimated that haul trucks transporting overburden account for approximately 78% of the total emissions of TSP at the Snapper Mine. Tronox has advised that the Modification would result in a decrease in overburden haulage distances of approximately 30%, as overburden would be temporarily placed around the mine path extension for infilling of the modified final depression, rather than transported behind the dredging operation for backfilling of the mine path. Dust emissions generated by overburden haulage would therefore be expected to decrease by approximately 30% as a result of the Modification.

PEL (2014) estimated that wind erosion from soil stockpiles, overburden dumps and disturbed areas contribute approximately 5% of total emissions of TSP from the Snapper Mine. The Modification would result in a minor decrease in distance between soil stockpiles/surface development areas and the nearest sensitive receiver (i.e. the Manilla Homestead) (from approximately 3.6 km to 3.3 km). The relative size of soil stockpiles would not change for the Modification. The mine path extension associated with the Modification would however be located further from the Manilla homestead (4.3 km) than the existing/approved mine path (3.8 km). The changes described above are expected to result in negligible change to the existing/approved dust deposition rates at the Manilla homestead.

Given that the Modification would result in a reduction in total dust emissions from the Snapper Mine (due to the approximate 30% reduction in overburden haulage distances), it is expected that the modified Snapper Mine would continue to comply with the relevant air quality criteria at all sensitive receivers surrounding the Snapper Mine.

7.2 Cumulative Air Quality Assessment

PAE Holmes (2010) noted that there may be some exceedances of the EPA 24-hour average PM_{10} impact assessment criterion of 50 µg/m^3 criterion at sensitive receivers due to elevated background levels unrelated to mining activities (such as dust storms and bushfires). However, no additional exceedances of the EPA 24-hour average PM_{10} impact assessment criterion of 50 µg/m^3 were predicted by PAE Holmes (2010) due to operations at the Snapper and Ginkgo Mines.

Given the Modification would result in a reduction in total dust emissions from the Snapper Mine, it is considered there would be no change to the potential cumulative air quality impacts described by PAE Holmes (2010) above.

8 CONCLUSIONS

The review has found the following:

- Given that the Modification would result in a reduction in total dust emissions from the Snapper Mine (due to the approximate 30% reduction in overburden haulage distances), it is expected that the modified Snapper Mine would continue to comply with the relevant air quality criteria at all sensitive receivers surrounding the Snapper Mine.
- Given the Modification would result in a reduction in total dust emissions from the Snapper Mine, it is considered there would be no change to the approved potential cumulative air quality impacts as a result of the Modification.

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SNAPPER MINE

Northern Extension Modification

Appendix D

Noise Review

TRONOX



ACOUSTICS AND AIR

SNAPPER MINE NORTHERN EXTENSION MODIFICATION

NOISE REVIEW

REPORT NO. 19375
VERSION A

NOVEMBER 2019

PREPARED FOR

TRONOX MINING AUSTRALIA LIMITED

WILKINSON MURRAY

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A	Final	21 November 2019	Lee Hudson	John Wassermann
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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1 per cent (%) of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

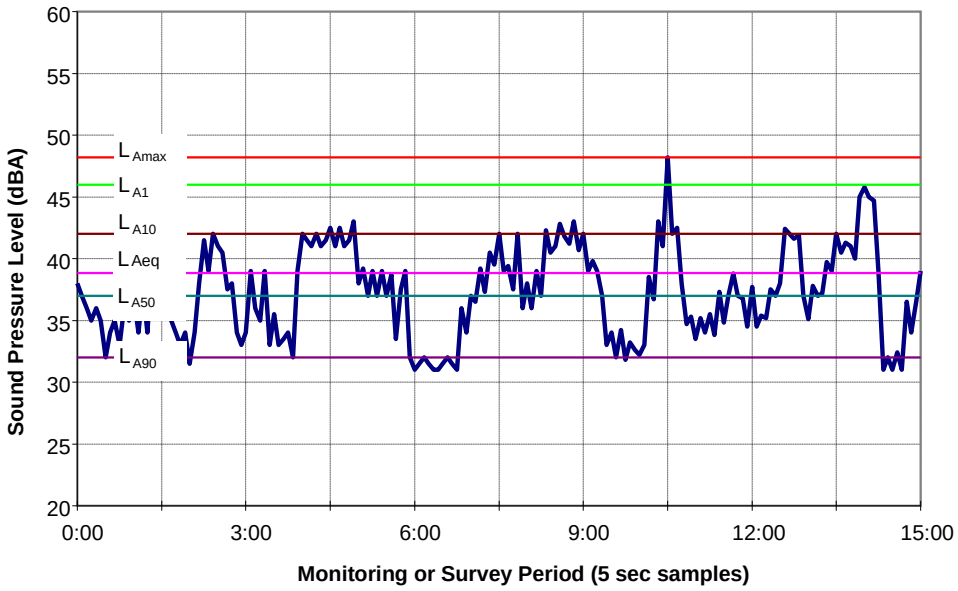
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1-1).

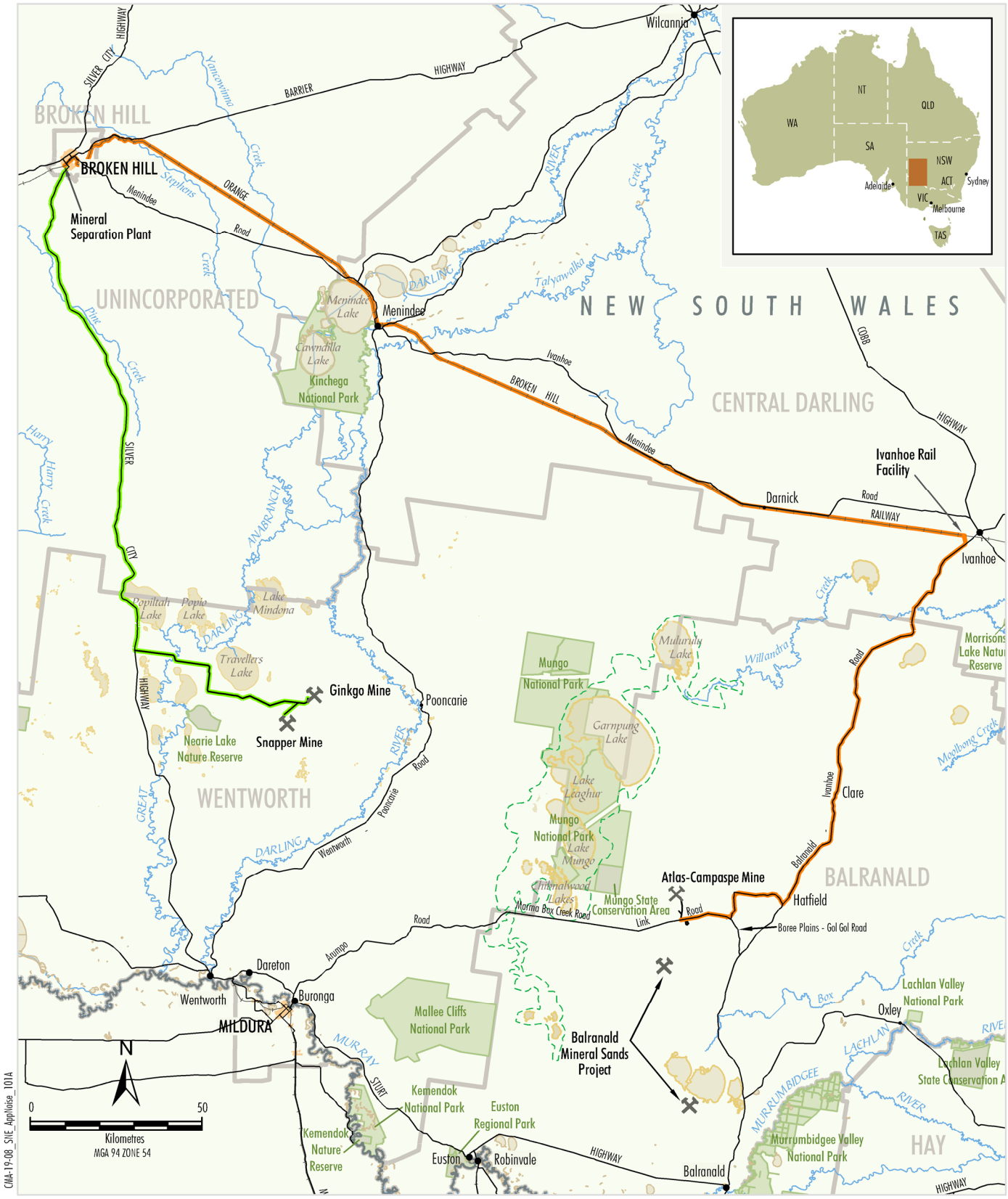
The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (Figure 1-1):

- the Broken Hill Mineral Separation Plant (MSP), located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north-east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

This Noise Review has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.

The review has been conducted in accordance with the NSW Environment Protection Authority (EPA) *Noise Policy for Industry* (NPfI) (EPA, 2017), and includes:

- an overview of the relevant regulatory requirements and noise criteria;
- a description of the meteorological characteristics and potentially sensitive receptors in the vicinity of the Snapper Mine;
- a review of the previous Snapper and Ginkgo Mine Noise Assessments;
- a review of the approved and proposed mining fleet and associated sound power levels (SWL);
- predictions of operational noise levels; and
- an assessment of potential operational and cumulative noise impacts.



LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: © NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)

TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1-1

2 OVERVIEW OF THE MODIFICATION

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

The Modification would include:

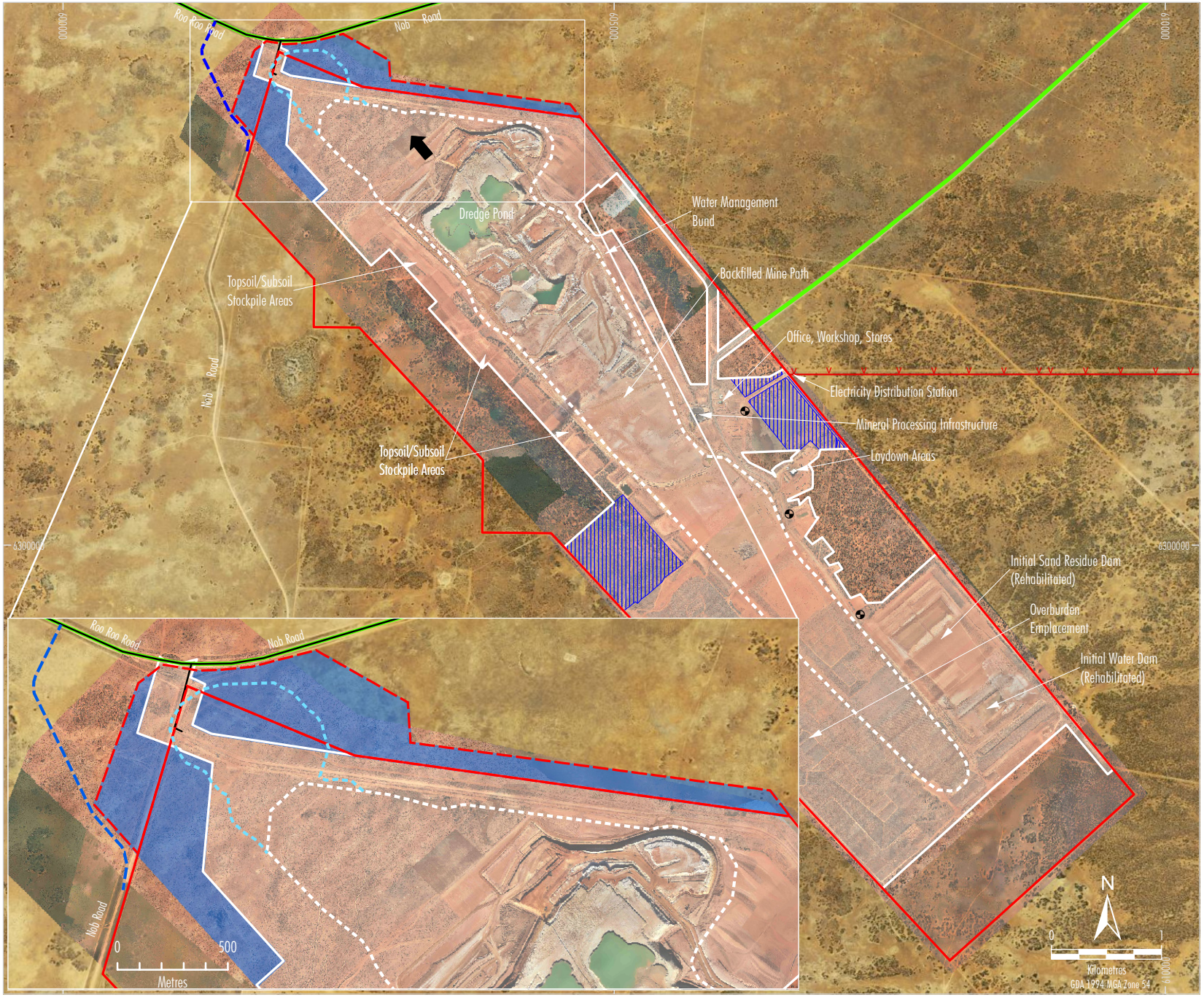
- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The modified general arrangement of the Snapper Mine is shown on Figure 2-1.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.2 and 2 of the Modification Report, respectively.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

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S N A P P E R M I N E

Modified Snapper Mine - Indicative General Arrangement

Figure 2-1

CMA-19-08_SNE_AppNoise_202B

3 NOISE CRITERIA

3.1 Operational Noise

Condition 10, Schedule 3 of Project Approval (06_0168) requires that operational noise generated by the Snapper Mine not exceed 35 A-weighted decibels (dBA) $L_{Aeq(15minute)}$ at any residence on privately-owned land. The 35 dBA criterion does not apply under the following meteorological conditions:

- wind speeds greater than 3 metres per second (m/s) at 10 metres (m) above ground level; or
- temperature inversions greater than 3 degrees Celsius (ºC)/100 m, and wind speeds greater than 2 m/s at 10 m above ground level.

In accordance with Condition 10, Schedule 3 of Project Approval (06_0168), the criterion also does not apply where Tronox has an agreement with the relevant residential property owners to generate higher noise levels and Tronox has advised the NSW Department of Planning, Industry and Environment in writing of the terms of the agreements.

The applicable operational noise criterion of 35 dBA for the Snapper Mine was based on the results of the background noise monitoring conducted by Holmes Air Sciences (HAS) (2007) for the original Snapper Mine Environmental Assessment (EA), which adopted rating background levels (RBL) of 30 dBA for the day, evening and night periods (i.e. the minimum RBLs assumed for assessment purposes in accordance with the procedures documented in the *Industrial Noise Policy* (INP) (EPA, 2000).

Tronox holds Environment Protection Licence (EPL) 12799 issued under the NSW *Protection of the Environment Operations Act, 1997* for the Snapper Mine. EPL 12799 does not contain any specific requirements in regard to noise emissions or monitoring.

Noise Policy for Industry Project Noise Trigger Levels

The NPfI (EPA, 2017) outlines a process for determining Project Noise Trigger Levels for assessing potential operational noise impacts, and supersedes the INP (EPA, 2000).

The Project Noise Trigger Levels for the Snapper Mine determined in accordance with the NPfI are outlined in Table 3-1.

Table 3-1 NPfI Project Noise Trigger Levels

Location	Day	Evening	Night
	$L_{Aeq,15min}$	$L_{Aeq,15min}$	$L_{Aeq,15min}$
All privately-owned land	40	35	35

The Project Noise Trigger Levels outlined in Table 3-1 are based on RBLs of 35 dBA, 30 dBA, and 30 dBA (i.e. the minimum assumed RBLs in accordance with the NPfI) for the day, evening and night periods respectively, based on the background noise survey conducted by HAS (2007) for the Snapper Mine EA (Section 4.2).

The existing Project Approval (06_0168) noise criterion of 35 dBA is more stringent than the NPfI Project Noise Trigger Level for the daytime (40 dBA) (Table 3-1).

3.2 Road Traffic Noise

Condition 11, Schedule 3 of Project Approval (06_0168) contains criteria applicable to noise generated by Snapper Mine-related vehicles on the Highway Access Route (HAR) between the Silver City Highway and the Snapper Mine, which have been reproduced in Table 3-2.

Table 3-2 Road Traffic Noise Criteria – Highway Access Route

Receiver	Traffic Noise Level $L_{Aeq,1hr}$ (dBA)	
	Day (7am-10pm)	Night (10pm-7am)
Residence on non-Proponent held land	50	45

In addition to the Project Approval (06_0168) road traffic noise criteria (Table 3-2), criteria for assessment of noise from traffic on public roads are set out in the NSW *Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water, 2011). These criteria are shown in Table 3-3.

Table 3-3 Criteria for Traffic Noise – Residences

Type of Development	Noise Level Criterion	
	Day (7am-10pm)	Night (10pm-7am)
Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq,15hour}$ 60 dBA	$L_{Aeq,9hour}$ 55 dBA
Existing residences affected by **additional traffic** on existing local roads generated by land use developments.	$L_{Aeq,1hour}$ 55 dBA	$L_{Aeq,1hour}$ 50 dBA

3.3 Cumulative Noise

To prevent continuing increases in background noise levels within an area due to the cumulative effect of multiple noise sources, noise from industrial development should remain within the NPfI recommended amenity noise levels.

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location within a particular land use area. The project amenity noise level represents the objective for noise from a single industrial development at a receiver location. The project amenity noise level for each new source of industrial noise is set at 5 dBA below the recommended amenity nose level.

To assess the potential cumulative impact of noise emissions from the Snapper Mine and Ginkgo Mines upon surrounding receivers, the amenity criteria presented in Table 3-4 apply.

Table 3-4 Amenity Criteria for Assessment of Cumulative Noise Impacts

Receiver	Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level L_{Aeq} (dBA)
Residence	Rural	Day	50
		Evening	45
		Night	40

Note 1: Daytime 7.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night 10.00 pm-7.00 am

4 EXISTING NOISE ENVIRONMENT

4.1 Receiver Locations

The potentially sensitive receiver locations in vicinity of the Snapper Mine area are shown on Figure 4-1. The Manilla and Trelega homesteads are the closest private sensitive receivers to the Snapper Mine (located approximately 4 km to the north-east and 7 km south respectively). The Woodlands homestead is the closest sensitive receiver to the HAR (located approximately 800 m to the north) (Figure 4-1).

4.2 Ambient Noise Monitoring

Monitoring to characterise the noise environment of the area surrounding the Snapper Mine was carried out by HAS (2007) for the Snapper Mine. The survey results are shown in Table 4-1.

Table 4-1 Background Noise Survey Results

Location	Monitoring Period	RBL (dBA)		
		Day[1]	Evening[1]	Night[1]
Manilla	25/08/2006 to 7/09/2006	26	25	25
Trelega	25/08/2006 to 7/09/2006	26	25	26

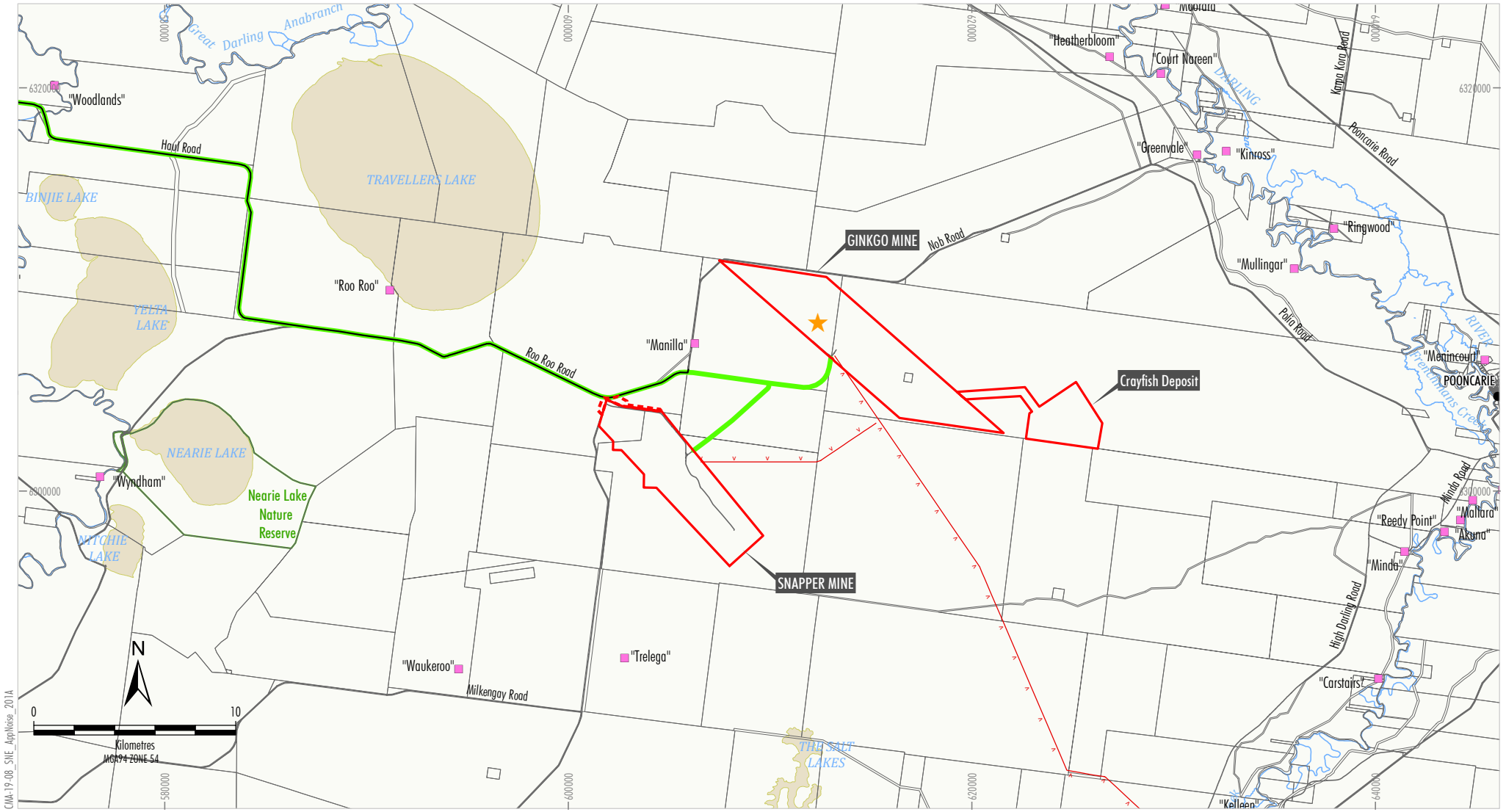
Source: HAS (2007)
Note 1: Daytime 7.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night 10.00 pm-7.00 am

4.3 Compliance Noise Monitoring

Noise monitoring at the Snapper Mine is undertaken in accordance with the *Murray Basin Mineral Sands Mines Noise Management Plan* (NMP) (GHD, 2018) (Section 5). In accordance with the NMP, compliance noise monitoring was conducted annually from the commencement of Snapper Mine operations until 2015 at the Manilla and Woodlands homesteads (i.e. the closest sensitive receivers to the Snapper Mine and HAR, respectively).

In 2016, and in accordance with Condition 10, Schedule 3 of Project Approval (06_0168), Tronox obtained signed agreements with the residents of the Manilla and Woodlands homesteads to discontinue noise monitoring at these locations due to ongoing compliance with the relevant noise criteria. Cristal (now Tronox) subsequently advised the NSW Department of Planning and Environment (DP&E) of these agreements in March 2016.

The results of the most recent period of unattended noise monitoring at the Manilla and Woodlands homesteads (May 2015) are presented in Table 4-2.



Source: NSW Spatial Services (2019); Tronox (2019)

LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA1)
- Cadastral Boundary
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line
- Meteorological Station
- Dwelling

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SNAPPER MINE

Sensitive Receiver Locations

Figure 4-1

Table 4-2 Compliance Survey Ambient Noise Monitoring Results

Location	Monitoring Period	Measured Noise Level (dBA)								
		Day[1]			Evening[1]			Night[1]		
		L_{A90}	L_{Aeq}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10}
Woodlands	08/05/2015 to 15/05/2015	32	42	43	20	31	33	22	30	31
Manilla	20/05/2015 to 27/05/2015	25	39	39	22	29	31	21	26	27

Source: Cristal Mining Australia (2018)
Note 1: Daytime 7.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night 10.00 pm-7.00 am

Compliance noise monitoring at the Manilla homestead up to and including 2015 demonstrated compliance with the Project Approval (06_0168) noise criterion of 35 dBA. On occasions where recorded noise levels exceeded 35 dBA, review of monitoring results (and associated recordings) indicated that windy conditions[1], wildlife and traffic noise were the cause of noise levels exceeding 35 dBA, and were not related to operations at the Snapper Mine (Cristal Mining Australia [Cristal], 2018).

As the Manilla homestead is the closest sensitive receiver to the Snapper Mine, compliance with the relevant noise criteria at Manilla would indicate compliance is also being achieved at the Trelega homestead.

Tronox did not receive any complaints regarding operational noise from the commencement of operations at the Snapper and Gingko Mines up to the end of 2018. A complaint from the Manilla homestead was however received in early 2019.

In response to the complaint from the Manilla homestead, and in accordance with the NMP, attended and unattended compliance noise monitoring was undertaken by Tronox and Renzo Tonin & Associates (RTA) (2019), respectively.

Attended noise monitoring conducted by Tronox indicated that operations at the Snapper Mine were only audible during periods with low ambient noise, periods which corresponded with noise levels below 35 dBA.

RTA conducted unattended noise monitoring at the Manilla homestead between Tuesday 6 August to Saturday 10 August 2019. The monitor deployed was set to record broadband and spectral statistical noise descriptors and audio to enable playback for the purpose of source identification. The 15-minute period during which the highest noise level was measured occurred between 5.15 am and 5.30 am on Wednesday 7 August 2019. The maximum measured $L_{eq,15min}$ noise level was 35 dBA. This level was considered indicative of maximum case mine noise during all periods. The $L_{A90,15min}$ background sound level during this period would be lower than the maximum measured $L_{eq,15min}$ and both levels therefore comply with the Project Approval (06_0168) criterion of 35 dBA.

[1] Compliance noise monitoring data recorded in 2011 and 2013-2015 did not remove noise data recorded during wind speeds above 3 m/s at 10 m above the ground, temperature inversions greater than 3 ^{o}C/100 m, and wind speeds greater than 2 m/s at 10 m above ground level.

4.4 Meteorology

4.4.1 General

At relatively large distances from a source, the resultant noise levels at a receiver will be influenced by meteorological conditions, specifically:

- wind; and
- temperature gradients.

Wind can increase noise at a receiver when it blows from the direction of the noise source at relatively low wind speeds (below 3 m/s). An increase in wind strength greater than 3 m/s generally results in a corresponding increase in wind noise at the receiver which masks noise from the source under investigation.

Temperature inversions (positive temperature gradients) can increase noise levels at surrounding receivers by the reflection of sound waves from warmer upper layers of air. Temperature inversions occur predominantly at night.

In assessing noise impacts, noise assessment criteria are expected to apply under weather conditions that are likely to occur at a particular site for a significant period of time.

The NPfI describes two approaches for assessing these effects; the simple and the more detailed approach.

The simple approach forgoes a detailed analysis of meteorological data and simply applies given default meteorological parameters to predict noise levels. This approach assumes that meteorological effects are present for a significant amount of time, avoiding the need to quantify these effects in detail. It is conservative, in that it is likely to predict the upper range of increases in noise levels due to meteorological conditions.

The more detailed approach involves an analysis of meteorological data to determine whether inversions and/or wind effects are significant features warranting assessment. Where assessment is warranted, default parameters are available for use in predicting noise or where preferred, measured values maybe used instead.

The following sections provide a summary of the synthetic (modelled) site-specific meteorological data (wind speeds and directions) from the Air Quality Assessment report prepared for the Ginkgo Mine Crayfish Modification (Katestone, 2012), as summarised by Wilkinson Murray (WM) (2012). As part of their assessment, Katestone (2012) evaluated the modelled wind data against wind records from the Ginkgo Mine meteorological station (located approximately 10 km north-east of the Snapper Mine), which showed a good correlation between the model predictions and records from the Ginkgo Mine meteorological station.

4.4.2 Wind

Figure 4-2 shows that on an annual basis, the highest frequencies of winds around the Snapper Mine occur from the south and south-west. Calm conditions (wind speeds equal to or less than 0.5 m/s) are observed for approximately 8.9% of the time and the annual average wind speed is 2.4m/s (HAS, 2007). Figure 4-3 shows that seasonal variation in the dominant wind direction (i.e. south-west) at the Snapper and Ginkgo Mines is limited.

Figure 4-2 Annual Wind Rose for the Ginkgo Mine (Katestone, 2012)

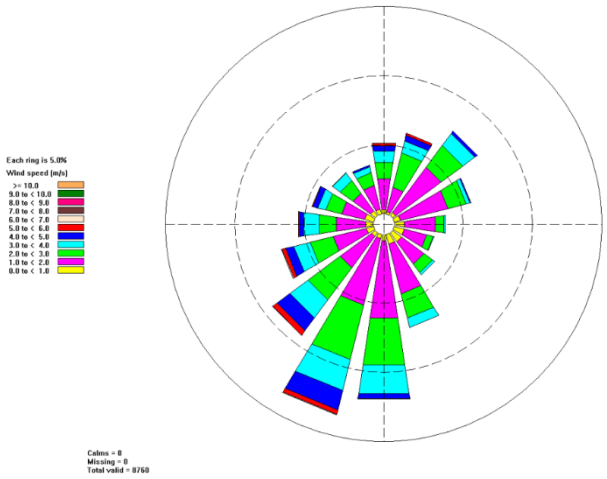
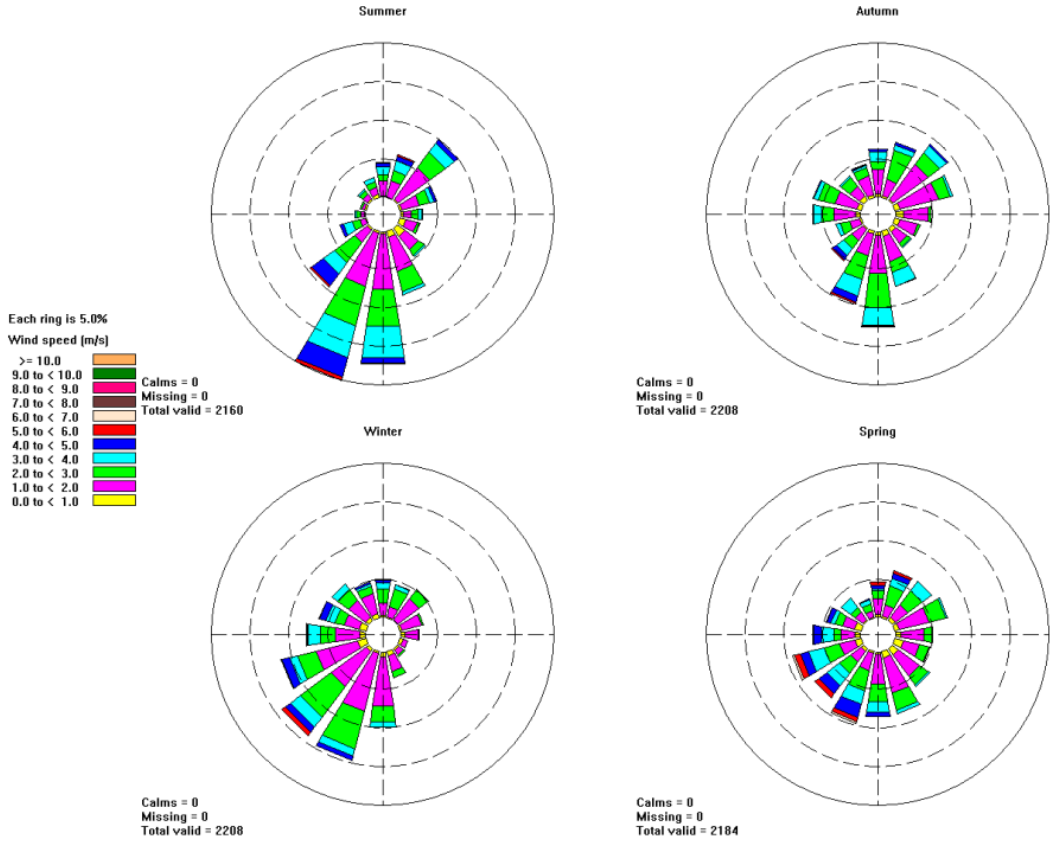


Figure 4-3 Seasonal Wind Roses for the Ginkgo Mine (Katestone, 2012)



4.4.3 Temperature Inversion

Pasquill-Gifford stability conditions indicate the potential for temperature inversions. There are six stability classes referred to as A to G. The frequencies of occurrence of stability classes are shown in Table 4-3 for the Ginkgo Mine (proximal to the Snapper Mine).

Table 4-3 Distribution of Atmospheric Stability Categories (WM, 2012)

Stability	Percentage Occurrence
A	2.6
B	14.8
C	18.5
D	17.2
E	5.8
F/G	41

Pasquill-Gifford stability conditions A to D indicate lapse conditions (negative temperature gradient). Pasquill-Gifford stability conditions E to G indicate temperature inversion conditions, E indicating a temperature gradient of between -0.5 and 1.5^{o}C/100 m, F indicating a temperature gradient of between 1.5 and 4^{o}C/100 m and G indicating a temperature gradient greater than 4^{o}C/100 m.

Stability Classes F and G apply normally at night when winds are light, and the sky is clear. Class E describes intermediate conditions between those described above.

There is a high percentage of D, E, F and G class conditions for the Ginkgo Mine (Table 4-3), reflecting a prevalence of stable meteorological conditions.

4.5 Meteorological Conditions Used for Noise Assessment Purposes

For the detailed noise assessment carried out for the Snapper Mine EA HAS (2007) used the INP (EPA, 2000) default meteorological parameters to predict noise levels at each receiver.

The Snapper Mine is located in an arid/semi-arid area that has annual average rainfall of less than 500 millimetres (mm). For such conditions, the INP recommends the following default meteorological conditions that enhance noise levels:

- Strong (G-class stability category) inversions:

  8^{o}C / 100 m inversion strength and source-to-receiver drainage flow wind of 1 m/s.

- Gradient wind:

  Source-to-receiver gradient wind of 3 m/s.

Comparing the actual wind and temperature inversion conditions with the INP default conditions, the INP default meteorological conditions provide a maximum scenario in terms of enhancement of operational noise due to meteorological factors.

The NPfI recommends different default meteorological conditions that enhance noise levels under the conditions experienced at the Snapper Mine:

- 4^{o}C/100 m inversion strength and source-to-receiver wind of 2 m/s.

The NPfI noise-enhancing meteorological conditions were adopted in the modelling conducted for this assessment (Section 7.2).

5 EXISTING NOISE MANAGEMENT

Noise management at the Snapper Mine is undertaken in accordance with the NMP (GHD, 2018) (Section 4.3), and includes the following noise management measures for the Snapper Mine:

- a noise monitoring program to assess compliance with the Snapper Mine operational and road traffic noise criteria (Section 3);
- contingency measures for controlling noise at the source and the receiver, and mitigating the transmission of noise between the source and receiver;
- a noise awareness program to educate employees on the effects of noise and quiet work practices – such as staff education programs to reinforce quiet driving styles/attitudes;
- a complaint handling and response protocol for the reporting and assessment of noise complaints, and identifying suitable preventative/corrective actions.

As described in Section 4.3, Tronox has received one noise-related complaint to date in relation to the Snapper and Ginkgo Mines, for which the complaint handling and response protocol was implemented.

Noise-related monitoring and compliance is reported annually in the Snapper Mine Annual Environmental Management Reports.

6 OVERVIEW OF PREVIOUS NOISE ASSESSMENTS

Several noise assessments have been conducted for the Snapper and Ginkgo Mines (HAS, 2007; PAEHolmes [PAEH], 2010 and Pacific Environment Limited [PEL], 2014).

The previous noise assessments assumed all plant and equipment to be operating concurrently, in which the maximum case scenarios modelled mining operations occurring at the closest potential distance to the sensitive receivers (Manilla and Trelega). Given this, the previously predicted noise levels in HAS (2007), PAEH (2010) and PEL (2014) are considered to be conservative.

A summary of the previous noise assessments relevant to the Snapper Mine is provided in this section.

6.1 Snapper Mineral Sands Project – 2007

A Noise Impact Assessment was conducted in accordance with the INP for the Snapper Mine EA in 2007 (HAS, 2007). Year 1 (construction) and Year 14 represented the 'maximum-case' scenarios given that mining operations during these years would be closest to the nearest sensitive receptors (i.e. Manilla and Trelega).

Table 6-1 presents the noise modelling results as predicted in the Snapper Mine EA Noise Assessment (HAS, 2007). Noise levels were predicted to be highest at Manilla during Year 14 operations.

Table 6-1 Snapper Mine Noise Assessment Modelling Results (HAS, 2007)

Receptor	Construction	Year 14 Operation	Noise Criteria (dBA)
Predicted $L_{Aeq\ (15\ minute)}$ (dBA) – Neutral Conditions			
Manilla	8	21	35
Trelega	10	3	
Other receivers*	<10	<10	
Predicted $L_{Aeq\ (15\ minute)}$ (dBA) – Inversion Conditions			
Manilla	19	28	35
Trelega	22	14	
Other receivers*	<15	<15	

Note: * Conservatively estimated from noise contours.

6.2 Snapper Mine & Ginkgo Mine Modification – 2010

A Noise Assessment was conducted in accordance with the INP for the Snapper Mineral Sands Mine and Ginkgo Mineral Sands Mine Modification EA by PAEH (2010). The assessment concluded that noise levels above the relevant criteria (35 dBA) would be unlikely at the nearest private sensitive receptors (i.e. Manilla and Trelega) under either neutral or temperature inversion conditions.

6.3 Ginkgo Mine – Crayfish Modification - 2012

WM (2012) prepared a Noise Assessment in accordance with the INP for an application to modify the Ginkgo Mine Development Consent (DA 251-09-01) to allow for the development of the Crayfish deposit. The assessment concluded that the development of the Crayfish deposit would not result in any significant contribution to the noise emissions of the Snapper and Ginkgo Mines at the surrounding sensitive receivers. Noise levels of below 10 dBA due to operations at the Crayfish deposit were predicted under neutral and adverse meteorological conditions at the Manilla and Trelega homesteads.

6.4 Snapper Mine Production Increase Modification - 2014

The most recent Noise Assessment for the Snapper Mine was conducted in 2014 (PEL, 2014).

PEL (2014) concluded that the relevant criterion (35 dBA) would be achieved at the nearest sensitive receptors under both neutral and adverse meteorological conditions.

In addition, the study found that road traffic noise levels were not expected to exceed the road traffic noise criteria (Table 3-2) on the HAR or Silver City Highway.

7 ASSESSMENT OF OPERATIONAL NOISE IMPACTS

7.1 Methodology

Prediction of operational noise levels at the identified receiver locations has been undertaken for the Modification based on the ISO 9613 (ISO, 1996) and CONCAWE (Manning, 1981) algorithms as implemented within the CadnaA acoustic modelling package, with adjustments for enhancements due to meteorological conditions.

Factors that are addressed in the model are:

- equipment sound level emissions and location;
- screening effects from buildings (if relevant);
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;
- ground absorption; and
- atmospheric absorption.

Information for the purpose of the noise modelling was provided by Tronox. This includes description of infrastructure and mobile plant, location of equipment, hours of operation and topographical information.

To assess any potential changes to the previously predicted noise levels and associated potential noise impacts (Section 6), a screening assessment has been conducted based on the minor changes to the mining fleet for the Modification (Section 7.2). The overall SWL associated with the modified mining fleet operating within the additional surface development area have been modelled and assessed against the relevant noise criteria (Sections 7.3 and 7.4).

7.2 Operational Noise

Relevant to this assessment, the Modification would include the extension of the approved mine path and associated supporting infrastructure into MLA 1, and a minor change to the approved mining fleet. The Modification would result in an increase in the distance between the mine path (and associated dredge mining operations) and the Manilla homestead, and a minor decrease in the distance between mining operations (e.g. soil stockpile areas) and the Manilla homestead.

Table 7-1 lists the approved and modified mining fleet and the modelled SWL associated with each item (based on the PEL [2014] assessment). Table 7-1 shows that the modified mining fleet (with 3 less excavators and 4 less haul trucks) does not result in any change to the approved overall total SWL associated with the mining fleet.

Table 7-1 Approved and Modified Snapper Mine Fleet

Equipment	Approved No.	SWL[1,2] (dBA)	Modified No.	SWL (dBA)
Backhoe	1	102	1	102
Bucket Scoop	4	115	4	115
Dozer	7	116	7	116
Excavator	7	114	4	114
Front End Loader	3	111	3	111
Grader	2	108	2	108
Lighting Tower	6	103	6	103
Scraper	1	115	1	115
Haul Truck	24	115	20	115
Water Truck	2	115	2	115
Service Truck	1	109	1	109
Articulated Dump Truck	4	115[1]	4	115
Total		132		132

Note:
1 These SWLs were adopted by PEL (2014) based on the levels adopted by WM (2012). In noting the WM (2012) SWLs were generally higher, PEL (2014) adopted them as a more conservative approach. The total SWL based upon these higher levels is 132dBA.
2 Source: WM (2012).

To quantify the potential increase in operational noise levels at the closest receiver (Manilla), the SWL associated with the modified mining fleet (Table 7-1) has been modelled for typical maximum case operational scenarios when all plant and fleet is working concurrently within the extension area, and the results are presented in Table 7-2.

Table 7-2 Predicted L_{Aeq} Operational Noise Levels

Receiver	Calm Meteorological Conditions (dBA)	Maximum Case Meteorological Gradient Wind of 3 m/s Predicted L_{Aeq} Noise Level (dBA)[1]	Maximum Case Meteorological 4 °C/ 100 m Inversion Strength and 2 m/s Wind Source to Receiver Predicted L_{Aeq} Noise Level (dBA)[1]
Manilla	29	35	35
Trelega	<10	15	<10

1 The default noise-enhancing meteorological conditions as prescribed in the NPfI.

Table 7-2 indicates that noise levels at the closest sensitive receivers (i.e. the Manilla and Trelega homesteads) would achieve the Project Approval (06-0168) criterion of 35 dBA, and the NPfI Project noise trigger levels of 40 dBA, 35 dBA and 35 dBA for the day, evening and night respectively, under neutral and adverse meteorological conditions.

7.3 Road Traffic Noise - Nob Road Realignment

As described in Section 3.2, the Modification would not result in any changes to mineral concentrate transport for the Snapper Mine. The Modification would therefore not result in any changes to the approved potential road traffic noise impacts along the HAR.

The Modification would however include the realignment of Nob Road around MLA 1 (Section 2, Figure 2-1). The realigned portion of Nob Road would be further from the closest sensitive receiver (i.e. Manilla), and there would therefore be a slight reduction in noise levels at Manilla from the vehicles travelling along this portion of Nob Road.

Compliance with the road traffic noise criteria at all sensitive receivers would continue to be met as a result of the Modification.

8 CUMULATIVE NOISE IMPACT

The Manilla homestead (the closest sensitive receiver to both the Snapper and Ginkgo Mines) is located approximately 4 km and 5 km from the Snapper and Ginkgo Mines, respectively. The potential for cumulative noise emissions to impact the Manilla homestead therefore requires consideration.

The predicted noise levels at Manilla under maximum case meteorological conditions from the Snapper and Ginkgo Mines (including the Ginkgo Mine Crayfish deposit) are shown together with the predicted cumulative noise level in Table 8-1.

Table 8-1 Cumulative Operational Noise at Manilla

Mining Operation	Predicted $L_{Aeq,15min}$ Operational Noise Level (dBA)
Snapper Mine	35[1]
Ginkgo Mine	29[2]
Crayfish Deposit	<10[3]
Total (Cumulative)	36

Note 1: Based on the predicted results in Table 7-2.
Note 2: Based on predicted noise level from HAS (2001).
Note 3: Based on predicted noise level from WM (2012).

Based on the maximum case scenario (i.e. with all mining operations occurring simultaneously under adverse meteorological conditions), the predicted cumulative noise level at Manilla would achieve the minimum (night time) NPfI recommended amenity noise levels of 40 dBA (Table 3-4). Compliance will therefore be achieved at Trelega, and other receivers located at greater distances from the Snapper mine.

9 CONCLUSION

This Noise Review has considered the aspects of the Modification that have the potential to emit noise to the environment surrounding the Snapper Mine. These operations have been reviewed in relation to the Noise Assessments previously prepared for the Snapper Mine and Ginkgo Mine.

This review concludes that the Modification is not expected to cause any significant increase in operational noise levels at the nearest surrounding receivers. All operational noise criteria (Project Approval noise limit and NPfI Project Noise Trigger Levels) are predicted to be achieved for the modified Snapper Mine.

The minor realignment of Nob Road required to accommodate the extended mine path will not result in any change to road traffic noise levels at surrounding receivers and the relevant assessment criteria will continue to be achieved.

10 REFERENCES

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SNAPPER MINE

Northern Extension Modification

Appendix E

Road Transport Review

TRONOX





Snapper Mineral Sands Mine Northern Extension Modification

Road Transport Review

Prepared for:

Tronox Mining Australia Limited

22 November 2019

The Transport Planning Partnership

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Snapper Mineral Sands Mine Northern Extension Modification

Road Transport Review

Client: Tronox Mining Australia Limited

Version: Final

Date: 22 November 2019

TTPP Reference: 19359

Quality Record

Version	Date	Prepared by	Approved by	Signature
Final	22/11/2019	Penny Dalton	Penny Dalton	

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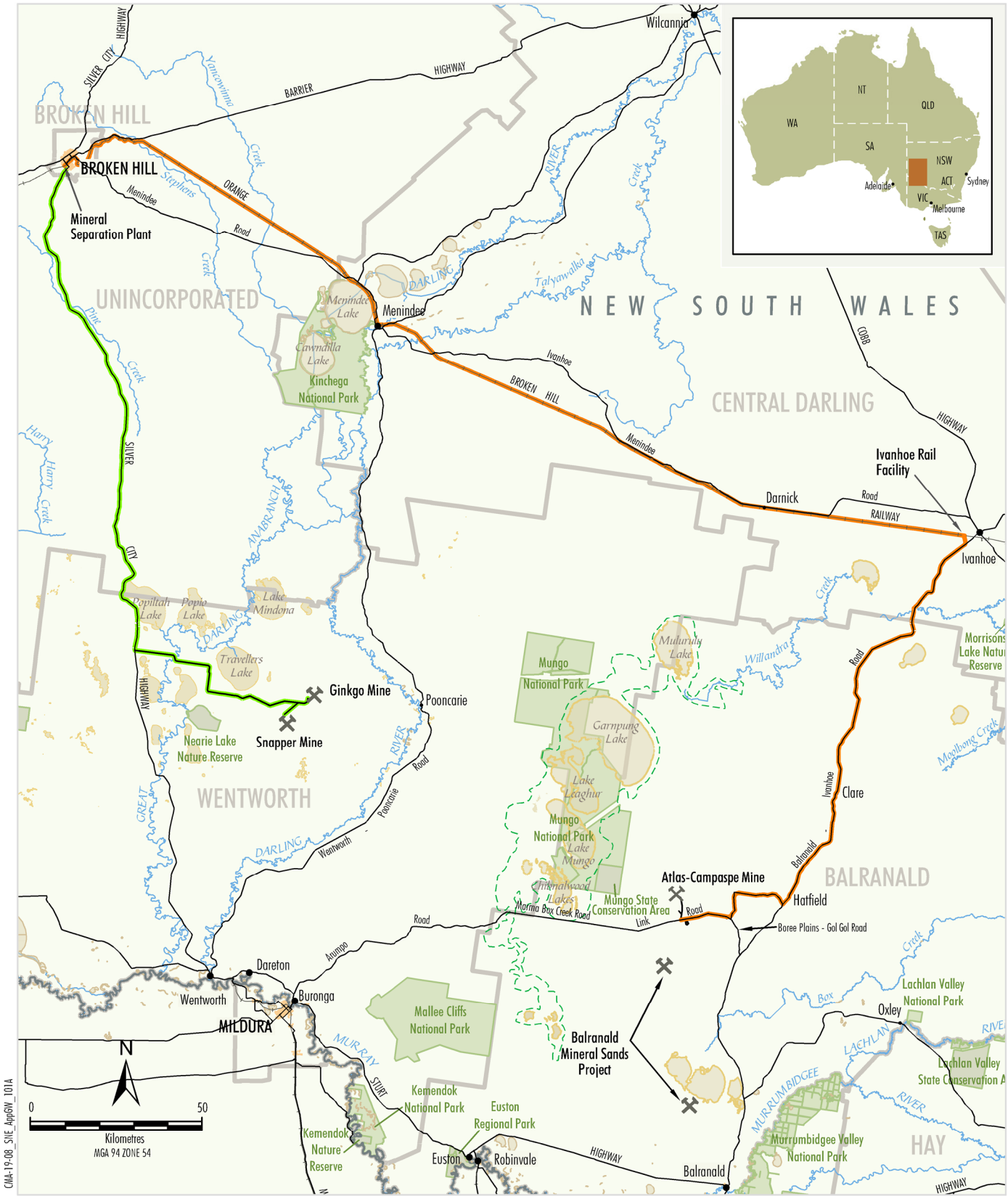
1 Introduction

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (Figure 1):

- the Broken Hill Mineral Separation Plant (MSP), located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

This Road Transport Review has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.


BROKEN HILL
BROKEN HILL
Mineral Separation Plant
UNINCORPORATED
NEW SOUTH WALES
CENTRAL DARLING
BALRANALD
WENTWORTH
MILDURA
Wilcannia
Menindee
Menindee Lake
Cawndilla Lake
Kinchega National Park
Ivanhoe
Ivanhoe Rail Facility
Darnick
Ginkgo Mine
Snapper Mine
Pooncarie
Nearie Lake Nature Reserve
Papiltah Lake
Popio Lake
Lake Mindona
Travellers Lake
Mungo National Park
Mutundy Lake
Garnpung Lake
Lake Leaghur
Lake Mungo
Chinnalwood Lakes
Atlas-Campaspe Mine
Mungo State Conservation Area
Hatfield
Clare
Dareton
Wentworth
Buronga
Mallee Cliffs National Park
Balranald Mineral Sands Project
Kemendok National Park
Kemendok Nature Reserve
Euston Regional Park
Euston
Robinvale
Balranald
Lachlan Valley National Park
Oxley
Murrumbidgee Valley National Park
Morrisons Lake Nature Reserve
Barrier Highway
Silver City Highway
Ivanhoe
Menindee
Broken Hill
Darnick
Railway
Cobb Highway
Ivanhoe
Balranald
Boree Plains - Gol Gol Road
Morma Box Creek Road
Link Road
Wentworth
Pooncarie
Road
Anumpo
Road
Darling River
Murray River
Lachlan River
Murrumbidgee River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Yancowinna Creek
Stephens Creek
Menindee Road
Orange
Pine Creek
Harry Harry Creek
Talyawalka Creek
Box Creek
Silver City Highway
Barrier Highway
Cobb Highway
Darling River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Lachlan River
Murrumbidgee River
Sturt Highway
Sturt Highway
Sturt Highway

2 Approved Operations and Modification

2.1 Snapper Mine Operations

The Snapper Mine extracts up to 9.2 million tonnes per annum (tpa) of ore, and produces up to 621,000 tonnes per annum (tpa) of mineral concentrate for transport by road to the MSP where stockpiling and final separation into saleable products occurs. The Snapper Mine operates 24 hours per day, seven days per week.

Roads and Maritime Services (RMS) approved vehicles are used to transport mineral concentrates from the Snapper Mine to the MSP via the mineral concentrate transport route (MCTR). MSP process waste generated at the MSP is backloaded in the empty mineral concentrate transport vehicles to the Snapper and Gingko Mines via MCTR. The MCTR route consists of:

- Snapper and Gingko Mines Access Road;
- Highway Access Road (including a section of Roo Roo Road);
- Silver City Highway;
- Kanandah Road;
- Pinnacles Road; and
- MSP access road.

The combined workforce at the Snapper and Gingko Mines is approximately 420 people, with between 200 and 250 people on site at any one time. Most of its employees live in the local region and reside on site during their rostered work periods. Some employees and contractors commute daily from local towns and rural areas. The peak periods for the movement of employees to and from the Snapper and Ginkgo Mines occur on Monday morning (arrivals) and Friday evening (departures).

Two vehicular access roads for the Snapper Mine are approved, located on the northern and eastern sides of the Snapper Mine. The eastern access is via the Snapper Mine Access Road, and is the primary access for Snapper Mine. The northern access is direct to Nob Road, however this access has remained closed and will not be required for the remaining life of the Snapper Mine.

In accordance with Condition 24, Schedule 3 of Project Approval (06_0168), a Transport Management Plan (Cristal Mining Australia [Cristal], 2015) has been prepared for the Snapper and Ginkgo Mines, and includes measures for the transport of hazardous materials and a Code of Conduct for all drivers transporting materials to and from the site, prepared in consultation with RMS and the Environment Protection Authority.

2.2 Overview of the Modification

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

The Modification would include:

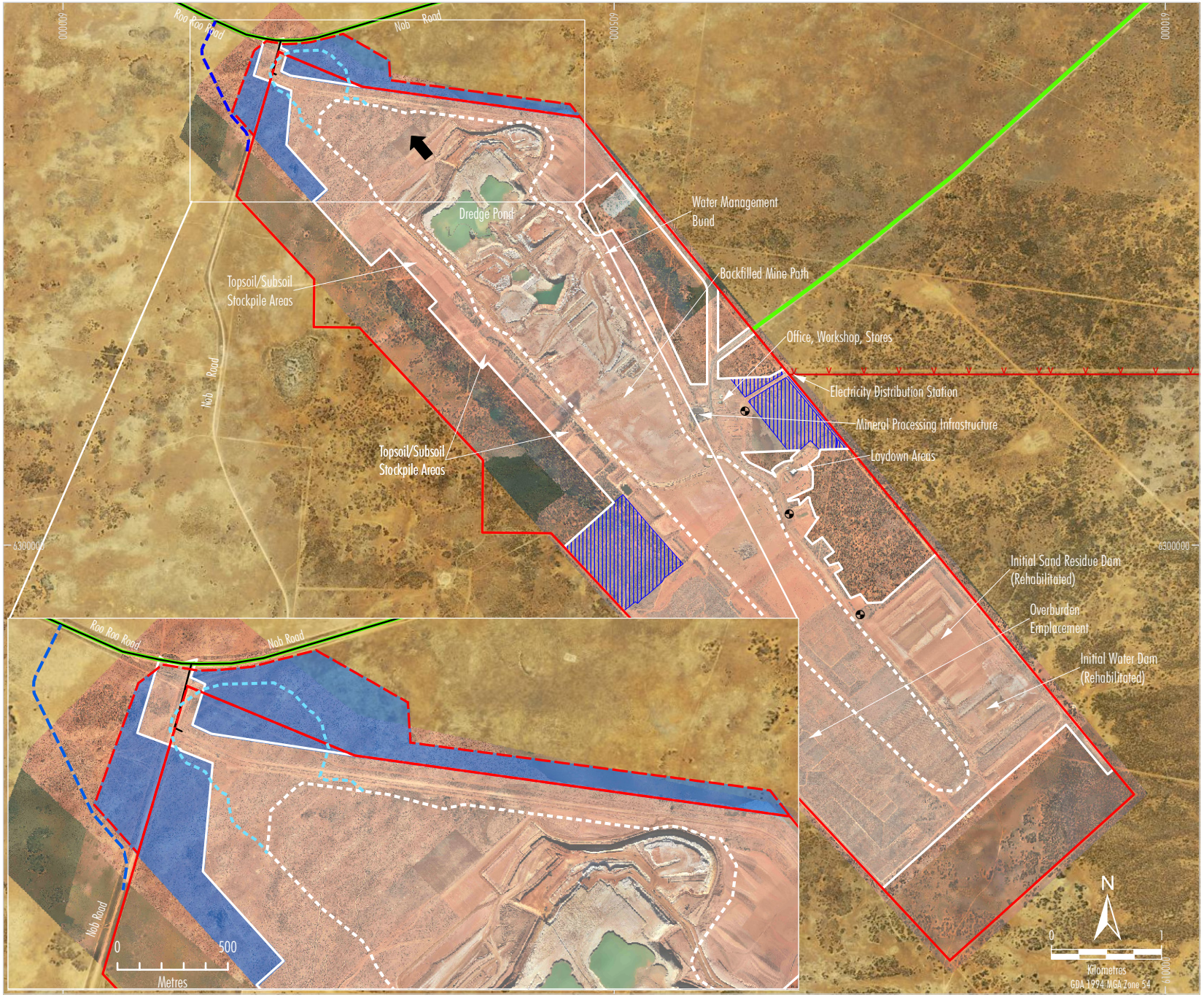
- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The indicative general arrangement of the of the modified Snapper Mine is shown on Figure 2.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.1 and 2 of the Modification Report, respectively.



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure 2

CMA-19-08_SNE_AppACHA_201C

2.3 Road Transport Aspects of the Modification

With regard to potential impacts on the road transport environment, the Modification proposes to re-align approximately 1 km of Nob Road around MLA 1 and construct a new intersection at the point where the re-aligned portion of Nob Road and Roo Roo Road meet (located approximately 600 m west of the existing intersection). The Nob Road realignment would be approximately 1.35 km in length (i.e. approximately 350 m longer than the portion of Nob Road that would be realigned).

3 Existing Road Transport Environment

3.1 Road Network

The roads and intersections relevant to the Modification are briefly described below.

3.1.1 Existing Roads

Roo Roo Road is a local unsealed formed road which provides a link between Nob Road near the Snapper Mine and Old Broken Hill Road near Nitchie Lake. The eastern 16 km of Roo Roo Road forms part of the Snapper and Gingko Mines MCTR. In the vicinity of Snapper Mine, Roo Roo Road supports travel speeds in the order of 100 kilometres per hour (km/h) and follows a generally straight and level alignment between a wide radius bend at its intersection with Nob Road and a wide radius bend approximately 6 km to the west. The road alignment is delineated with guideposts and chevron alignment markers (CAMs), (D4-6) where required.

Nob Road is a local unsealed formed road which passes around the western and northern sides of the Snapper Mine, and provides a link between High Darling Road approximately 38 km north of Wentworth and Polia Road 20 km northwest of Pooncarie. The portion of Nob Road immediately to the west of the Snapper Mine has a poor surface, with rutting and corrugations evident, which constrain travel speeds to approximately 80 to 85 km/h in order to maintain passenger comfort. This length of Nob Road does not have guideposts to delineate the road alignment. To the north of the Snapper Mine between Roo Roo Road and the Snapper and Gingko Mines Access Road, Nob Road forms part of the MCTR, and its carriageway is of a higher standard than that west of Snapper Mine. This portion of Nob Road supports travel speeds in the order of 100 km/h, and the road alignment is delineated with guideposts and CAMs where required.

The **Snapper and Gingko Mines Access Road** (which forms part of the MCTR) provides an east-west link between Gingko Mine and Nob Road. It is a private road used by all traffic approaching and departing the Gingko and Snapper Mines. It is signposted with a speed limit of 80 km/h, reducing to 60 km/h on the approaches to the intersection with the Snapper Mine Access Road. The carriageway is approximately 10 m wide, with narrow unsealed shoulders and guideposts and CAMs are used to delineate the road alignment.

The **Snapper Mine Access Road** provides a link between the Snapper Mine and the Snapper and Gingko Mines Access Road. It is a private road used by all traffic approaching and departing the Snapper Mine. It is a gravel road with a signposted speed limit of 80 km/h, reducing to 60 km/h on approach to the intersection with the Snapper and Gingko Mines Access Road. The carriageway is approximately 10 m wide, with unsealed shoulders, and guideposts and unidirectional hazard markers (D4-1-2) are used to delineate the road alignment.

3.1.2 Existing Intersections

The **Nob Road and Roo Roo Road intersection** is a basic T-intersection, at which the southern approach of Nob Road meets Roo Roo Road at 90 degrees. Nob Road (south) is the minor road and Roo Roo Road and Nob Road (east) form the major road. A "GIVE WAY" sign controls traffic at the intersection, which also features a sight board comprising two unidirectional hazard markers (D4-1-1) end to end facing the minor road traffic at the intersection.

The **Snapper and Gingko Mines Access Road and Nob Road intersection** is a basic T-intersection, at which Nob Road (north) meets Nob Road (west) and the Snapper and Gingko Mines Access Road (east) at 90 degrees. Nob Road (north) is the minor road, controlled with a "GIVE WAY" sign, and a sight board faces the minor road traffic.

The **Snapper Mine Access Road and Snapper and Gingko Mines Access Road intersection** is a T-intersection with standard priority and "STOP" signs for traffic on the Snapper Mine Access Road. Lighting is provided to illuminate the intersection, and as noted above, speed limits of 60 km/h are signposted on all approaches to the intersection.

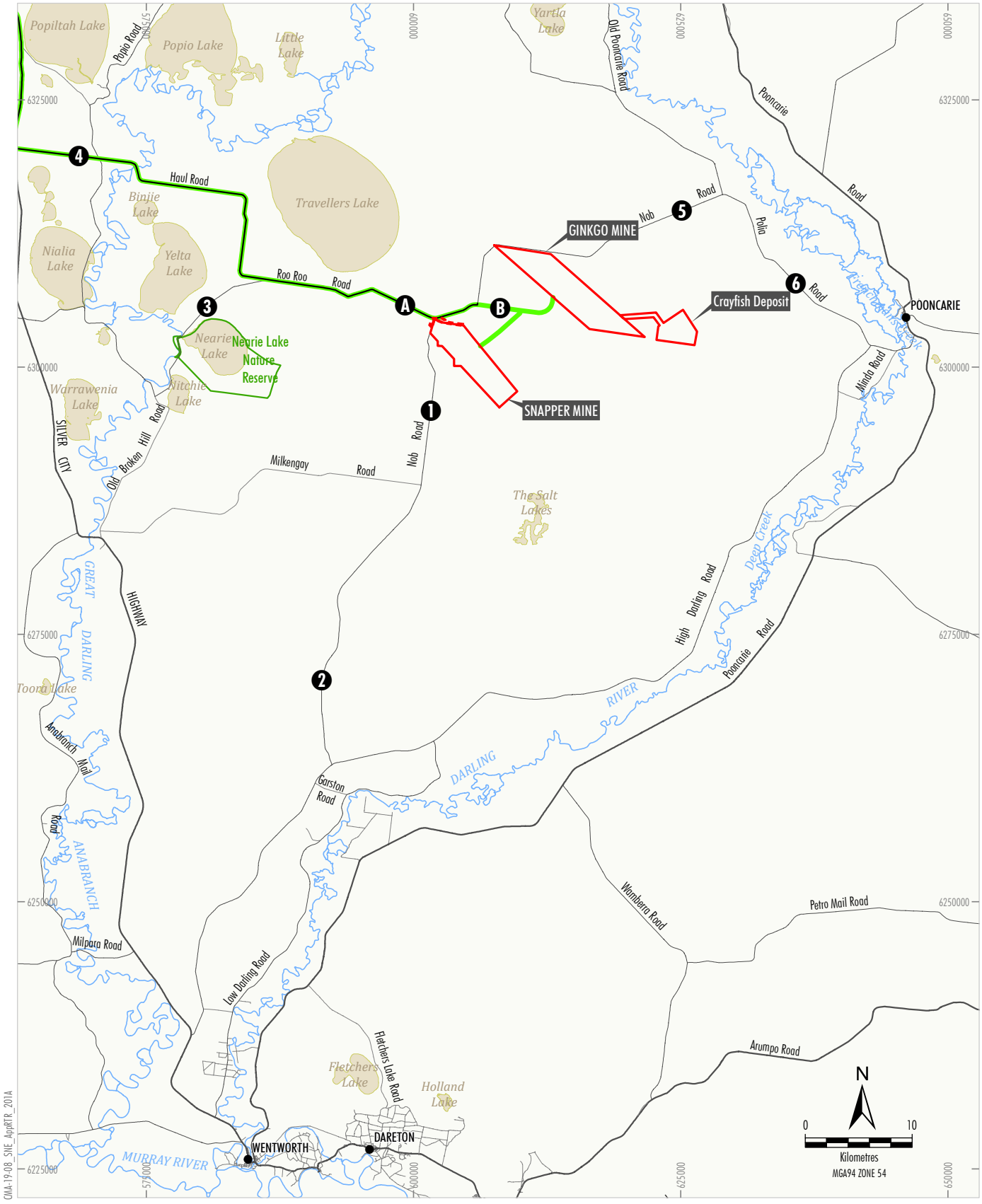
3.2 Traffic Volumes

A review of available traffic data on roads serving the Snapper and Ginkgo Mines has been undertaken to quantify the existing conditions against which the potential traffic impacts of the Modification can be assessed.

3.2.1 Local Road Condition Assessment Surveys

Tonkin Consulting (2013) undertook a study to determine the traffic generated by the Snapper and Gingko Mines and the distribution of those trips on the local unsealed roads. At the time of those surveys, Tonkin (2013) indicates that the Snapper and Ginkgo Mines employed approximately 200 employees and 200 contractors. The combined workforce of approximately 400 people is similar to but slightly below the current combined workforce of 420 people.

Analysis of an employee survey identified the routes taken by employees travelling to and from the Gingko and Snapper Mines, noting that many employees altered their route according to the current road conditions and/or seasonal weather conditions. Tonkin Consulting (2013) assessed the results of the employee surveys, additional data relating to contractors not covered in the employee survey and the traffic volume data, and quantified the average daily traffic generation of the Snapper and Gingko Mines and its distribution on the road network. Key results from that assessment are summarised in Table 3.1. The traffic survey locations from Tonkin Consulting (2013) (i.e. locations 1 to 6 in Table 3.1) are shown on Figure 3.



Source: NSW Spatial Services (2019); Tronox (2019)

LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Mineral Concentrate Transport Route and MSP Process
- Waste Transport Route
- Highway Access Road
- ❶ Traffic Survey Location

TRONOX

SNAPPER MINE

Traffic Survey Locations

Figure 3

CMA-19-08_SNE_AppRTR_201A

Table 3.1: Snapper and Gingko Mines Daily Traffic Generation and Distribution 2013

Road and Location	Snapper and Gingko Mine Light Vehicle Traffic (Class 1 only)	
	Vehicles per Day	Axles per Day
Total Mine Traffic	29.1	58.2
Route to/from South		
(1) Nob Road South of Roo Roo Road	16.1	32.2
(2) Nob Road North of High Darling Road	15.6	31.1
Routes to/from West		
(3) Roo Roo Road West of Highway Access Road	4.2	8.5
(4) Highway Access Road West of Peter Withers Bridge	7.5	15.0
Route to/from East		
(5) Nob Road West of Polia Road	1.3	2.5
(6) Polia Road South of Nob Road	1.3	2.5

Class 1 light vehicles only
Source: Figure 3 Tonkin Consulting (2013)

The survey suggests that on an average day in 2013, the light vehicle traffic generated by the Snapper and Gingko Mines was distributed as follows:

- 55.4 percent of light vehicle trips to/from the south via Nob Road;
- 40.3 percent of light vehicle trips to/from the west via Roo Roo Road; and
- 4.3 percent of light vehicle trip to/from the east via Nob Road and Polia Road.

In the immediate vicinity of the Snapper and Ginkgo Mines, the background daily traffic not related to the Gingko or Snapper Mines at the time of the 2013 surveys was determined by Tonkin Consulting (2013) to be very low, e.g. approximately nine vehicles per day on Nob Road south of Roo Roo Road.

3.2.2 Gingko and Snapper Mines Monitoring Surveys 2018-2019

TTPP has reviewed the results of monitoring surveys conducted by Tronox on roads serving the Snapper and Gingko Mines between September 2018 and January 2019. The number of vehicles per day varied over the survey period, as presented in Table 3.2, and the survey locations (i.e. locations A and B in Table 3.2) are shown in Figure 3. The 85th percentile daily volume is the volume which was exceeded on 15 percent of days, and so represents a reasonably busy day at each of the locations. The 85th percentile traffic demands are considered an appropriate level for design and assessment purposes, and are referred to herein as the design day traffic.

Table 3.2: Daily Traffic Volumes September 2018 to January 2019 (vehicles per day)

Road and Location	Average Day	85th Percentile Design Day
(A) Roo Roo Road west of Nob Road	77	92
(B) Snapper and Gingko Mines Access Road east of Nob Road	110	137

The 2018-2019 monitoring surveys included classification of the vehicles based on the Austroads Vehicle Classification System. Articulated vehicles include semi-trailers, rigid trucks with trailers, B-Doubles and road trains where permitted. The surveyed classification of vehicles as articulated or non-articulated at the survey locations are summarised in Table 3.3, together with the calculated daily vehicles on the 85th percentile day over the survey period.

Table 3.3: Vehicle Classifications September 2018 to January 2019

Road and Location	Non-Articulated	Articulated	Total
Percent of Total Vehicles			
(A) Roo Roo Road west of Nob Road	29.7	70.3	100
(B) Snapper and Gingko Mines Access Road east of Nob Road	53.3	46.7	100
Average Day (vehicles per day)			
(A) Roo Roo Road west of Nob Road	23	54	77
(B) Snapper and Gingko Mines Access Road east of Nob Road	59	51	110
Design Day Traffic (vehicles per day)			
(A) Roo Roo Road west of Nob Road	27	65	92
(B) Snapper and Gingko Mines Access Road east of Nob Road	73	64	137

Considering the hourly distribution of traffic over the surveyed period in September 2018 to January 2019, the peak two way volume in any hour was an average of 12 to 13 percent of the daily volume on the Snapper and Gingko Mines Access Road and on Roo Roo Road. The peak hour volumes on the design day are therefore estimated at:

- Roo Roo Road west of Nob Road 11 vehicles per hour; and
- Gingko and Snapper Mines Access Road east of Nob Road 17 vehicles per hour.

3.3 Road Crash History

Crash data was obtained from Centre of Road Safety (2019) covering the period from 1 January 2014 to 31 December 2018. The data includes those crashes which conform to the national guidelines for reporting and classifying road vehicle crashes based on the following criteria:

- The crash was reported to the police.
- The crash occurred on a road open to the public.
- The crash involved at least one moving vehicle.
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Crash data was reviewed for the sections of road which would be directly impacted by the Modification, and on the approaches to those sections of impacted roads:

- Roo Roo Road between Nob Road and 2 km west of Nob Road;
- Nob Road between Roo Roo Road and 4 km south of Nob Road; and
- Nob Road between Roo Roo Road and 1 km east of Roo Roo Road.

The crash data revealed that no crashes were reported on the relevant sections of road over the five year period investigated. This suggests there is no inherent issue with the design or controls on the roads which would be impacted by the Modification.

3.4 Road Network Capacity and Efficiency

The design day peak hourly traffic volumes on Roo Roo Road and the Snapper and Gingko Mines Access Road are sufficiently low that there is substantial spare capacity available, and drivers would experience negligible delays or restrictions to their desired travel speed as a result of interaction with other vehicles.

4 Impacts of the Modification

4.1 Impact on Mine Traffic Generation and Distribution

The Modification would not change the number of employees, the operational shift and roster arrangements, nor the transport of mineral concentrates and waste products associated with the Gingko and Snapper Mines. The number of vehicle trips generated by the Gingko and Snapper Mines and the distribution of those trips throughout the day and week would therefore not change.

The Modification would not change the directional distribution of the traffic generated by the Gingko and Snapper Mines. All mine-generated traffic would continue to access the Snapper Mine via the Snapper and Gingko Mines Access Road and Snapper Mine Access Road.

4.2 Traffic on Realignment of Nob Road

The results of the monitoring surveys and distribution surveys (Section 3.2) have been used to estimate the volume of traffic on the portion of Nob Road which would be realigned for the Modification.

Review of the data in Table 3.3 and considering the findings of the Tonkin Consulting (2013) distribution surveys (Table 3.1) suggests that all articulated vehicles to and from the Snapper and Gingko Mines travel on Roo Roo Road west of Nob Road (i.e. the MCTR), and do not turn south down Nob Road. This is expected, noting heavy vehicles transporting mineral concentrate are only permitted to travel along the MCTR, and the relatively poor condition of Nob Road south does not make it an attractive alternative route for other heavy vehicles.

The Tonkin Consulting (2013) distribution surveys suggest that the remaining vehicles surveyed on the Snapper and Gingko Mines Access Road would be distributed as follows:

- Roo Roo Road west of Nob Road average day 24 vehicles, design day 29 vehicles;
- Nob Road south of Roo Roo Road average day 32 vehicles, design day 40 vehicles; and
- Nob Road north of the Snapper and Gingko Mines Access Road average day three vehicles, design day four vehicles.

The surveyed daily volumes on Roo Roo Road west of Nob Road are similar to but slightly below the estimates above suggested by the distribution survey. The differences are very small however and are not considered to be significant, noting that the distribution survey was conducted five years ago, and minor changes in the overall traffic distribution can be expected over time.

The portion of Nob Road west of the Snapper Mine (south of Roo Roo Road) is therefore estimated to carry approximately 32 to 33 vehicles per day associated with the Snapper and Gingko Mines on an average day, and approximately 40 to 42 vehicles per day associated with the Snapper and Gingko Mines on the 85th percentile day. Tonkin Consulting (2013) found that daily traffic on this road not related to the mines was very low, at approximately nine vehicles per day. On this basis, total traffic on Nob Road south of Roo Roo Road is estimated at approximately 42 vehicles per day on an average day and 51 vehicles per day on the design day.

Surveyed peak hourly traffic represented 12 to 13 percent of daily traffic on Roo Roo Road and the Snapper and Gingko Mines Access Road. It is therefore estimated that Nob Road south of Roo Roo Road carries a peak of approximately six to seven vehicles per hour on the design day.

4.3 Intersection Operation

The Modification would not impact the number of vehicles at the intersection, rather the intersection would be relocated and reconstructed approximately 600 m west of its current location. Existing two way peak hourly traffic volumes on the design day on the roads in the vicinity of the realignment of Nob Road are (Section 3.2 and Section 4.2):

- Nob Road south of Roo Roo Road six to seven vehicles per hour;
- Roo Roo Road west of Nob Road 11 vehicles per hour; and
- Gingko and Snapper Mines Access Road east of Nob Road 17 vehicles per hour.

At unsignalised intersections with minor roads, where there are relatively low volumes of through and turning vehicles, capacity considerations are usually not significant, and detailed analysis of capacity is not warranted. As a guide, at volumes below the following combinations of maximum hourly volumes at a cross intersection with a two lane two-way road, capacity analysis is not warranted:

- major road 400 vehicles per hour, minor road 250 vehicles per hour;
- major road 500 vehicles per hour, minor road 200 vehicles per hour; and
- major road 650 vehicles per hour, minor road 100 vehicles per hour.

Comparing the existing busy day traffic volumes above at the intersection of Roo Roo Road with Nob Road, it is evident that the peak hourly volumes are well below the threshold volumes for analysis, and as such, there is no capacity concern regarding the operation of the proposed intersection of Roo Roo Road with the realignment of Nob Road. Formal analysis of the operation of the intersection is not justified, delays experienced by drivers would be very low.

4.4 Impact on Roadway Capacity and Efficiency

The Modification would not change the number, timing or distribution of vehicle trips on the road network, and so would have no impact on the midblock capacity available on the roads, nor on the likely interaction between drivers. Construction of the realignment of Nob Road is expected to permit higher vehicle travel speeds than occur currently because the road would be constructed to an improved surface standard than the existing road, which would improve the level of service experienced by drivers on that road.

4.5 Road and Intersection Design

The realignment of Nob Road (south) would be constructed as an unsealed road, to meet the relevant design requirements of Wentworth Shire Council (WSC) and/or Austroads as required. Standard drawings for road cross sections are shown as "under development" on WRC's website (November 2019), however it is generally expected that the realignment would be constructed to sustain higher operating speeds than currently occur on Nob Road (south). General design considerations are discussed below.

Based on the estimated traffic volumes on that portion of Nob Road (Section 4.2), it would be considered a Class 4B unsealed road (ARRB, 2009). Class 4B unsealed roads are minor roads carrying up to 150 vehicles per day, and used for connection between local centres, generally constructed as an all-weather two-lane road, with a minimum carriageway width of 7.0 m. These have a typical operating speed of up to 70 km/h, which is below the current observed operating speed of Nob Road, thus a higher standard of road (Class 4A) may be required to comfortably and safely sustain higher vehicle speeds.

For unsealed roads, travel speeds can vary significantly from day to day based on prevailing road surface or weather conditions. Drivers are encouraged to drive to the road conditions rather than imposing a speed limit. The observed vehicle speeds on Roo Roo Road during the monitoring traffic surveys in 2018-2019 suggest that the operating speed is in the order of 100 km/h. NSW Centre for Road Safety (2009) acknowledges that in some locations the default state speed limit may be the preferred option on an unsealed road, and in such cases, the "REDUCE SPEED TO CONDITIONS" (G9-318-1) signs may be used to remind drivers to drive to conditions on unsealed roads.

The new intersection of Roo Roo Road with the realigned Nob Road would form a T-intersection, with a similar layout as the existing intersection, i.e., Nob Road (south) would be the minor road, and Roo Roo Road and Nob Road (east) would be the major road. The intersection would be designed in accordance with the principles outlined in ARRB (2009) and the requirements of Austroads (2017a and 2017b). Signage would be provided in accordance with Australian Standard 1742.2 (2009), consisting of "GIVE WAY" signage and bidirectional sight boards. The minor road would intersect with the major road at 90 degrees to maximise visibility for all drivers.

The location of the proposed intersection has been considered with regard to sight distance. Safe Intersection Sight Distance (SISD) is the minimum standard which should be provided on the major road at any intersection. And provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road moving into a possible collision situation. Austroads (2017b) indicates that for an operating speed of 100 km/h on the major road, the desirable minimum SISD is 248 m for the general minimum driver reaction time of 2.0 s and assuming a level sealed road surface. The distance on an unsealed road would vary somewhat from this, due to the different wearing surface impacting the deceleration of vehicles. Observations on site (refer to Photograph A 6 and Photograph A 7 in Appendix A) suggest that the available sight distance for both eastbound and westbound car drivers at the proposed intersection location is in excess of 500 m, thus SISD will be achieved. Existing low vegetation on the northern side of Roo Roo Road / Nob Road to the east of the intersection should be managed to ensure sight lines remain clear.

Austroads (2017c) sets out warrants for rural intersection treatments, which are based on the number of turning and through vehicle movements at the intersection. The forecast peak hourly traffic volumes at the intersection are sufficiently low that the minimum preferred treatment would be warranted under such conditions. The minimum treatment provides the simplest intersection layout, with appropriate corner radii to suit the swept path of the design vehicle. The basic treatments at a T-intersection include:

- BAR treatment, being a widened shoulder on the major road which allow through vehicles to pass to the left of a vehicle turning right into the minor road;
- BAL treatment on the major road, being a widened shoulder which assists turning vehicles to move further off the carriageway, making it easier for a through vehicle to pass; and
- BAL turn treatment on the minor road, allowing turning movements to occur from a single lane only, with a narrow shoulder which prevents drivers from standing two abreast at the holding line.

4.6 Impact on Travel Times

The realignment of Nob Road south of Roo Roo Road would increase the distance travelled by vehicles approaching and departing the Snapper and Gingko Mines Access Road to and from the south only. The route via the realigned Nob Road would increase the travel distance for that traffic by approximately 950 m (being approximately 600 m additional distance on Roo Roo Road and 350 m additional on Nob Road).

It is expected that the realignment of Nob Road would be constructed to a better standard than the current Nob Road, which would facilitate higher travel speeds than currently occur. Assuming the average travel speed on the realignment of Nob Road is in the order of 100 km/h, (similar to that of Roo Roo Road and Nob Road on the MCTR), while that on the existing Nob Road is 85 km/h, the realignment of Nob Road (south) would increase travel times for mine-generated traffic by approximately 20 seconds.

The realignment of Nob Road south of Roo Roo Road would decrease the distance travelled by vehicles travelling between Nob Road (south) and Roo Roo Road by approximately 250 m. As above, the route via the realigned Nob Road would decrease the travel times for vehicles travelling between the south and east by approximately 23 seconds.

In the context of the location of the Snapper and Gingko Mines in the region, and the travel distances and times inherent in accessing the mines and other properties in the region, the impacts of the Modification on travel distances and times are negligible.

4.7 Impact on Road Safety

The review of the road crash history of the roads impacted by the Modification did not identify any causation factors associated with the existing road network that may be exacerbated by the Modification. The realignment of Nob Road (south) and its new intersection with Roo Roo Road would be designed and constructed to established WSC and/or Austroads standards, applying the Safe System approach to road safety.

As described in Section 2.2, the Modification includes the extension of the existing/approved mine path and associated supporting infrastructure into MLA 1. As a result, the mining areas would extend further to the north and views of the modified Snapper Mine may be visible from a short section of Roo Roo Road.

Tronox would locate lighting plants in the mining areas so that they would be directed away from vehicles travelling along Roo Roo Road and would also continue to use directional lighting and light shields to minimise light spill.

With the implementation of these management measures, it is considered that the modified Snapper Mine operational lighting would not present a potential risk to road safety on Roo Roo Road.

4.8 Mitigation Measures

The assessment above does not highlight any need for mitigation measures to effectively manage the road transport impact of the Modification.

5 Conclusions

This study has found that the Modification would have acceptable impacts on the capacity, efficiency and safety of the road network. It is recommended that the realignment of Nob Road and its new intersection with Roo Roo Road be constructed to meet relevant WSC and/or Austroads design requirements.

Appendix A

Photos



Photograph A 1: Intersection of Nob Road and Roo Roo Road, facing West from Nob Road



Photograph A 2: Intersection of Nob Road and Roo Roo Road, facing North from Nob Road



Photograph A 3: Intersection of Nob Road and Roo Roo Road, facing East from Roo Roo Road



Photograph A 4: Nob Road between Roo Roo Road and Snapper and Gingko Mines Access Road



Photograph A 5: Nob Road west of Snapper Mine, facing South



Photograph A 6: Roo Roo Road near Proposed Intersection Location, facing East



Photograph A 7: Roo Roo Road near Proposed Intersection Location, facing West

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SNAPPER MINE

Northern Extension Modification

Appendix F

Hydrogeological Review

TRONOX



TRONOX MINING AUSTRALIA LIMITED

SNAPPER MINE NORTHERN EXTENSION MODIFICATION

HYDROGEOLOGICAL REVIEW

POONCARIE, NSW



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Attachment A Snapper Groundwater Monitoring - Modelled Vs Measured Hydrographs

Attachment B Predicted Groundwater Contours for the Snapper and Ginkgo Mines

1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (Figure 1):

- the Broken Hill Mineral Separation Plant, located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north-east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

This Groundwater Review has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.

1.1 Overview of the Modification

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

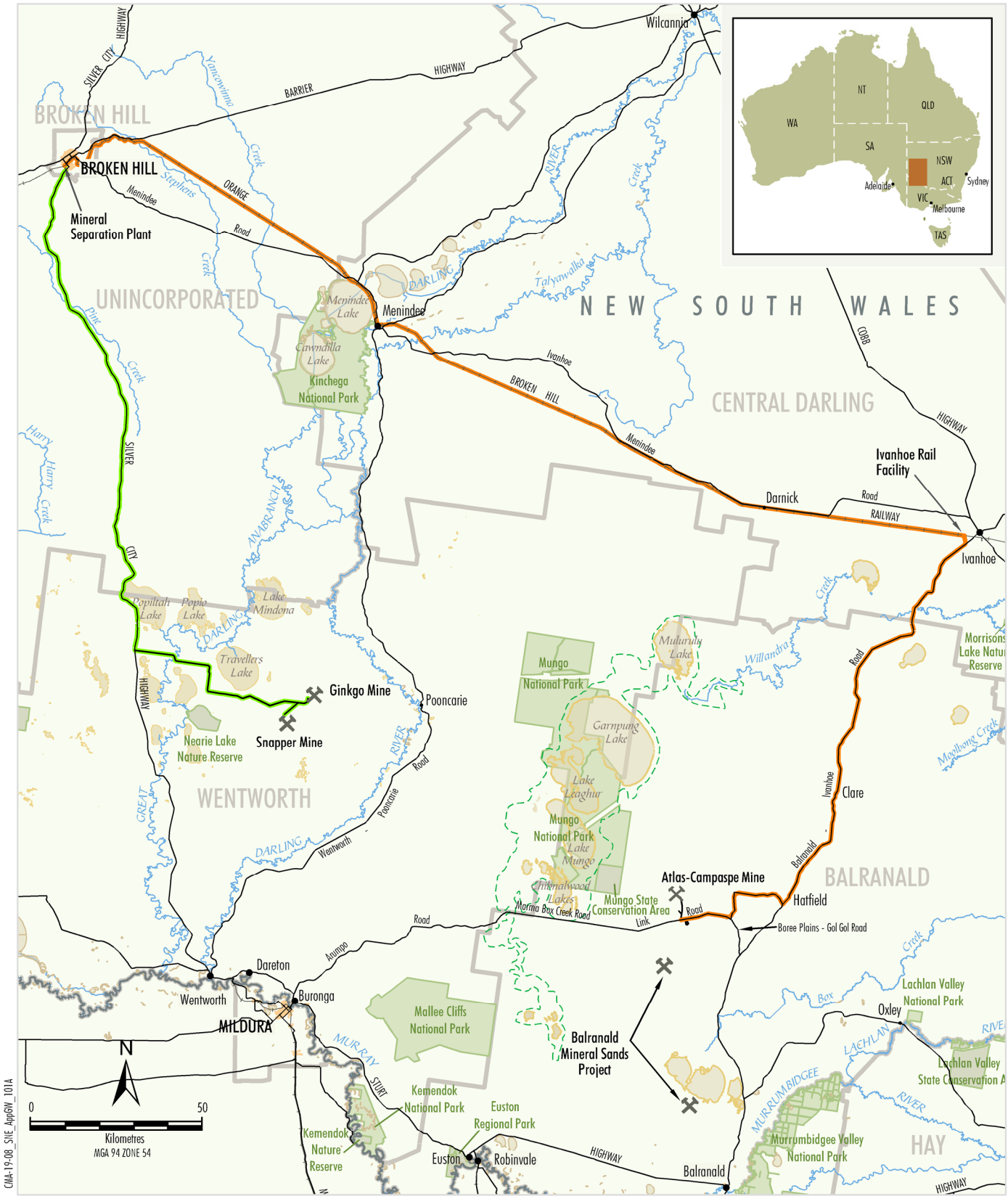
The Modification would include:

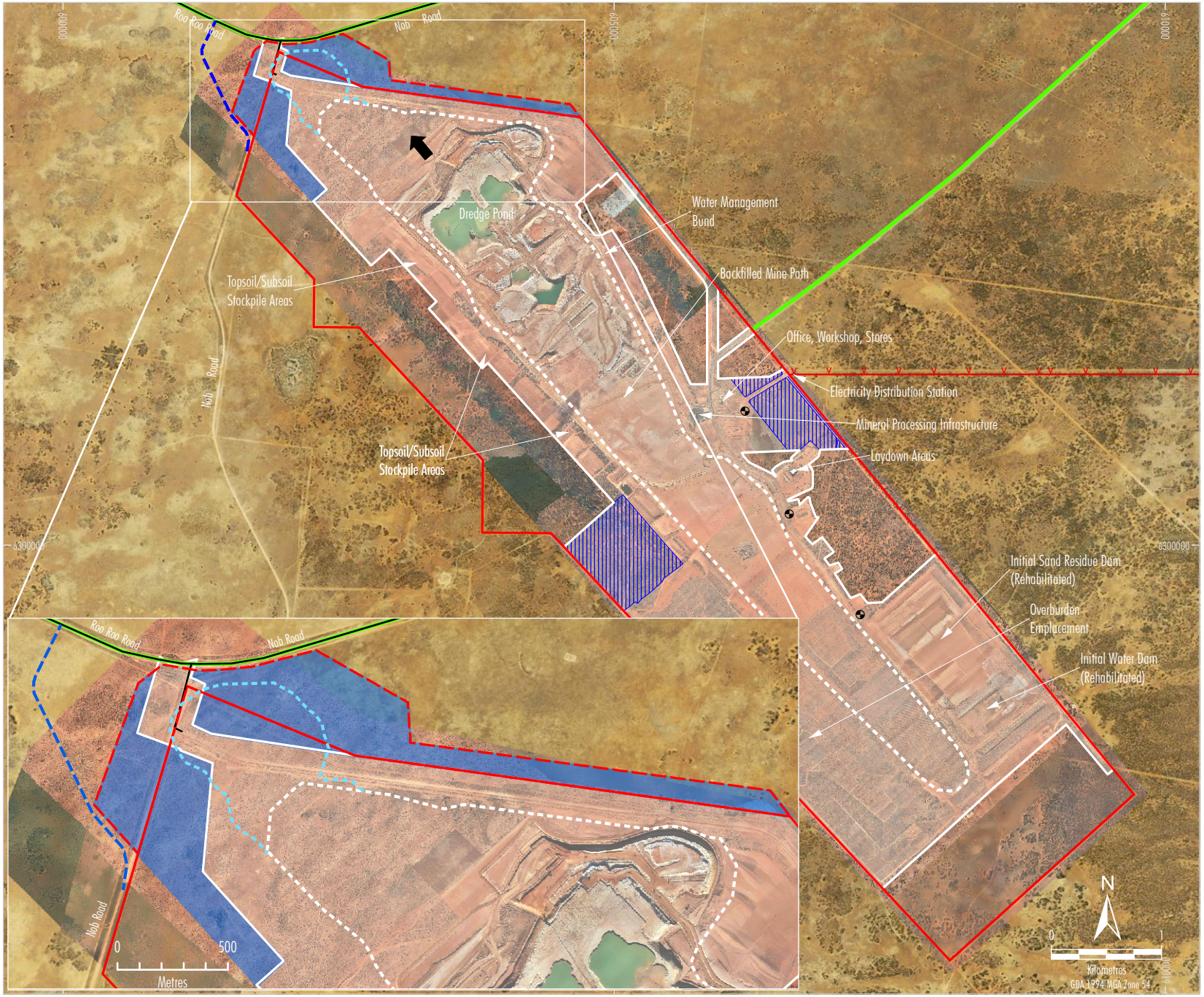
- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The modified general arrangement of the Snapper Mine is shown on Figure 2.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;


BROKEN HILL
BROKEN HILL
Mineral Separation Plant
UNINCORPORATED
NEW SOUTH WALES
CENTRAL DARLING
BALRANALD
WENTWORTH
MILDURA
Wilcannia
Menindee
Menindee Lake
Cawndilla Lake
Kinchega National Park
Ivanhoe
Ivanhoe Rail Facility
Darnick
Ginkgo Mine
Snapper Mine
Pooncarie
Nearie Lake Nature Reserve
Papiltah Lake
Popio Lake
Lake Mindona
Travellers Lake
Mungo National Park
Mutundy Lake
Garnpung Lake
Lake Leaghur
Lake Mungo
Chinnalwood Lakes
Atlas-Campaspe Mine
Mungo State Conservation Area
Hatfield
Clare
Dareton
Wentworth
Buronga
Mallee Cliffs National Park
Balranald Mineral Sands Project
Kemendok National Park
Kemendok Nature Reserve
Euston Regional Park
Euston
Robinvale
Balranald
Lachlan Valley National Park
Oxley
Murrumbidgee Valley National Park
Morrisons Lake Nature Reserve
Barrier Highway
Silver City Highway
Ivanhoe
Menindee
Broken Hill
Darnick
Railway
Cobb Highway
Ivanhoe
Balranald
Boree Plains - Gol Gol Road
Morma Box Creek Road
Link Road
Wentworth
Pooncarie
Road
Anumpo
Road
Darling River
Murray River
Lachlan River
Murrumbidgee River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Yancowinna Creek
Stephens Creek
Menindee Road
Orange
Pine Creek
Harry Harry Creek
Talyawalka Creek
Box Creek
Silver City Highway
Barrier Highway
Cobb Highway
Darling River
Great Darling Anabranch
Willandra Creek
Maaloong Creek
Lachlan River
Murrumbidgee River
Sturt Highway
Sturt Highway
Sturt Highway



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure 2

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- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.1 and 2 of the Modification Report, respectively.

2 HYDROGEOLOGICAL ENVIRONMENT

2.1 Topography and Drainage

The Snapper Mine is located within the lower Darling River Basin of the lower Murray River system in NSW (Figure 1). The major drainage feature is the Darling River, which intersects the Murray River at Wentworth. Paralleling the Darling River is the Great Darling Anabranch which only flows under flood conditions. Numerous ephemeral lakes are associated with the Great Darling Anabranch, which occasionally hold water. Further north, the Menindee Lakes are used for water storage and irrigation supply.

Regionally the topography is relatively flat, with local undulation due to sand dune ridges, which have been stabilised by vegetation. There are no significant drainage channels to the Darling River or the Anabranch from the Snapper Mine. Rainfall run-off may temporarily collect in local topographic lows before infiltrating to the underlying aquifer or evaporating.

2.2 Surface Water Features

Regional and local hydrological features of relevance to the proposed Modification are described below:

- **Darling River** – The Darling River (Figure 1) is surrounded by a fresh to brackish groundwater lens (alluvial lens).[1,2] The Darling River provides some local fresh water recharge to the alluvial system. Interaction to the underlying deeper groundwater system is considered to be localised and episodic.[1,2]
- **Menindee Lakes** – The Menindee Lakes (Figure 1) are natural lakes with man-made weirs to raise their level for water storage. The lakes provide local fresh water recharge to the local shallow aquifers.[1,2]
- **Great Darling Anabranch** – The Great Darling Anabranch (Figure 1) normally consists of a series of pools and occasionally floods. Similar to the Darling River, the Great Darling Anabranch is surrounded by a fresh to brackish groundwater lens (alluvial lens).[1] It is expected that periods of high flow in the Great Darling Anabranch would result in some limited contribution to the underlying deeper groundwater systems; however, due to the intermittent nature of these events and the lack of significant connection between surface and deeper systems, this contribution is likely to be lower than that from the Darling River.[1]
- **Great Darling Anabranch Lakes** – The lakes adjacent to the Great Darling Anabranch (Figure 1) are gentle deflation basins that are normally dry, however some of the lakes do receive water when the Great Darling Anabranch has flow released from the Menindee Lakes.[3] Occasional wet surface conditions in the lakes would provide small intermittent recharge to the deeper underlying saline groundwater.[1]

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[1] Commonwealth Scientific and Industrial Research Organisation (CSIRO) Land and Water. *Salinity Impact Assessment. Appendix K of Darling Anabranch Environmental Impact Assessment for Stock and Domestic Pipeline and Reinstatement of Environmental Flows*, 2004.

[2] Geoscience Australia. *Broken Hill Managed Aquifer Recharge (BHMAR) Project, Report 5, Summary Report*, GeoCat #73823, 2012.

[3] Earthtech, *Darling Anabranch Environmental Impact Statement for Stock and Domestic Pipeline and Reinstatement of Environmental Flows*. Department of Infrastructure, Planning and Natural Resources, NSW.

- **The Salt Lakes** – Water loss from the Loxton-Parilla aquifer occurs via evaporation at locations where the surface elevation is near to the groundwater table level. Deposition of salt left behind from the saline water results in "salt pans". The Salt Lakes, 8 km south-east of the Snapper Mine are one such location. Others locations are found at distances of 50 to 100 km to the south-west and west of the Snapper Mine.[4]
- **Localised Freshwater Lenses** – Isolated freshwater lenses also occur below localised topographic depressions in the region. This generally occurs in topographically enclosed basins where rainfall runoff is concentrated and recharges shallow groundwater. Rainfall recharge in these areas form a localised freshwater lens over the denser more saline groundwater. An example of this is located at Chalky Well (Figure 3) to the north-east of the Snapper Mine.
- **Lake Victoria** – Lake Victoria is a shallow freshwater lake adjacent to the Murray River, approximately 100 km to the south-west of Snapper Mine. It is managed as off-river storage by government agencies, with an embankment around its extent to increase storage capacity.[5] Groundwater seeps from the base of the lake into the shallow aquifer and towards the Murray River. Given the lakes' distance from the Snapper and Ginkgo Mines, there is not expected to be any groundwater effect from the mining operation at this location.
- **Murray River** – At its closest point, the Murray River is approximately 80 km south of the Snapper Mine (Figure 1). In this section of the river, the water levels are controlled by a series of locks resulting in a range of effects including groundwater inflow and outflow from the river, depending on the local gradient.[6] Saline groundwater flow from the Loxton-Parilla, and other shallow aquifers, enters the river along much of its length increasing the salinity load which eventually reaches South Australia. The effect of groundwater changes at the Snapper Mine would be negligible over this distance.

2.3 Regional and Local Hydrogeology

A number of large scale ridges and basins (likely fault bounded blocks) form the pre-Tertiary basement profile, over which the relatively flat lying Tertiary and Quaternary sediments of the Murray Basin have formed.[7]

Specific groundwater information is provided by the Murray Basin Hydrogeological Map Series,[8] which indicate the general geometry of various aquifers and aquitards, based on sparse distribution of drillholes.

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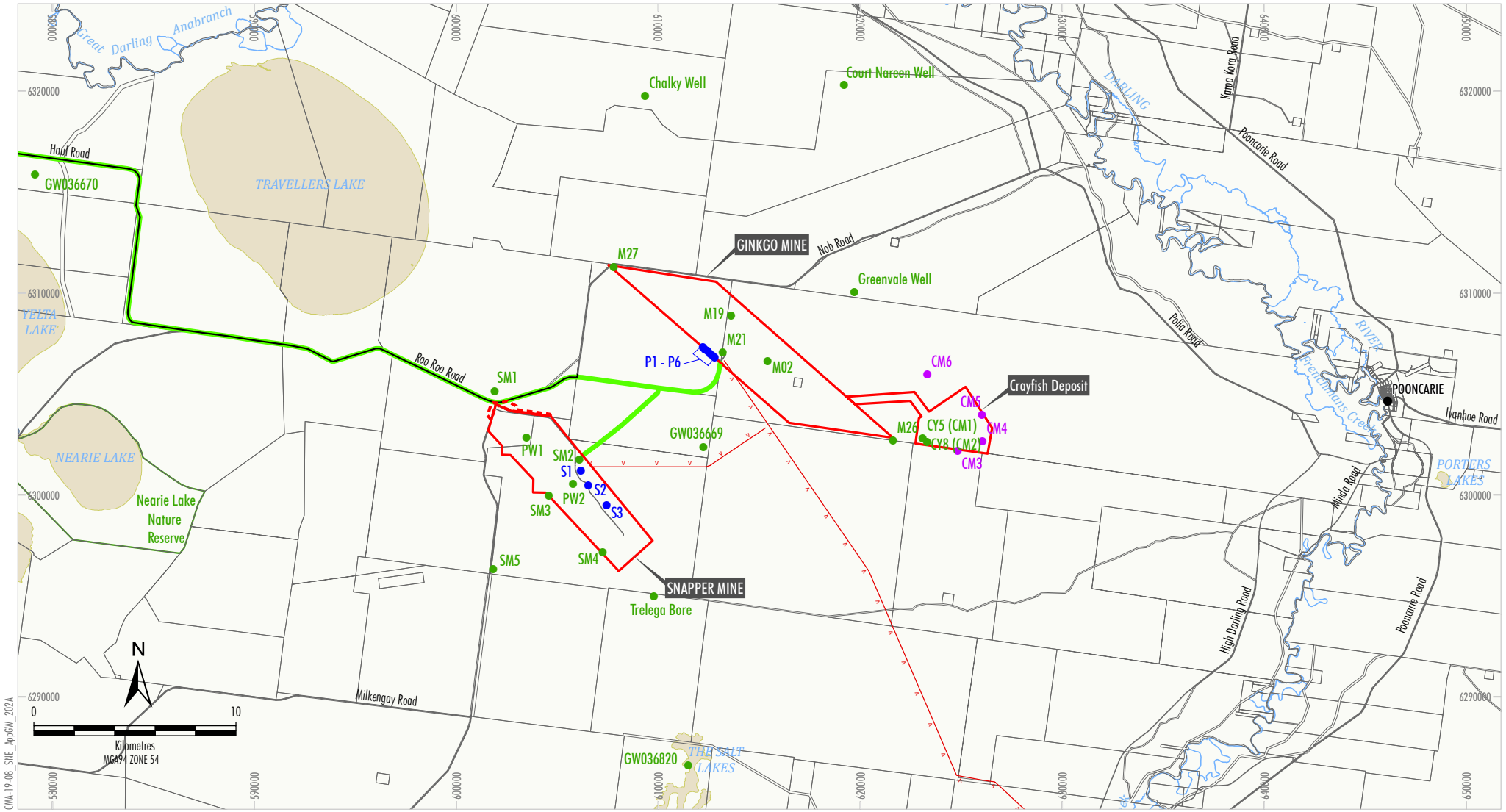
[4] Murray Basin Hydrogeological Map Series 1:250,000 Map Sheets, AnaBranch, Menindee, Ana Branch, Mildura, BMR and AGSO, 1992–1994

[5] Murray-Darling Basin Authority. *Lake Victoria*, https://www.mdba.gov.au/river-information/running-river-murray/lake-victoria.

[6] Brodie, R.S., *The Lower Darling Regional Steady State Groundwater Flow Model*, Australian Geological Survey Organization, Canberra, 1998/19.

[7] Brown, C.M. and Stephenson, A.E., *Geology of the Murray Basin, Southeastern Australia*. Bureau of Mineral Resources, Australia. Bulletin 235, 1991.

[8] Australian Geological Survey Organisation, *Murray Basin Hydrogeological Map Series, 1993*.



CMA-19-08_SNE_AppGW_202A

Source: NSW Spatial Services (2019); Tronox (2019)

LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA 1)
- Cadastral Boundary
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line
- Existing Groundwater Monitoring Bore
- Existing Water Supply Bore
- Proposed Groundwater Monitoring Bore

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SNAPPER MINE

Location of Groundwater Monitoring Sites

Figure 3

The Snapper Deposit (and the Ginkgo and Crayfish Deposits) lie in the shallow, saline aquifer of the Loxton-Parilla Sands (the upper aquifer) beneath the shallow Quaternary Woorinen and Shepparton Formation Layers (Figure 4). High permeability 'surf-zones' are commonly found in the off-shore direction from the beach deposition of the mineral strands, and the ore zone itself has a higher permeability than the average for the Loxton-Parilla Formation.

Saline aquifers within the underlying Renmark Group have been mapped to include sand beds of the Upper, Middle and Lower Olney Formation and the basal Warina Sand.[7] At the Snapper and Ginkgo Mines, the Upper Olney Formation is indicated to be a thin zone of fine sand directly beneath and connected to the Loxton-Parilla Sands.[9]

The Middle Olney Formation is not well defined in the local area but is more significant to the north where it connects with both the Upper and Lower Olney Formations.[7] The Lower Olney Formation and Warina Sand are located at about reduced level (RL) -170 metres (m) to RL -260 m beneath the Snapper and Ginkgo Mines overlying pre-Tertiary bedrock.[10] The Geera Clay Aquitard is approximately 130 m thick in the local area and separates the saline Upper and Lower Olney Formation units (Figure 4).[9] Further south the Geera Clay is partially replaced by clays of the Bookpurnong Beds, Winnambool Formation and Ettrick Formation which encase the permeable Murray Group Limestone Aquifer (Figure 4).

The groundwater flow in all aquifers is from recharge areas in the north and east to discharge areas in the south-west towards the Murray River and Lake Victoria. The groundwater gradient is very flat with a local gradient of about 1V:10,000H. Groundwater pressures in each aquifer are similar, with a small downward gradient in the recharge areas (north) and a larger upward gradient in the discharge zone (south).

2.4 Groundwater Dependent Ecosystems

There are currently no high priority groundwater dependent ecosystems identified in the Western Murray Porous Rock Water Source defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act, 2000* within which the Snapper and Ginkgo Mines are located.

The *NSW State Groundwater Dependent Ecosystems Policy*[11] recognises the four Australian groundwater dependent ecosystem types[12] that can be found in NSW, namely:

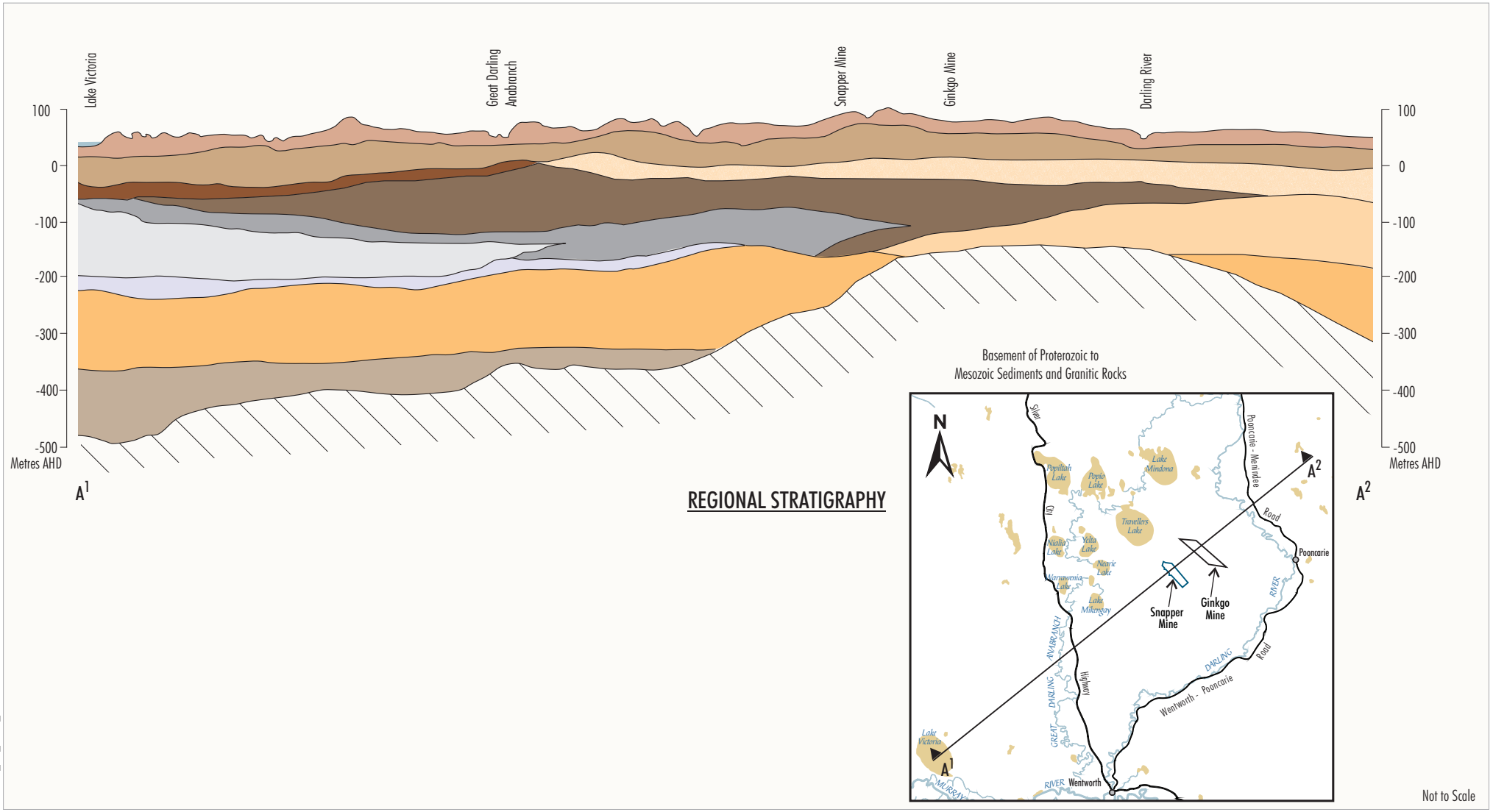
- terrestrial vegetation;
- baseflows in streams;
- aquifer and cave ecosystems; and
- wetlands.

[9] Bemax Resources, Exploration Drilling Database – Pooncarie Region.

[10] GEO-ENG, *Deep Bore DPB-02 Commissioning*, Snapper Mine Site, 7005(N2), 2009.

[11] Department of Land and Water Conservation, *NSW State Groundwater Dependent Ecosystems Policy*, 2002.

[12] Hatton, T. And Evans, R., *Dependence of Ecosystems on Groundwater and Its Significance to Australia*. LWRC Occasional Paper No. 12/98.



REGIONAL STRATIGRAPHY

LEGEND

- Quaternary Sediments
- Loxton-Parilla Sands
- Bookpurnong Beds
- Upper Renmark Group
- Middle Renmark Group
- Geera Clay
- Winnambool Formation
- Murray Group Limestone
- Ettrick Formation
- Lower Renmark Group
- Warina Sand

Source: Golder Associates, 2001

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SNAPPER MINE

Regional Stratigraphy

Figure 4

CMA-19-08_SNE_AppGW_001A

It is unlikely that there would be groundwater dependent ecosystems at the Snapper Mine site as the groundwater table is located approximately 30 m below the surface and there is no evidence of any perched water tables.

There is no groundwater dependent vegetation known to occur within the Snapper Mine or surrounds.[13] There are no permanent surface water features at the Snapper Mine site (i.e. no groundwater window lakes fed by the deep underlying saline groundwater aquifer) and therefore no groundwater dependent baseflows in streams and wetlands.

Groundwater and surface water elevation data indicates that the Lower Darling River exists under losing conditions most of the time (level higher than the groundwater table), and thus is not dependent on groundwater.[14,15]

The Salt Lakes are located approximately 8 km to the southeast of the Snapper Mine. The water table is approximately 2 m from the surface at this location and the local ecosystem is affected by the evaporation of the saline water from the aquifer.

2.5 Groundwater Quality

Groundwater monitoring results from the Snapper and Ginkgo Mines and the Murray Basin Hydrogeological Map Series[8] indicate salinities (measured as total dissolved solids [TDS]) in excess of 35,000 milligrams per litre (mg/L) for the upper aquifer and 14,000 mg/L to 35,000 mg/L for the deep Tertiary Lower Olney Formation/Warina Sand aquifer (the lower aquifer).

Groundwater quality monitoring (including total dissolved solids [TDS] and other analytes) is undertaken for the Snapper Mine in accordance with the *Ginkgo and Snapper Mines Water Environmental Management Plan* (WMP) (Section 2.7).[16] Monitoring results at Tronox-owned bores (Figure 3) for TDS in the upper and lower aquifers at Tronox bores are shown on Charts 1 and 2, respectively.

Monitoring to date indicates that salinity (TDS) levels have been stable since the commencement of Snapper Mine operations (i.e. salinity levels have remained high in both the upper and lower aquifers).

2.6 Groundwater Users

Previous investigations have identified that groundwater use in the local area is limited to three private wells (Chalky Well, Court Nareen Well and Greenvale Well – Figure 3) which access fresh water lenses above the saline water table. The private bore at Trelega (Figure 3) is not used due to high salinity levels. The lack of active bores in the region is understandable given the poor quality of the groundwater.

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[13] FloraSearch and Resource Strategies, *Snapper Mineral Sands Project Flora Assessment*, February 2007.

[14] NSW Office of Water, *Western Murray Porous Rock and Lower Darling Alluvium Groundwater Sources, Groundwater Status Report 2011*. Published January 2013.

[15] Golder Associates, *Hydrogeological Feasibility Study for the Ginkgo Mineral Sands Project in the Murray Basin*, July 2001, Report # 01612006.

[16] Cristal Mining Australia, (2016), *Ginkgo and Snapper Mines Water Environmental Management Plan, October 2016*. Prepared by GHD for Cristal Mining Australia Ltd.

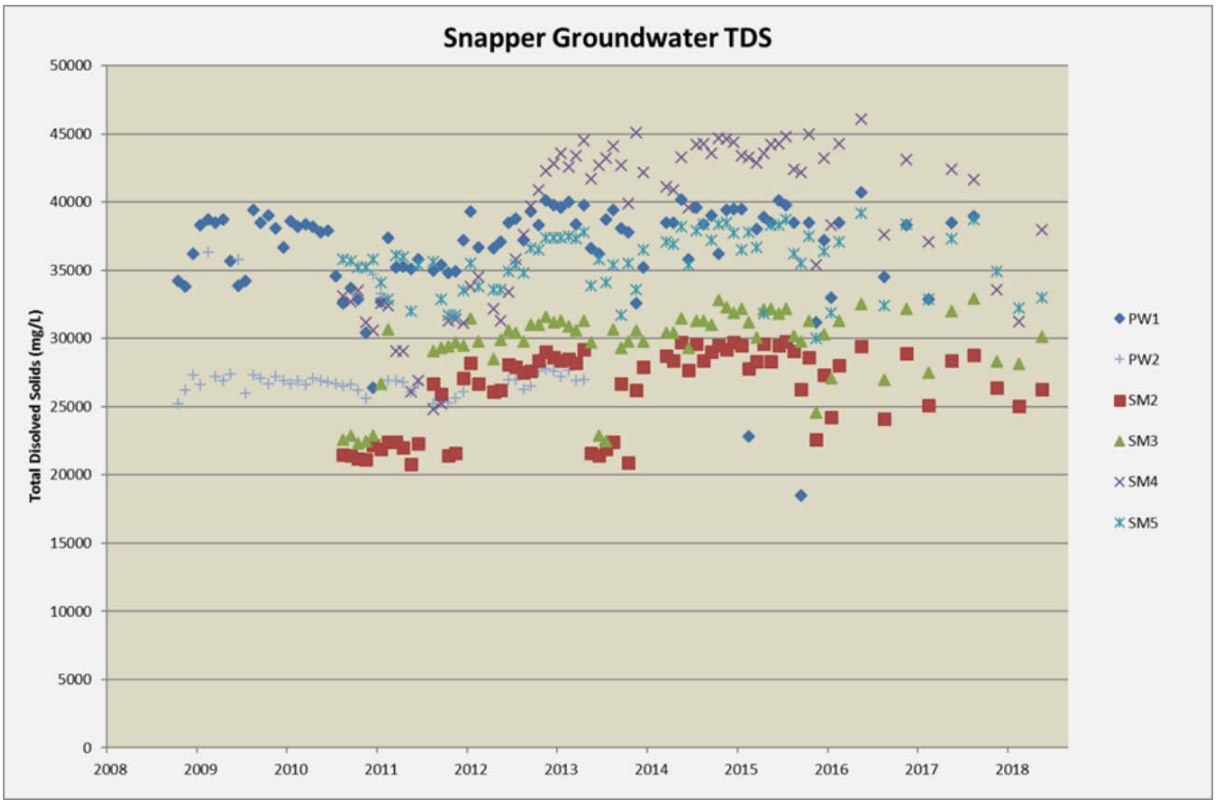


Chart 1 Snapper Mine TDS Monitoring Results (Upper Aquifer) - 2008 to August 2018
(Source: Cristal Mining Australia, 2018)

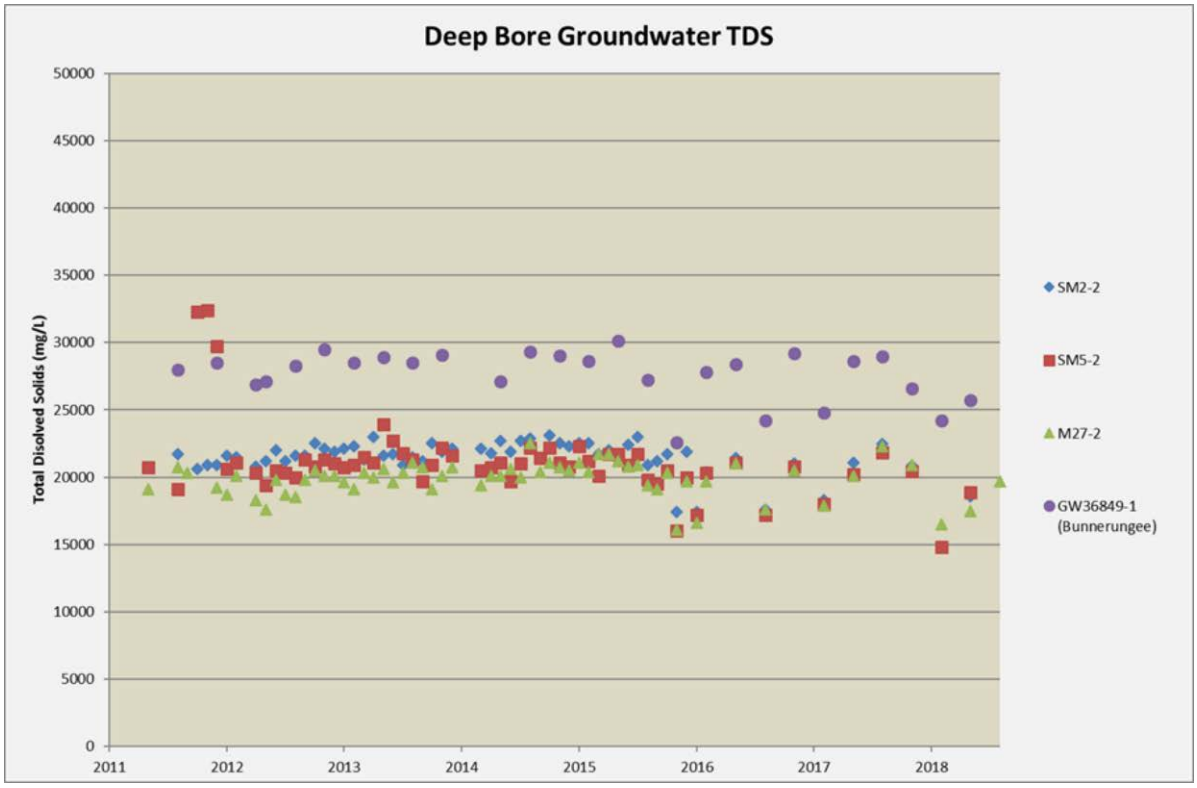


Chart 2 Snapper Mine TDS Monitoring Results (Lower Aquifer) - 2008 to August 2018
(Source: Cristal Mining Australia, 2018)

2.7 Existing Groundwater Management

Groundwater management at the Snapper and Ginkgo Mines is described in the WMP[16], prepared in accordance with Condition 2, Schedule 3 of Project Approval (06_0168), and Condition 11, Schedule 3 of the Ginkgo Mine Development Consent (DA 251-09-01).

The WMP:

- describes relevant groundwater criteria;
- details a program for groundwater management and monitoring,
- details mitigation measures related to groundwater; and
- describes the auditing, reporting and reviewing requirements of the WMP.

Groundwater level and quality monitoring at the Snapper Mine is currently conducted at various Tronox-owned, government and private bores in the vicinity of the Snapper and Ginkgo Mines (Figure 3). A summary of the Tronox-owned monitoring bores located within and adjacent to the Snapper Mine is provided in Table 1.

Table 1
Snapper Mine Groundwater Monitoring Sites

Bore Name	Monitoring Depth/s	Parameters[2]
SM2	Shallow and Deep	Level, TDS
SM3	Shallow	Level, TDS, EC, Chloride, Sulphate, Bicarbonate, K, Na, Ca, Mg, Fe, Pb, Mn, P
SM4	Shallow	Level, TDS, EC, Chloride, Sulphate, Bicarbonate, K, Na, Ca, Mg, Fe, Pb, Mn, P
SM5	Shallow and Deep	Level, TDS
PW1[1]	Shallow	Level, TDS, EC, Chloride, Sulphate, Bicarbonate, K, Na, Ca, Mg, Fe, Pb, Mn, P
PW2[1]	Shallow	Level, TDS, EC, Chloride, Sulphate, Bicarbonate, K, Na, Ca, Mg, Fe, Pb, Mn, P

Notes:

[1] Monitoring at Tronox bores PW1 and PW2 was discontinued after these bores were mined through in August 2018 and April 2013, respectively.

[2] Groundwater levels and TDS are monitored monthly, while EC, Chloride, Sulphate, Bicarbonate, K, Na, Ca, Mg, Fe, Pb, Mn and P are monitored quarterly.

EC Electrical Conductivity.

2.8 Licensing

The Snapper and Ginkgo Mines are located within the Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act, 2000*.

Relevant to the Modification, the Western Murray Porous Rock Water Source includes groundwater contained in all shallow unconsolidated geological layers (Shepparton Formation to Renmark Group Units).

The long term annual extraction limit stipulated in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* for the Western Murray Porous Rock Water Source is 530,486 million litres per annum (ML/annum).[14] As of January 2013, water allocation includes 26,747 ML/annum for basic landholder rights, 21,780 ML/annum for access licence use (primarily Tronox's allocation as indicated below) and 14,582 ML/annum for Special purpose access (salinity and water table management).[14]

Tronox currently holds a combined total of 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Snapper and Ginkgo Mines, authorised by the following water access licences (WALs):

- WAL 27918 (60AL582836) – 14,000 shares;
- WAL 27915 (60AL582832) – 7,402 shares; and
- WAL 27912 (60AL582834) – 40 shares.

As the groundwater is saline, there is no significant demand for water from this source in the region, and the aquifers are indicated to be under allocated.

3 EXISTING HYDROGEOLOGICAL ASSESSMENTS

3.1 Groundwater Assessments

A hydrogeological assessment and numerical groundwater model was prepared by Golder Associates in 2001 for the Ginkgo Mine.[17] The assessment and model were subsequently revised by Golder Associates in 2007 to incorporate the effects of the Snapper Mine.[18,19,20] A further hydrogeological assessment was carried out by GEO-ENG in 2010 (the 2010 Hydrogeological Assessment) to assess the potential hydrogeological impacts associated with the proposed change to the lower aquifer water supply (rather than the approved upper aquifer water supply).[21]

An assessment of the potential hydrogeological impacts associated with the proposed development of the Crayfish Deposit at the Ginkgo Mine was completed in 2013 (the 2013 Hydrogeological Assessment).[22] The 2013 Hydrogeological Assessment updated the groundwater model used in the 2010 Hydrogeological Assessment to incorporate the effects of mining the Crayfish Deposit along with the approved Snapper Mine (herein referred to as the existing groundwater model).

The 2013 Hydrogeological Assessment details the cumulative hydrogeological impacts associated with the approved Snapper and Ginkgo Mines. A summary of the key findings of the 2013 Hydrogeological Assessment is provided in Table 2. The areal extent of predicted groundwater level variations from the 2013 Hydrogeological Assessment are provided in Attachment B.[23]

Table 2
Summary of Key Findings of the Ginkgo Mine Crayfish Deposit 2013 Hydrogeological Assessment

Assessment Component	Finding
Regional Drawdown	• 1 m drawdown in the lower aquifer at approximately 5 km. • 1 m drawdown in the upper aquifer at approximately 4 km.
Hydrological Features	• No significant change in water levels beneath local hydrological features (Darling River, Darling Anabranch and associated lakes, The Salt Lakes, Lake Victoria and the Murray River).
Groundwater Users	• Maximum predicted drawdown at private bores is not considered significant (0.18 m).
Water Quality	• There is not expected to be any measurable effect on groundwater quality. • Any small change in salt concentrations due to increased evaporation is expected to be insignificant.

[17] Golder Associates, *Hydrogeological Feasibility Study for the Ginkgo Mineral Sands Project in the Murray Basin*, July 2001, Report # 01612006.

[18] Golder Associates, *Snapper Mineral Sands Project Environmental Assessment Report, Appendix A—Hydrogeological Assessment*, March 2007, Report # 06613504/016.

[19] Golder Associates, *Hydrogeological Study for Snapper Deposit Pooncarie, NSW*, December 2007, Report # 06613504/017.

[20] Golder Associates, *Re-Run of Regional Groundwater Model, Snapper Mineral Sands Project.*, 19 September 2008. Project # 087616009001.

[21] GEO-ENG, *BEMAX Resources Limited, Section 75W Modification, Snapper & Ginkgo Mines – Hydrogeological Assessment*, Pooncarie, NSW, 2010.

[22] GEO-ENG, *Cristal Mining Australia, Ginkgo Mine Modification Modified Request Project Crayfish Deposit – Hydrogeological Assessment, Pooncarie, NSW*, September 2013.

[23] Operations at the Crayfish Mine are planned to commence in 2020, and thus the predicted effect of mining at Crayfish has not yet occurred.

An assessment of the potential hydrogeological impacts associated with increasing the mineral concentrate production rate at the Snapper Mine was completed in 2014 (the 2014 Hydrogeological Assessment).[24] The 2014 Hydrogeological Assessment concluded that the increased mineral concentrate production rate was not expected to result in any significant change to the cumulative groundwater impacts associated with the Snapper and Ginkgo Mines (i.e. the key findings of the 2013 Hydrogeological Assessment [Table 2] were expected to be unchanged).

[24] GEO-ENG, Cristal Mining Australia, *Snapper Mine Production Increase Modification Hydrogeological Review. Pooncarie, NSW, July 2014.*

4 PERFORMANCE OF THE EXISTING GROUNDWATER MODEL

Plots of the measured and modelled hydrographs are provided in Attachment A for the Snapper Mine upper and lower aquifer monitoring bores (Figure 3). The modelled hydrographs and groundwater level variations are based on the existing groundwater model.

To date, the groundwater level monitoring results have been generally consistent with the predictions of the existing groundwater model (Attachment A). For example, the measured rise in the upper aquifer water levels at bores SM2 and SM3 from approximately August 2015 to February 2017 (Attachment A) is similar to what was predicted by the existing groundwater model. The predicted rise in the upper aquifer was due to increased water disposal in the centre of the mine path as mining of the northern half of the Snapper deposit commenced.

The second predicted rise in the upper aquifer from 2019 to 2022 is again associated with increased water disposal (through the deposition of sand-residues) in the central mine path area as the dredge pond level is lowered at the northern end of the mine path. During the same period, monitoring bore SM1 located north of the mine path is predicted to have a decline in the water level of the upper aquifer. Attachment A indicates that the predicted rise in the upper aquifer for bores SM2 and SM3, and the predicted lowering in the upper aquifer for monitoring bore SM1 are beginning to be measured.

Overall, the hydrograph comparisons (Attachment A) show a reasonable match between the predicted and measured groundwater levels and groundwater level trends to date. The small variations between the measured and modelled groundwater levels (Attachment A) are considered to be due to changes in the mine advancement rate.

5 EXISTING AND MODIFIED GROUNDWATER INTERACTIONS

5.1 Existing Snapper Mine Mining Operations

Dredge mining at the Snapper Mine requires the development and maintenance of a dredge pond. The level of the dredge pond varies above or below the natural groundwater table level according to the relative position of the orebody in relation to the natural groundwater table level.

The dredge consists of a rotating bucket wheel that cuts the ore and then deposits it at the dredge suction pipe inlet. The ore slurry is then pumped to the primary gravity concentration unit for primary gravity concentration. In mid-2016, a supplementary (mini) dredge began operating in addition to the main dredge to mine ore in shallower areas of the dredge pond. The dredge mining method adopted by the supplementary dredge is the same as the main dredge.

Sand residues generated at the primary gravity concentration unit were initially placed in an off-path sand residue dam but are now placed in the mining void behind the dredge pond (which creates a groundwater mound and returns water to the upper aquifer).

Make-up water for the Snapper Mine is provided by water supply bores located at the Snapper Mine at up to 270 litres per second (L/s) (Figure 3). The water supply bores extract water from the lower aquifer, which is isolated from the upper aquifer.

The existing/approved water management system at the Snapper Mine is primarily a recirculating system, where greater than 90% of the water used to pump ore from the mining face is infiltrated back into the dredge pond/upper aquifer from the deposited sand residues. The remainder is lost via evaporation, residual moisture in the mineral concentrate taken off-site, dust-suppression, and office, camp and workshop use.

As the sand residues are placed near to the mining void behind the dredge pond, there is a significant groundwater flow from the sand residues back to the dredge pond. The level of the dredge pond relative to natural water table and the maximum level and position of the deposited sand residues relative to the back of the dredge pond affect the gradient and thus the amount of water recirculated.

5.2 Modification – Mining Operations

The Modification would not change the Snapper Mine mining operations described above (Section 1.1).

The Modification would however extend the mine path by approximately 600 m at the northern end (an approximate 3.5% increase to the total length of the mine path) (Figure 2). This would result in a minor extension (to the north) of the groundwater interactions associated with the dredge pond, namely lowering of the water table level due to dredge pond level maintenance, and creation of a groundwater mound behind the advancing dredge pond due to the deposition of sand residues.

5.3 Modification – Final Depression and Water Disposal Dam

Final Depression

At the cessation of mining, a final depression associated with the dredge pond (the final depression) is approved to remain at the Snapper Mine. The final depression will be partially backfilled with overburden material pushed down from the depression batters such that its floor would be at approximately 2 to 4 m above the final groundwater table. Capillary rise in sand is typically less than 1 m.[25] Thus direct evaporation from the upper aquifer should be prevented.

Incident rainfall and local surface water runoff following rainfall events will temporarily pond in the final depression prior to evaporating or infiltrating into the upper aquifer. The rate of infiltration in the final depression will be higher than normal, but over the scale of the aquifer, this will be insignificant.

The Modification would increase the size of the final depression from approximately 40 ha to 200 ha (Figure 5). The floor of the final depression would remain at approximately 2 to 4 m above the final groundwater table.

The Modification would not change the direct evaporation from the aquifer at the final depression given the approximate floor of the final depression relative to the final groundwater table would remain unchanged (i.e. 2 to 4 m).

The increased surface area associated with the modified final depression would however result in an increase in the amount of infiltration to the upper aquifer. The increased infiltration would however remain insignificant over the scale of the aquifer.

Water Disposal Dam

A water disposal dam is approved to be constructed within the mine path. A final depression associated with the water disposal dam in the central mine path area is also approved to remain following cessation of operations at the Snapper Mine.

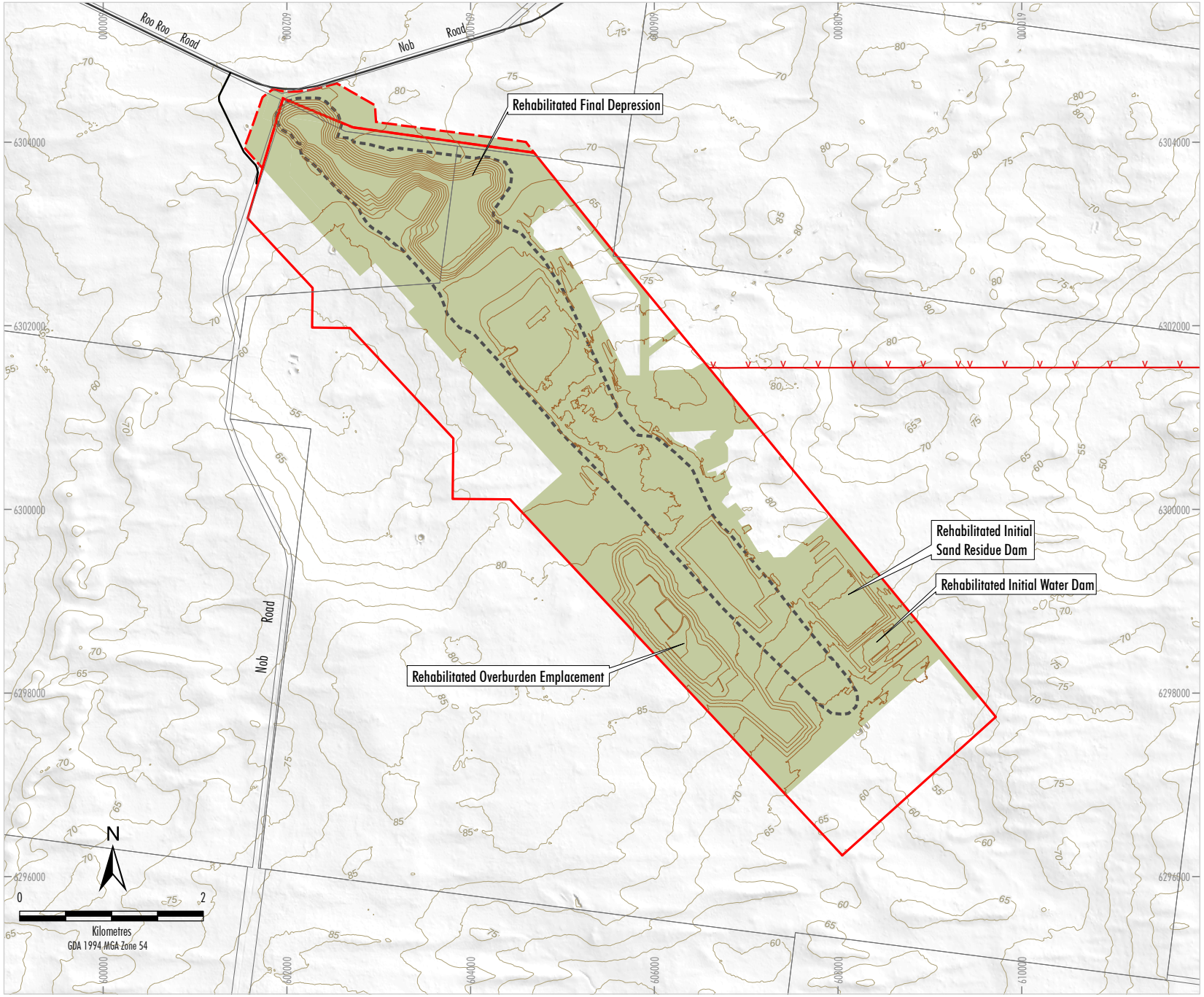
The final depression associated with the water disposal dam would be incorporated into the modified final depression for the Modification. The potential groundwater impacts of the final depression associated with the water disposal dam in the central mine path area would no longer occur.

The incorporation of water disposal in the final depression would result in increased mounding in the upper aquifer in a portion of the northern section of the mine path.

5.4 Modification – Water Supply Bores

The Modification would not result in any change to water demand from the water supply bores at the Snapper Mine (Figure 3).

[25] Venkatramaiah, *Geotechnical Engineering*, New Age International, 2006, New Delhi.



LEGEND

- Mining Lease Boundary (ML 1621)
- Mining Lease Application Boundary (MLA 1)
- Extent of Backfilled Mine Path
- Extent of Rehabilitation
- Electricity Transmission Line

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative Final Landform

Figure 5

CMA-19-08_SNE_AppGW_204C

6 ASSESSMENT OF POTENTIAL IMPACTS

An assessment of the potential impacts of the Modification on regional drawdown, hydrological features, groundwater quality and groundwater users is provided below.

6.1 Regional Drawdown

Contours showing the predicted change in groundwater levels in the upper and lower aquifers in year 7 and at the end of the Snapper Mine (reproduced from the 2013 Hydrogeological Assessment) are provided in Attachment B.

The Modification is not expected to result in any significant changes to the approved regional groundwater drawdown effects in the upper and lower aquifers, as described below.

6.1.1 Lower Aquifer

As the Modification would not result in any changes to water demand, there would be no change to extraction from the lower aquifer and potential impacts on the lower aquifer would not change from those simulated in the existing groundwater model.

6.1.2 Upper Aquifer

As described in Section 5.3, the Modification would not change the Snapper Mine mining operations, however would extend the mine path by approximately 600 m at the northern end. The Modification would therefore result in a minor northern extension in drawdown in the upper aquifer associated with the mine path extension.

In addition, as mining in the northern section of the mine path would occur over a shorter period (March 2020 to June 2021) than predicted in the existing groundwater model, drawdown effects on the upper aquifer would occur for shorter period of time (i.e. recovery of the upper aquifer would commence earlier).

The incorporation of water disposal in the final depression would however result in increased mounding in the upper aquifer in a portion of the northern section of the mine path.

6.2 Hydrological Features

Based on expected groundwater drawdown effects (Section 6.1) and experience to date at the Snapper and Ginkgo Mines, the change in water levels beneath local surface water features (Darling River, Darling Anabranch and associated lakes, The Salt Lakes, Lake Victoria and the Murray River), would be very small and would not have any measureable effect on these features (i.e. no change to the approved impacts described in Table 2).

6.3 Groundwater Quality

As the Modification would not result in changes to the existing/approved water management practices at the Snapper Mine, the Modification is expected to result in negligible impacts on groundwater quality. As described in Section 2.5, no significant change in water quality has been observed as a result of the Snapper Mine.

6.4 Groundwater Users

Previous investigations have identified that groundwater use in the local area is limited to three private wells (Chalky Well, Court Nareen Well and Greenvale Well – Figure 3) which access fresh water lenses above the saline water table. The private bore at Trelega is not used due to high salinity levels. The lack of active bores in the region is understandable given the poor quality of the groundwater.

Based on expected groundwater drawdown effects (Section 6.1) and experience to date at the Snapper and Ginkgo Mines, the potential impact at the nearest private bore, Greenvale Well, approximately 16 km to the north-east of Snapper Mine would also be negligible (i.e. no change to the approved impact described in Table 2).

6.5 Final Depression

As described in Section 5.3, the size of the final depression would increase as a result of the Modification, which would result in a minor increase in the amount of infiltration to the upper aquifer from the modified final depression.

6.6 Consideration of the Aquifer Interference Policy

The *NSW Aquifer Interference Policy*[26] (the AIP) establishes minimal impact considerations for highly productive and less productive groundwater. NSW Office of Water mapping indicates that there is no highly productive groundwater in the vicinity of the Snapper Mine. It follows that porous rock aquifers in the vicinity of the Snapper Mine are less productive.

Table 3 provides an assessment of the Modification against the minimal impact considerations in the AIP and include consideration of cumulative impacts where appropriate.

Table 3
Less Productive Porous Rock Aquifer – Minimal Impact Considerations

Level 1 Minimal Impact Consideration	Assessment
Water Table Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) High priority groundwater dependent ecosystem; or (b) High priority culturally significant site; Listed in the schedule of the relevant water sharing plan. OR A maximum of a 2 m water table decline cumulatively at any water supply work.	**Complies with Level 1 minimal impact considerations.** • The *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* does not list any "high priority groundwater dependent ecosystem" in the vicinity of the Snapper Mine. • The Modification would not result in a cumulative drawdown of more than 2 m at any privately owned water supply work (Section 6.4).
Water Pressure A cumulative pressure head decline of not more than a 2 m decline, at any water supply work.	**Complies with Level 1 minimal impact considerations.** • The Modification would not result in cumulative drawdown or more than 2 m at any privately owned water supply work (Section 6.4).
Water Quality Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	**Complies with Level 1 minimal impact considerations.** • The Modification is expected to result in negligible impacts on groundwater quality (Section 6.3). On this basis, the Modification would not lower the beneficial use category of the groundwater source.

[26] NSW Government, Department of Primary Industries, Office of Water, *NSW Aquifer Interference Policy.* September 2012.

7 MONITORING, MANAGEMENT AND MITIGATION MEASURES

As described in Section 2.7, monitoring and management of groundwater at the Snapper Mine is conducted in accordance with the WMP[16], prepared in accordance with Condition 2, Schedule 3 of Project Approval (06_0168), and Condition 11, Schedule 3 of the Ginkgo Mine Development Consent (DA 251-09-01).

The existing WMP[16] should continue to be implemented for the modified Snapper Mine. The existing WMP is also considered to be appropriate and no changes are required for the Modification.

In the unlikely event that a leaseholder's water supply is adversely and directly impacted (other than an impact that is negligible) as a result of the Snapper Mine, Tronox would implement measures to mitigate and/or compensate leaseholders in accordance with Condition 5(f), Schedule 3 of Project Approval (06_0168).

8 GROUNDWATER LICENSING

Based on the existing and proposed mining operations, the existing volumetric licence allocations held by Tronox are considered to be adequate (Section 2.8). As the Snapper Mine, Ginkgo Mine and the Atlas-Campaspe Project are located within the same groundwater source (i.e. Western Murray Porous Rock Water Source) the appropriate licence allocations would be traded in accordance with the rules of the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011*.

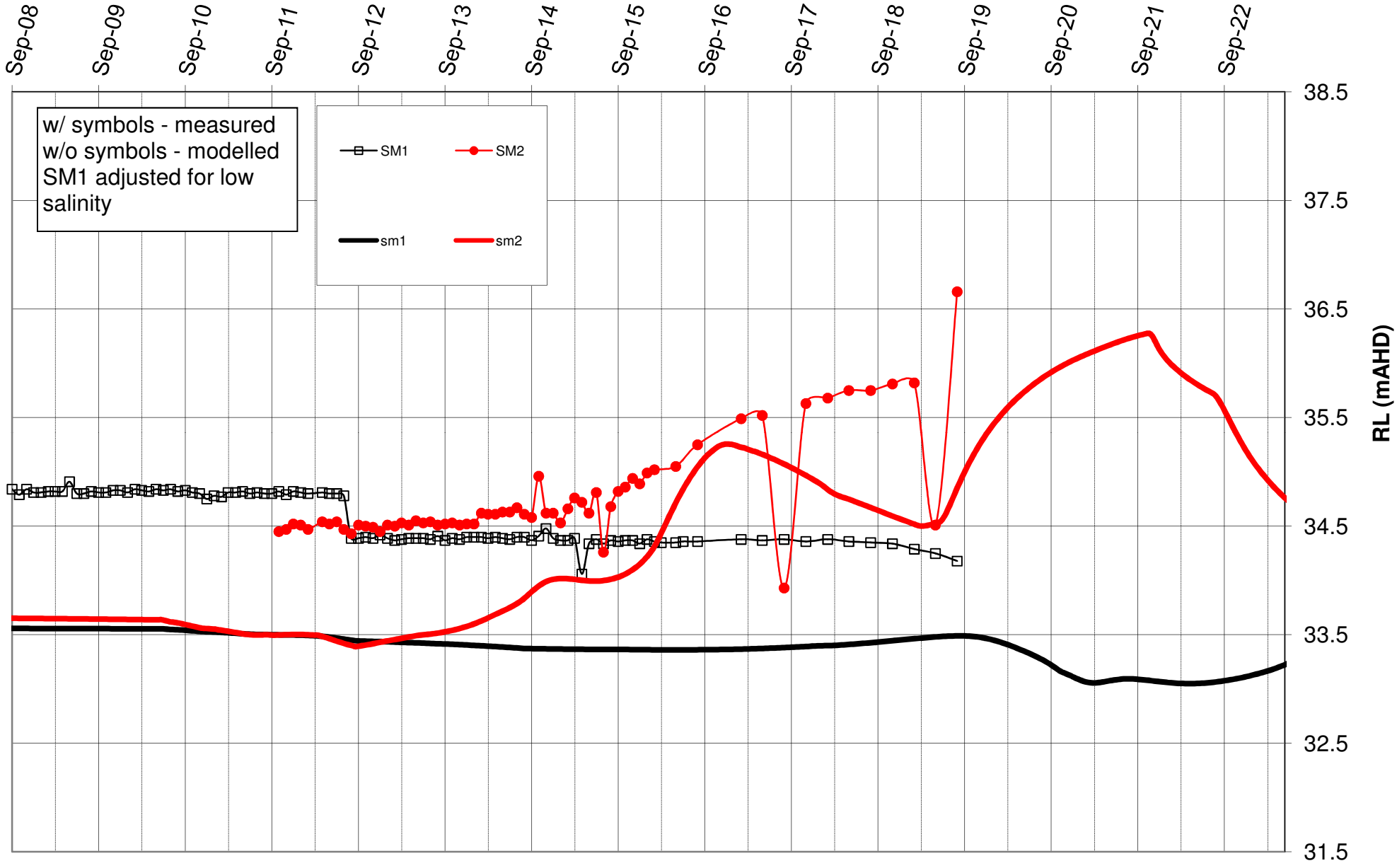
9 CONCLUSION

The Modification is not expected to result in any significant change to the cumulative groundwater impacts associated with the Snapper and Ginkgo Mines.

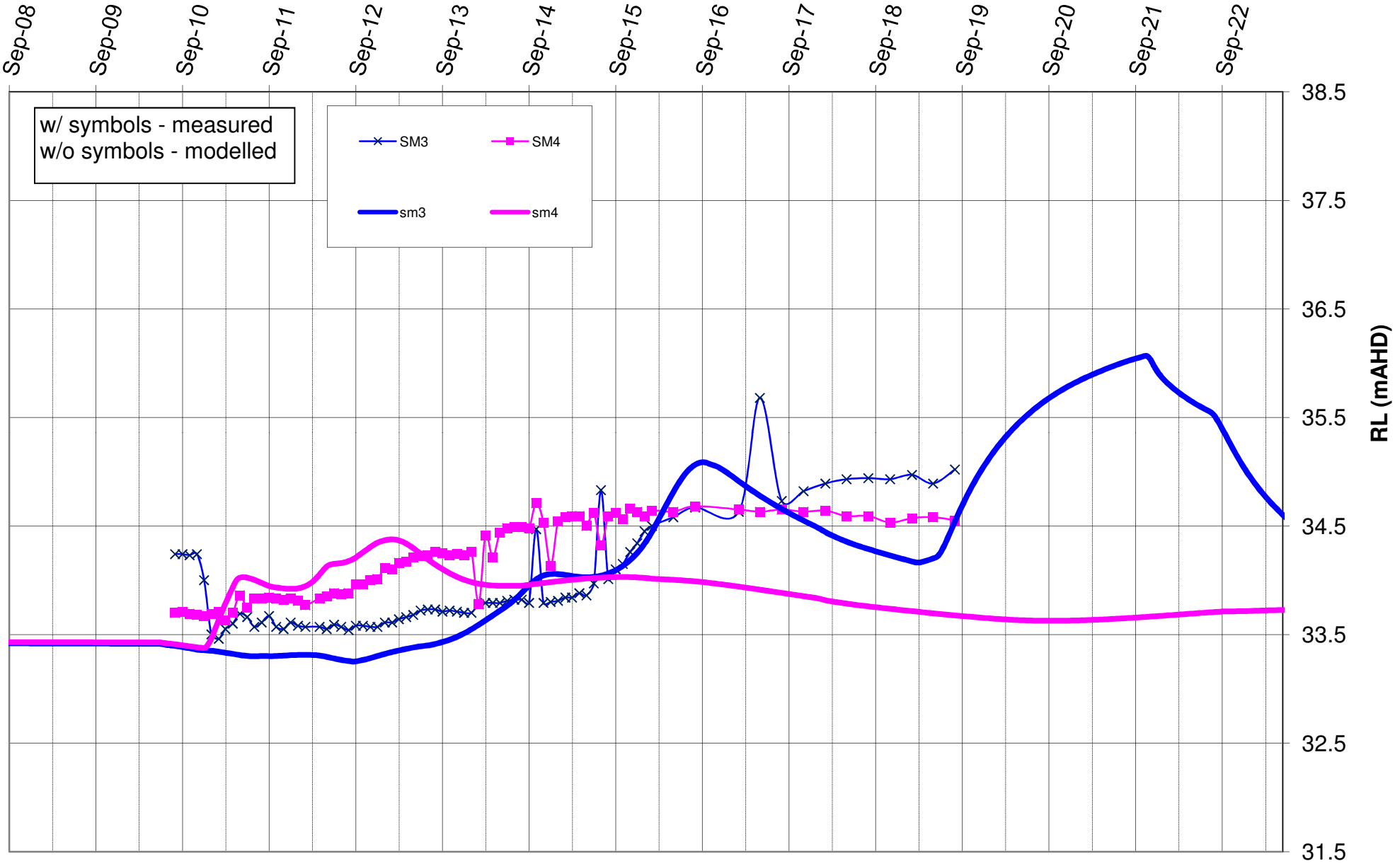
ATTACHMENT A

SNAPPER GROUNDWATER MONITORING - MODELLED VS MEASURED HYDROGRAPHS

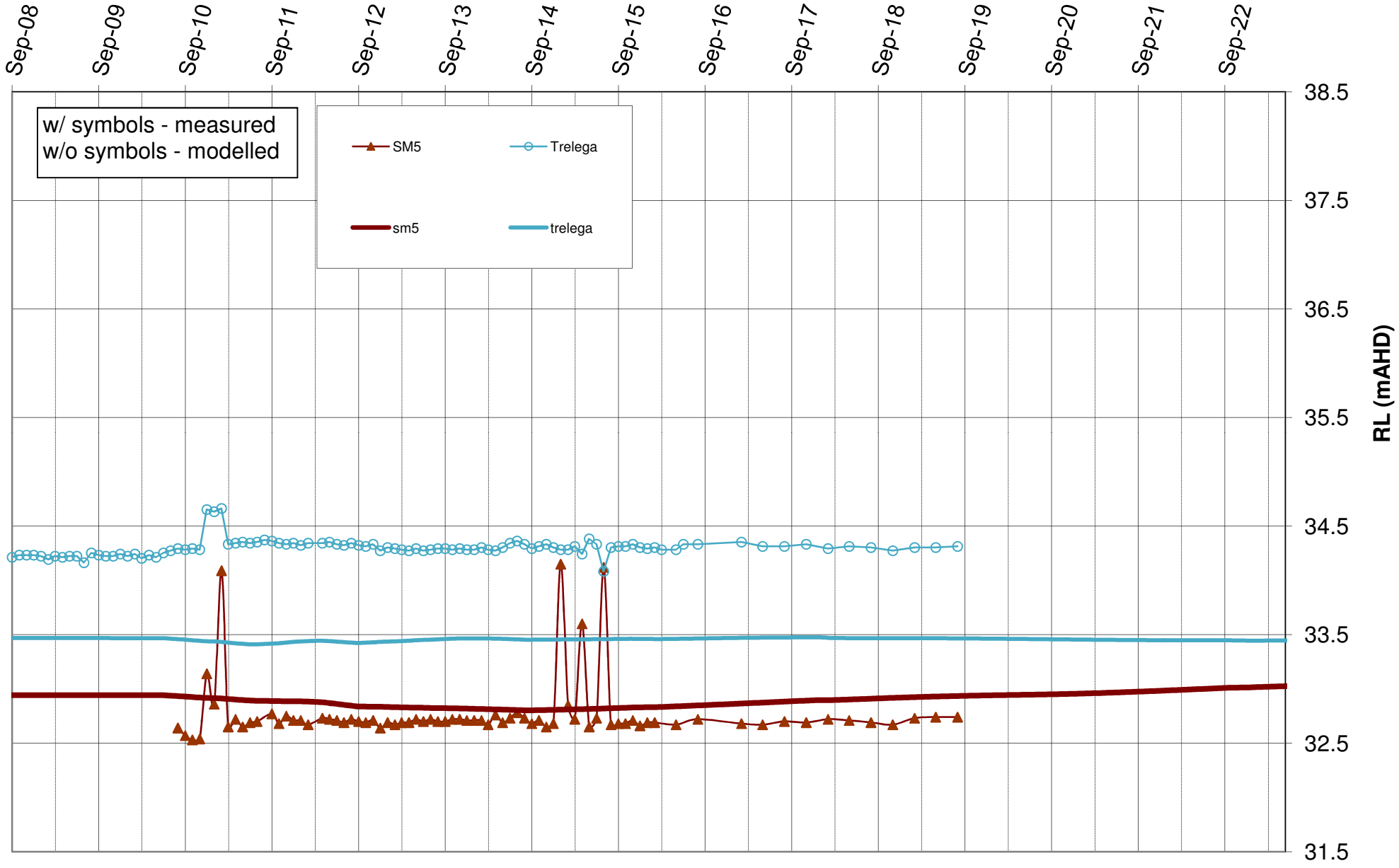
Modelled vs. Measured Hydrographs



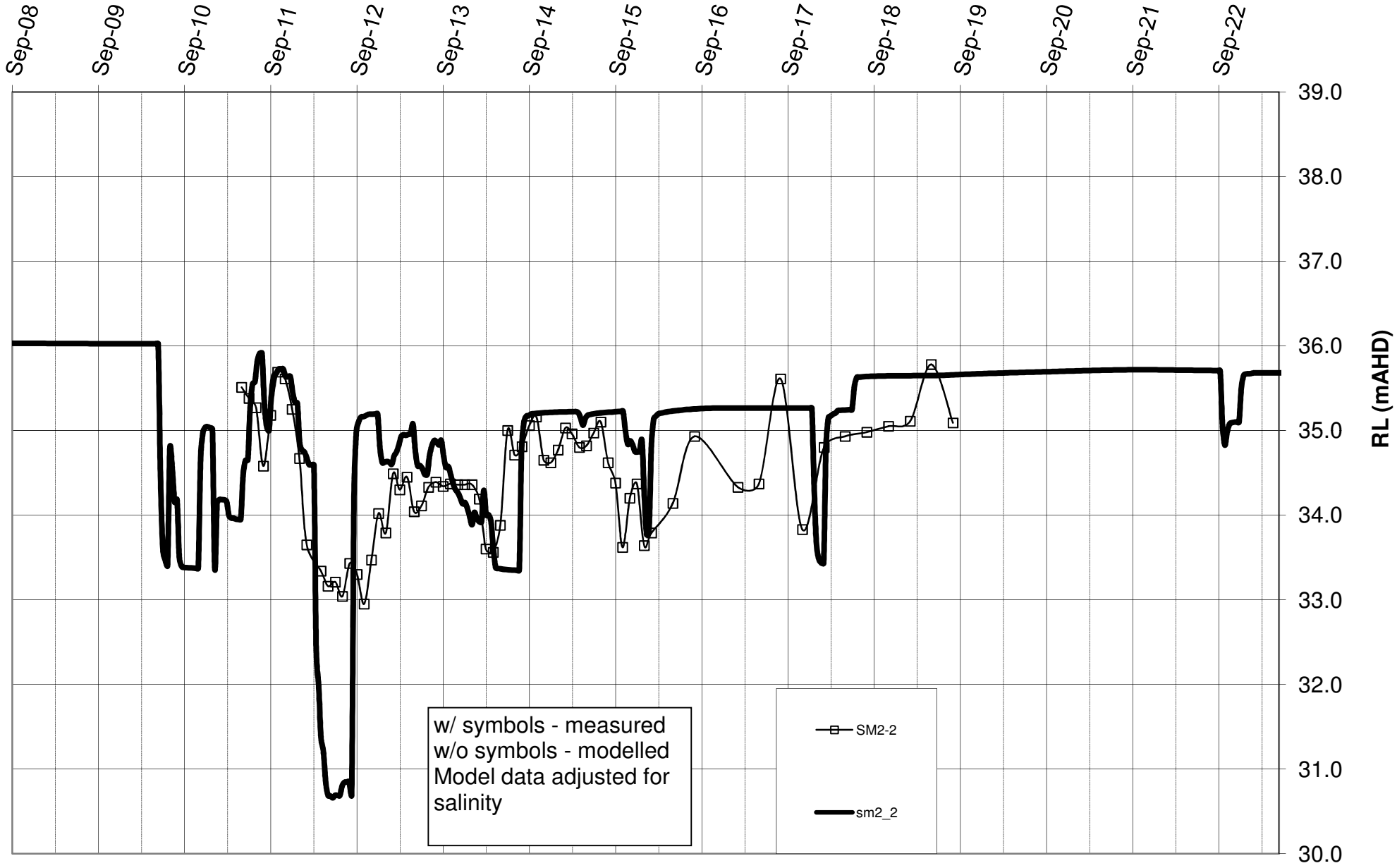
Modelled vs. Measured Hydrographs



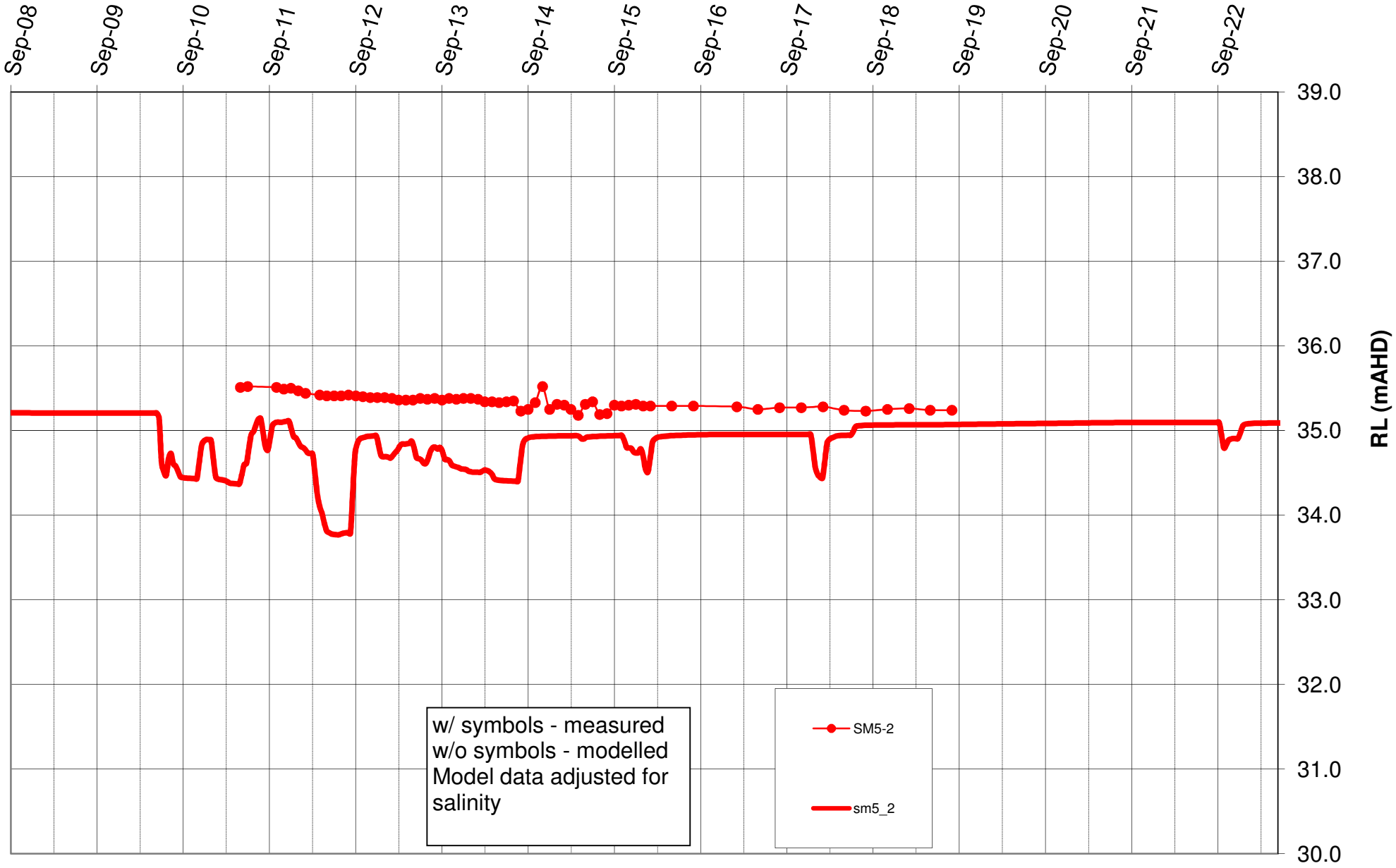
Modelled vs. Measured Hydrographs



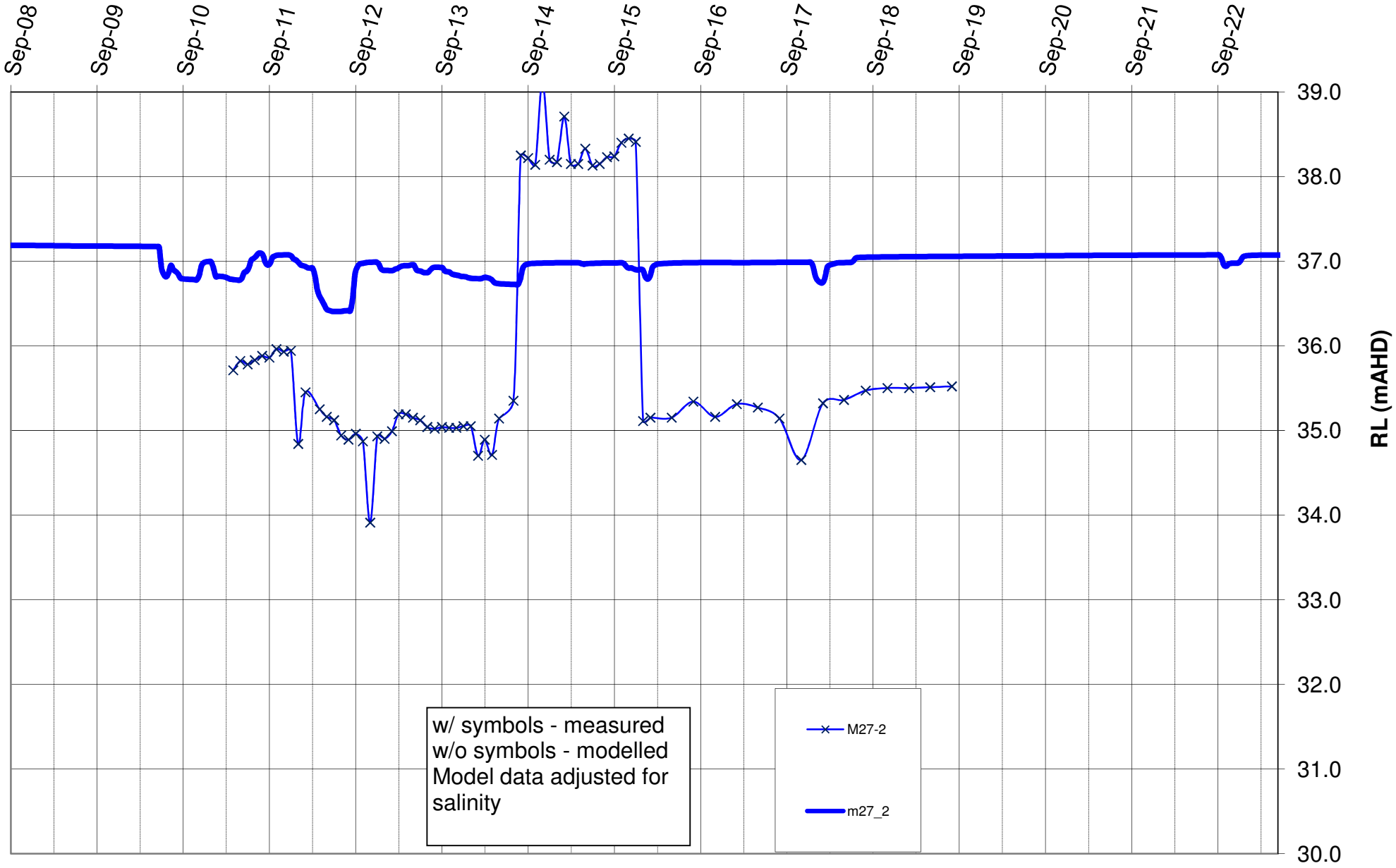
Modelled vs. Measured Hydrographs



Modelled vs. Measured Hydrographs

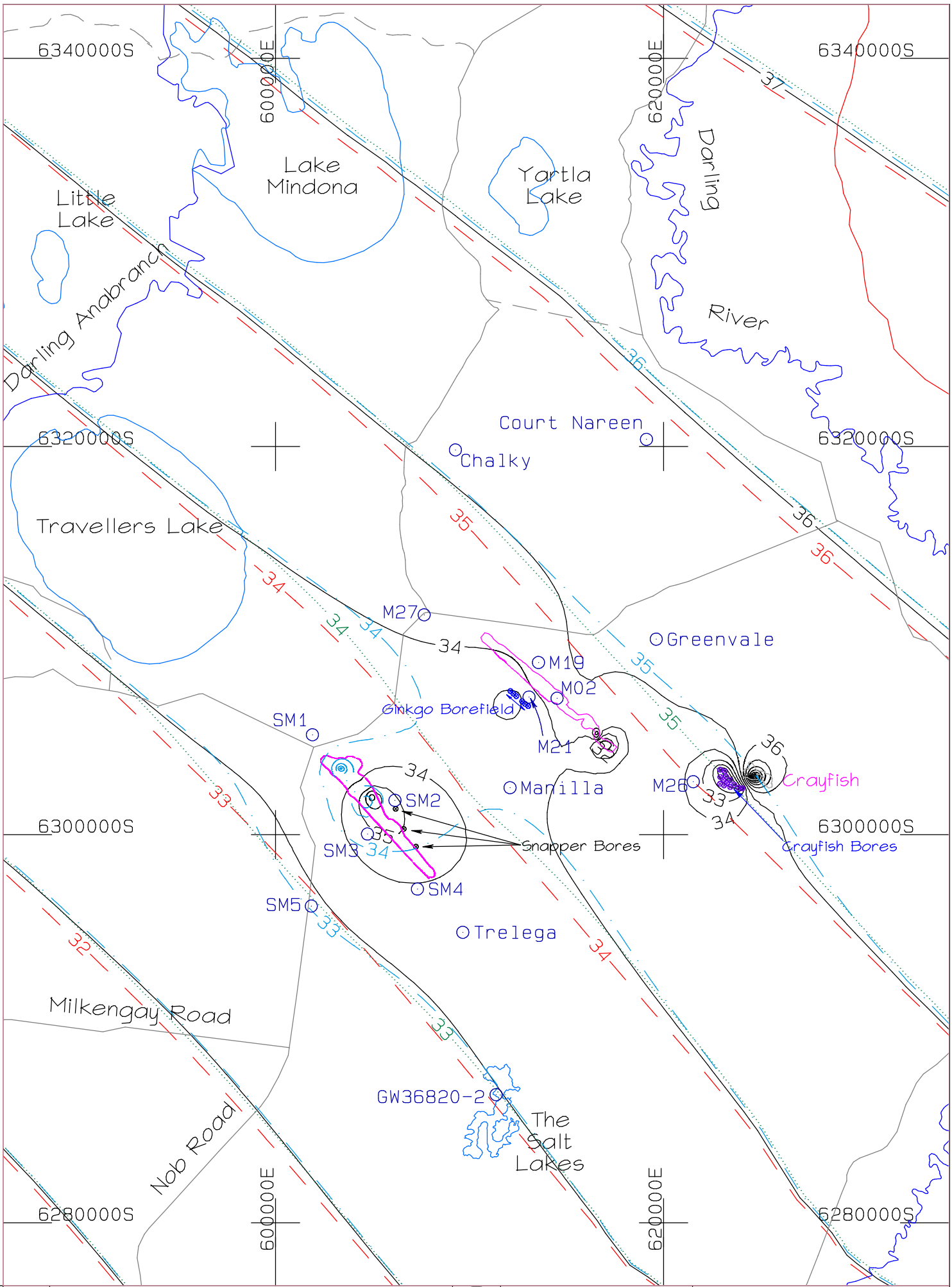


Modelled vs. Measured Hydrographs



ATTACHMENT B

PREDICTED GROUNDWATER CONTOURS FOR THE SNAPPER AND GINKGO MINES



19.5 x 26.41

North

Tronox Mining Australia

Upper Aquifer GDW Contours

Jul 2005 - Pre-Mining

Jun 2017 - 7 Yrs Snapper

Apr 2025 - End of Mining at Snapper

Apr 2035 - 10yr post Mining

Surveyed: Tronox

Plotted: Oct 31 2019

Design: GEO-ENG

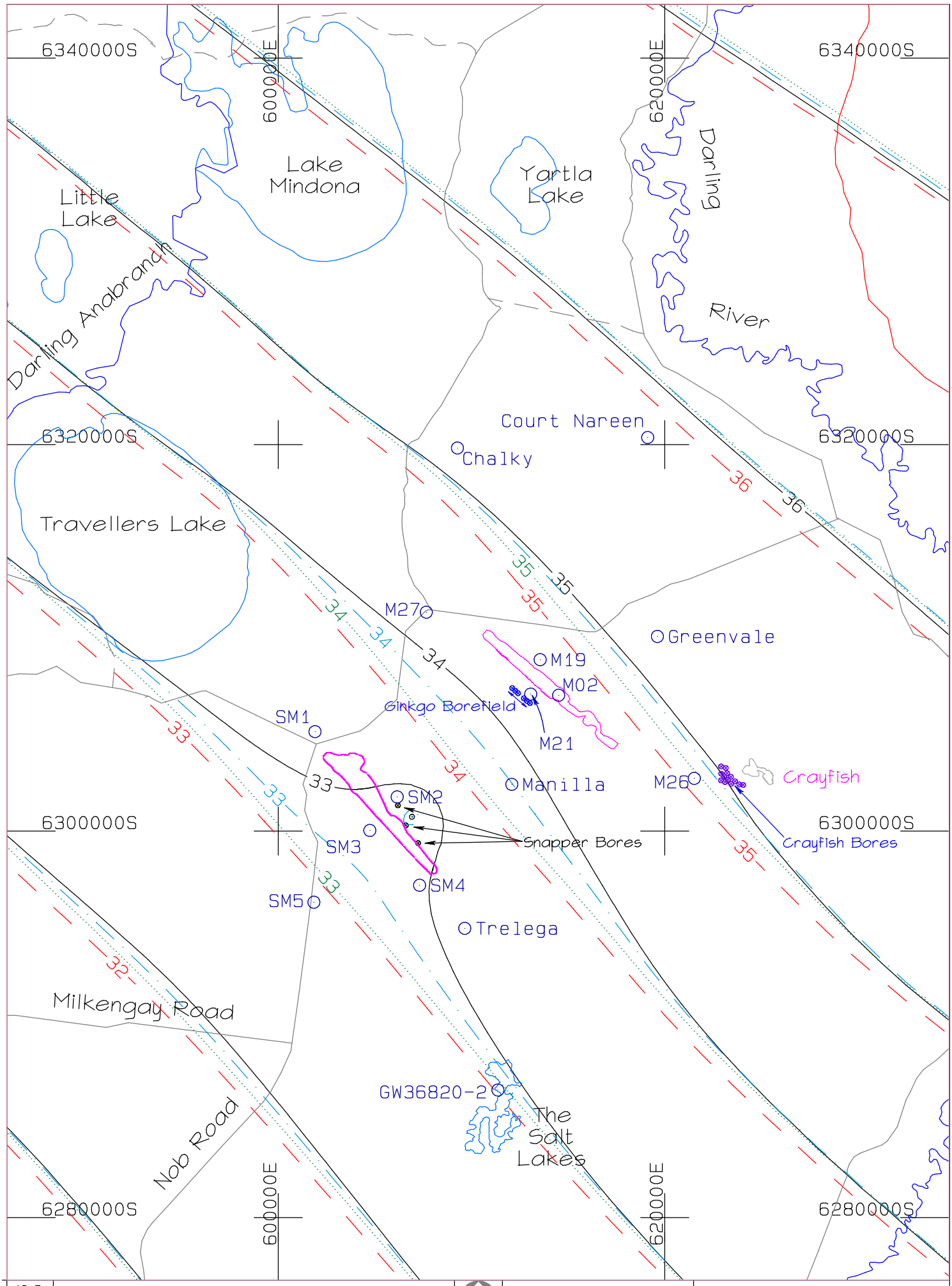
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19.5 x 26.41

North

Tronox Mining Australia

Lower Aquifer GDW Contours

Jul 2005 - Pre-Mining

Jun 2017 - 7 Yrs Snapper

Apr 2025 - End of Mining at Snapper

Apr 2035 - 10yr post Mining

Surveyed: Tronox

Plotted: Oct 31 2019

Design: GEO-ENG

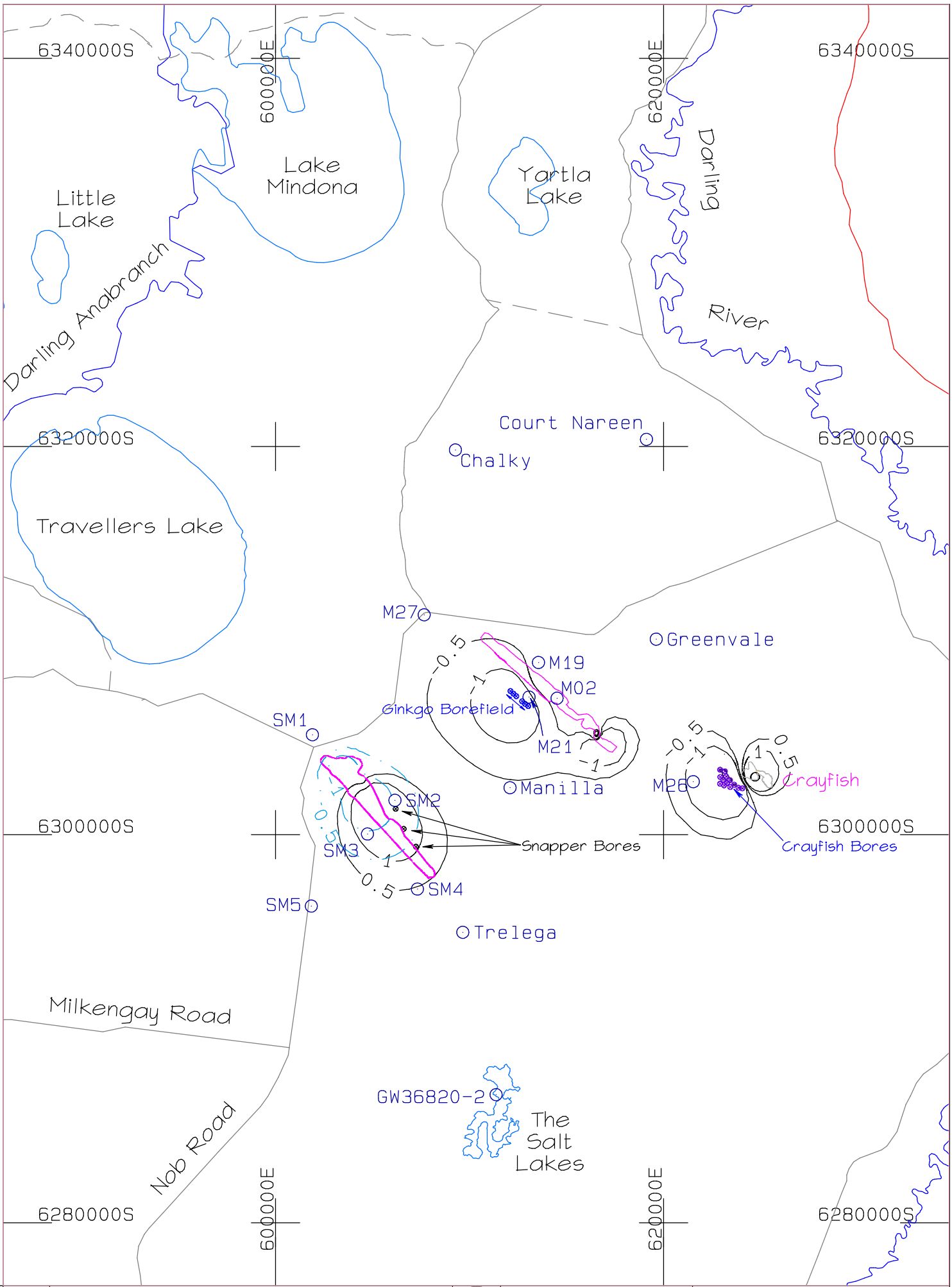
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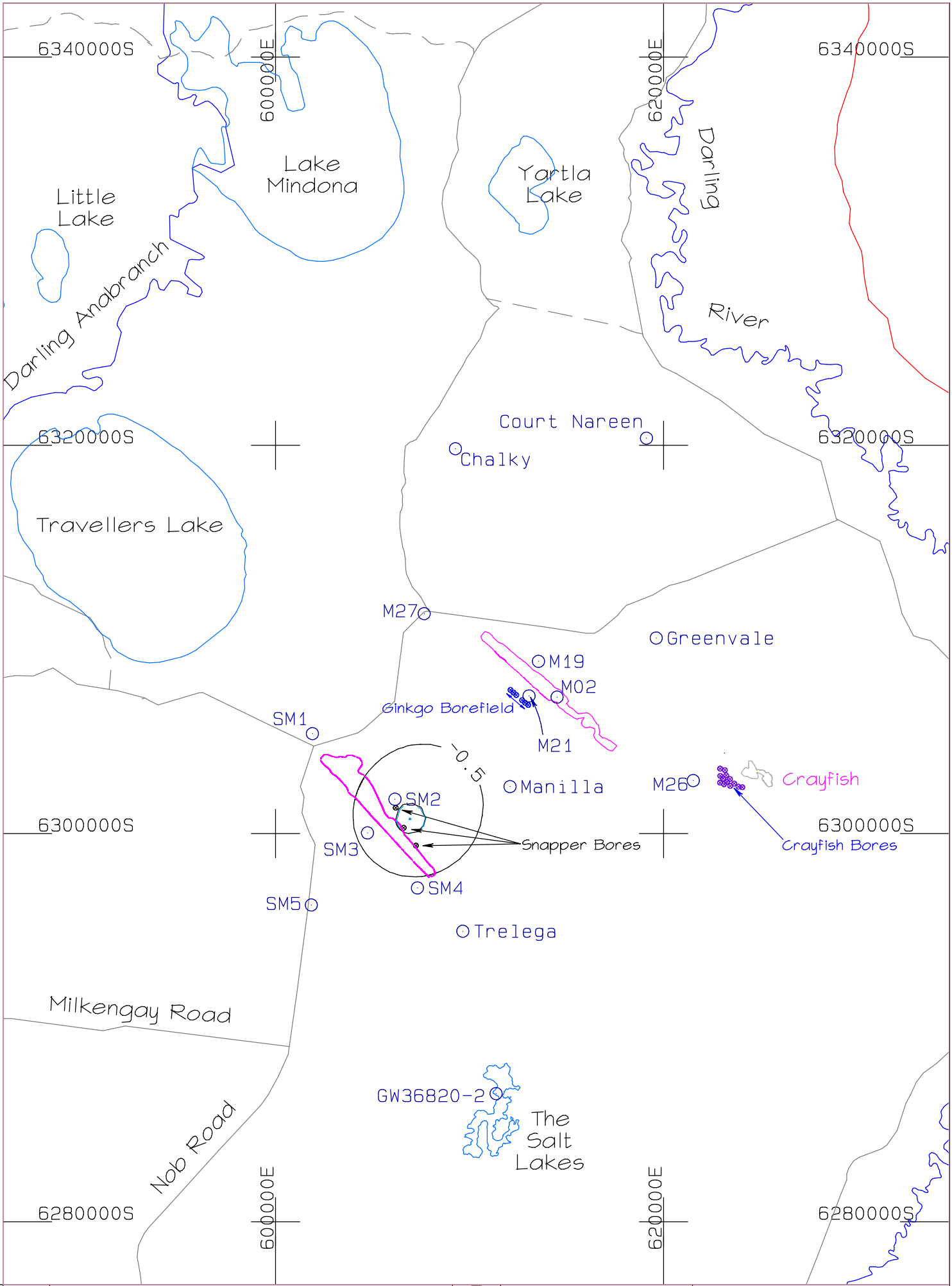
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19.5 x 26.41	Note: Contours of Groundwater Change (+) increase (-) drawdown. Intervals: 0.5, 1, 5, 10 (m)	North	Tronox Mining Australia				Upper Aquifer GDW Contours
Jun 2017 - 7 Yrs Snapper — Apr 2025 - End of Mining at Snapper			Surveyed: Tronox	Plotted: Oct 31 2019	Design: GEO-ENG	Contour int: 1m File No.: I:\FEFLOW\SGC\import+export\Plots\SGC_DD4.pro	DATUMS: Hor: GDA Ver: A.H.D. — A4 - 1 : 250000



19.5 x 26.41	Note: Contours of Groundwater Change (+) increase (-) drawdown. Intervals: 0.5, 1, 5, 10 (m)	North	Tronox Mining Australia					Lower Aquifer GDW Contours
Jun 2017 - 7 Yrs Snapper — Apr 2025 - End of Mining at Snapper			Surveyed: Tronox	Plotted: Oct 31 2019	Design: GEO-ENG	Contour int: 1m	DATUMS: Hor: GDA Ver: A.H.D.	A4 - 1 : 250000
						File No.: I:\ FEFLOW\SGC\import+export\Plots\SGC_DD4_19.pro		

SNAPPER MINE

Northern Extension Modification

Appendix G

Land Contamination Assessment

TRONOX



SNAPPER MINE NORTHERN EXTENSION MODIFICATION

LAND CONTAMINATION ASSESSMENT



NOVEMBER 2019
Project No. CMA-19-08
Document No. 1000472

EXECUTIVE SUMMARY

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act, 1979* (EP&A Act) (Project Approval [06_0168]) in 2007. Tronox proposes a modification to Project Approval (06_0168), herein referred to as the Snapper Mine Northern Extension Modification (the Modification), and would be sought under section 4.55(2) of the EP&A Act.

The Land Contamination Assessment has been prepared to address *State Environment Planning Policy No 55 - Remediation of Land* and takes the form of a Stage 1 Preliminary Investigation prepared in accordance with the NSW Department of Urban Affairs and NSW Environment Protection Authority (EPA) 1998 *Managing Land Contamination Planning Guidelines* and the NSW Office of Environment and Heritage's 2011 *Guidelines for Consultants Reporting on Contaminated Sites*.

This Land Contamination Assessment has been prepared for the areas within the additional surface development areas proposed as part of the Modification. These areas are collectively referred to as the Site.

The objectives of this Stage 1 Preliminary Investigation were to identify any past or present potentially contaminating activities, provide a preliminary assessment of any contamination and, if required, provide a basis for a more detailed investigation. The scope of work conducted for the Stage 1 Preliminary investigation included:

- review of the Site's environmental setting;
- review of the Site's history to identify past potentially contaminating activities or contaminated areas;
- site inspection to identify current potentially contaminating activities or contaminated areas;
- a preliminary assessment of the Site contamination; and
- assessment of the suitability of the Site for the proposed use.

The review of Site's history included a desktop Site history assessment including the collection and collation of information from the following sources:

- EPA's Contaminated Land Record of Notices;
- EPA's *Protection of the Environment Operations Act, 1997* Public Register;
- underground utilities search;
- section 10.7 Planning Certificates;
- historical aerial photographs; and
- interviews with surrounding leaseholders.

No potentially contaminating activities or contaminated areas were identified on the Site during the review of the Site's history.

Tronox personnel undertook an inspection of the Site on 12 November 2019.

No contaminated land or potential sources of contamination were observed during the Site inspection.

Based on the outcomes of this Stage 1 Preliminary Investigation, it is considered that no remediation would be required for the Modification. Notwithstanding the above, in the event that an area of potential land contamination is identified during activities associated with the Modification, work in that immediate area would cease and the area made safe. The unexpected contamination would be assessed by a suitably qualified person and remediation strategies put in place to manage this contamination if necessary after approval by the appropriate authority.

The land contamination assessment would be undertaken in accordance with the relevant guidelines (including guidelines under Schedule 6 of the NSW *Environmental Planning and Assessment Act, 1979* and the NSW *Contaminated Land Management Act, 1997*).

Based on the above assessment it is concluded that further investigation is not required and that the Site is suitable for the proposed industrial development (i.e. the mine path extension, associated supporting infrastructure and Nob Road realignment).

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1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine) which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act, 1979* (EP&A Act) in 2007 (Project Approval [06_0168]). The Snapper Mine integrates with existing/approved Tronox operations in western NSW, including (Figure 1):

- the Broken Hill Mineral Separation Plan, located approximately 170 km north of the Snapper Mine;
- the Ginkgo Mine, located approximately 10 km north east of the Snapper Mine; and
- the Atlas-Campaspe Mine, located approximately 105 km east of the Snapper Mine.

This Land Contamination Assessment has been prepared to support the application to modify Project Approval (06_0168) for the Snapper Mine, which would be sought under section 4.55(2) of the EP&A Act.

1.1 OVERVIEW OF THE MODIFICATION

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (herein referred to as the Snapper Mine Northern Extension Modification [the Modification]).

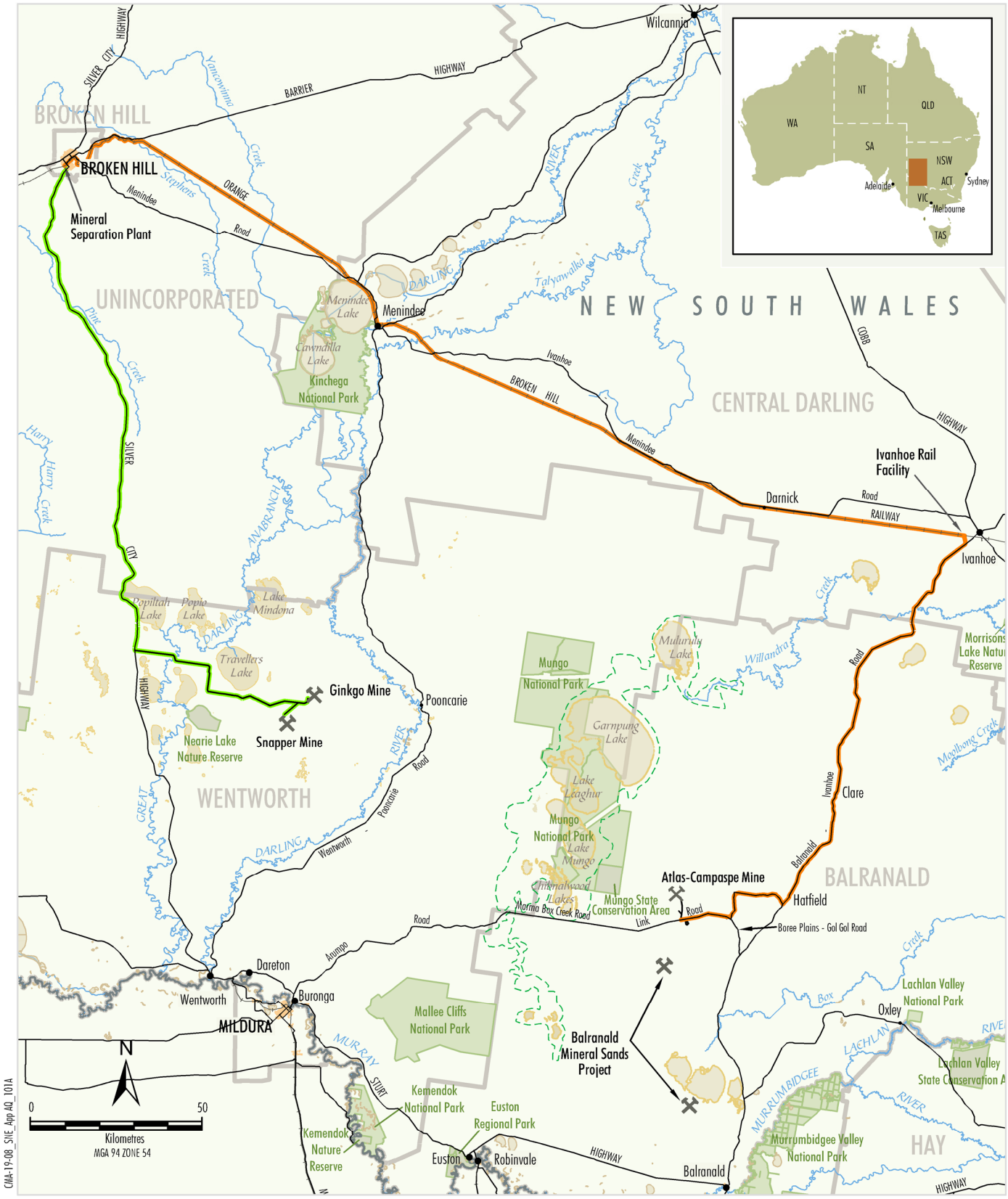
The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The indicative general arrangement of the modified Snapper Mine is shown on Figure 2.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mining fleet;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;



Source: *© NSW Department of Finance, Services & Innovation (2018); Cristal Mining Australia (2012)*

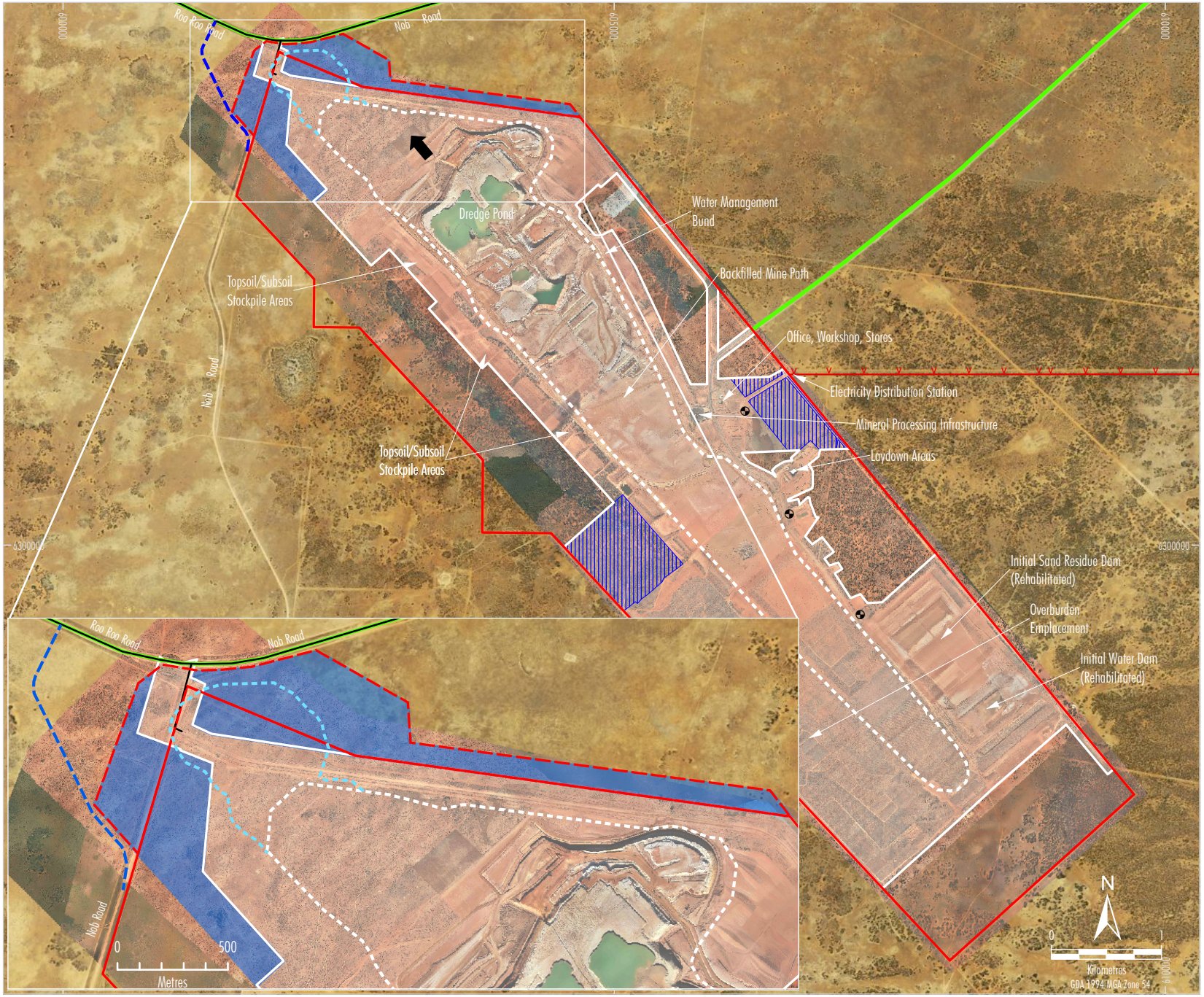
TRONOX

SNAPPER MINE

Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1



LEGEND

Approved Project

- Mining Lease Boundary (ML 1621)
- Existing/Approved Surface Development Extent
- Mine Path Extent
- Direction of Mining
- Water Supply Bore
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Highway Access Road
- Electricity Transmission Line

Modified Project

- Mining Lease Application Boundary (MLA 1)
- Approved Surface Development Areas to be Relinquished
- Additional Surface Development Extent
- Additional Mine Path Extent
- Realigned Road

Source: NSW Spatial Services (2019); Tronox (2019)
Orthophoto: Tronox (2019)

TRONOX

SNAPPER MINE

Modified Snapper Mine - Indicative General Arrangement

Figure 2

CMA-19-08_SNE_AppGW_201D

- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

A detailed description of the existing/approved and modified Snapper Mine is presented in Sections 1.1 and 2 of the Modification Report, respectively.

1.2 OBJECTIVES AND SCOPE

This Land Contamination Assessment has been prepared for the areas within the additional surface development area (the Mine area) and proposed Nob Road realignment route (the road realignment area) associated with the Modification (Figure 2). These areas are collectively referred to as the Site.

The objectives of this Stage 1 Preliminary Investigation were to identify any past or present potentially contaminating activities, provide a preliminary assessment of any contamination and, if required, provide a basis for a more detailed investigation. The scope of work conducted for the Stage 1 Preliminary investigation included:

- review of the Site's environmental setting;
- review of the Site's history to identify past potentially contaminating activities or contaminated areas;
- site inspection to identify current potentially contaminating activities or contaminated areas;
- a preliminary assessment of the Site contamination; and
- assessment of the suitability of the Site for the proposed use.

1.3 METHODOLOGY

This Land Contamination Assessment was prepared in general accordance with the following guidelines:

- *Managing Land Contamination Planning Guidelines State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) (NSW Department of Urban Affairs and Planning [DUAP] and the NSW Environmental Protection Authority [EPA], 1998).
- *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage [OEH], 2011).

2 SITE IDENTIFICATION

The Mine area is located immediately to the north of the approved Snapper Mine, and south of Nob Road (Figure 2). The Mine Area consists of native vegetation (used for light intensity rangeland grazing) and a public road. There are no buildings located in the Mine area.

The road realignment area is located adjacent (west) of the Mine area (Figure 2). The area associated with the road realignment consists of native vegetation (used for light intensity rangeland grazing). There are no buildings located in the road realignment area.

The Mine and road realignment areas are located wholly within the Wentworth Local Government Area (LGA) on land zoned Zone RU1 (Primary Production) under the *Wentworth Local Environmental Plan 2011*. Further detail on the zoning of the Snapper Mine area (including the Site) is provided in Section 4 of the Modification Report.

The real property descriptions of the Site are provided in Table 1 and shown on Figure 3.

Table 1
Site Real Property Descriptions

Tenure Type	Lot Number	Deposited Plan Number
Leasehold	Part of 1926	763904
Leasehold	Part of 1927	763905

And all road reserves within the Site area shown on Figure 3.



LEGEND

- Mining Lease Boundary (ML 1621)
- Mining Lease Application Boundary (MLA 1)
- ExistingApproved/Approximate Extent of Surface Development
- Highway Access Road
- Cadastral Boundary
- Additional Surface Development Extent
- Realigned Road

Source: NSW Spatial Services (2019)

TRONOX

SNAPPER MINE

Site Cadastral Information

Figure 3

CMA-19-08_SNE_App LC_202A

3 SITE DESCRIPTION

This section provides a description of the Site. A more detailed description of the Modification area (including the Site) is provided in Section 6.8 of the Modification Report.

3.1 LAND USE ACTIVITIES

The dominant land use at the Site is light intensity rangeland grazing. A public road is also present in the Mine area (i.e. Nob Road) (Figure 2).

Planning Certificates were obtained from the Wentworth Shire Council under section 10.7 of the EP&A Act (Attachment A) for the properties listed in Table 1. The Planning Certificates indicate that the Wentworth Shire Council has no record that the land on the Site is significantly contaminated land.

3.2 TOPOGRAPHY

The land within the Mine area shows very limited relief and comprises generally flat to gently undulating sandplains covered by a combination of grasslands, low woodland and shrublands. Elevations range from approximately 70 m Australian Height Datum (AHD) to approximately 75 m AHD across the Site area.

3.3 GEOLOGY

The Murray Darling Basin is a large sedimentary basin covering approximately 300,000 square kilometres extending across the borders of NSW, Victoria, Queensland and South Australia. The basin contains mineral sands deposits within the Loxton-Parilla Sands host unit, a sequence of weakly consolidated, near horizontally bedded sands that were deposited during marine transgressions and regressions in the Late Miocene to Late Pliocene period. The Snapper mineral deposit occurs within the Loxton-Parilla Sands host unit.

The Lower Loxton-Parilla Sands are typically overlain by barren sand of the Upper Loxton-Parilla Sand unit. The Shepparton Formation overlies the Upper Loxton-Parilla Sands and is a sandy clay unit with thick layers of clay. The Shepparton Formation can outcrop in places but is generally overlain by a thin layer of the Woorinen Formation consisting of very fine to coarse sand, silty sand, sandy clay and minor calcrete.

3.4 HYDROGEOLOGY

The Snapper Mine lies within a large aquifer system that extends west of the Great Darling Anabranch, east of the Darling River and south to the Murray River. The main aquifer of interest to the Snapper Mine is the Loxton-Parilla aquifer which overlies the sandy sediments of the Upper Renmark Group (BEMAX Resources [BEMAX], 2007).

There are no permanent surface water features at or surrounding the Snapper Mine (i.e. no groundwater window lakes fed by the deep underlying saline groundwater aquifer) (BEMAX, 2007).

An assessment of potential impacts of the Snapper Mine on groundwater resources (including identification of groundwater users) was previously conducted for the Snapper Mine Environmental Assessment by Golder Associates Pty Ltd (2007). Furthermore, GEO-ENG (2019) has assessed the potential groundwater impacts of the Modification, summarised in Section 6.7 of the Modification Report.

3.5 HYDROLOGY

The Snapper Mine is located within the lower Darling River Basin of the lower Murray River system in NSW (GEO-ENG, 2014). The major drainage feature is the Darling River, which intersects the Murray River at Wentworth. Paralleling the Darling River is the Darling Anabranch which only flows under flood conditions. Numerous ephemeral lakes are associated with the Anabranch, which occasionally hold water. Further north, the Menindee Lakes are used for water storage and irrigation supply (GEO-ENG, 2014).

As a result of the limited and well dispersed annual rainfall, the sandy soils, limited topographical relief and high evaporation rates, there are no well-defined natural drainage channels within the Snapper Mine area (BEMAX, 2007). Overland flow does occur during prolonged rainfall events and surface waters accumulate in topographic depressions and then evaporates or seep into the groundwater table over time (BEMAX, 2007).

Notwithstanding the above, an assessment of potential impacts of the Snapper Mine on surface water resources (including identification of surface water users) was previously conducted for the Snapper Mine Environmental Assessment (BEMAX, 2007). An assessment of potential impacts of the Modification on surface water resources is provided in Section 6.10 of the Modification Report.

3.6 BUILDINGS

Buildings (e.g. dwellings, workshops) can be a possible source of contamination (e.g. waste water disposal, stored hydrocarbons and/or chemicals). As described in Section 2, there are no buildings currently located within the Site and aerial photos were also used to check for historic dwellings and none were identified (Section 4.4). Therefore, dwellings were not considered a potential for contamination at the Site.

4 SITE HISTORY

A desktop Site history assessment was undertaken to identify potentially contaminating activities or contaminated areas. Information used to assist in the desktop Site history assessment was collected and collated from the following sources:

- EPA's Contaminated Land Record of Notices;
- EPA's *Protection of the Environment Operations Act, 1997* (POEO Act) Public Register;
- underground utilities search;
- section 10.7 Planning Certificates;
- historical aerial photographs; and
- interviews with surrounding leaseholders.

The findings of the desktop Site history assessment are summarised below.

4.1 ENVIRONMENT PROTECTION AUTHORITY PUBLIC REGISTER SEARCHES

A search of the EPA's Contaminated Land Record of Notices for the Site was conducted on 18 October 2019. No notices were identified in these searches (Attachment B).

A search of the EPA's POEO Act Public Register was undertaken for the area surrounding the Site on 18 October 2019. The only licenced activity returned by the search was Environment Protection Licence 12799 for the Snapper Mine. No licensed activities were identified on the Site (Attachment C).

4.2 UNDERGROUND UTILITIES SEARCH

An underground utility search using the Dial Before You Dig (DBYD) search was undertaken for the Site. The search indicated that neither Essential Energy nor Telstra have any recorded underground cables, pipes, earths or wires within the Site. The Essential Energy DBYD search is provided in Attachment D.

4.3 SECTION 10.7 PLANNING CERTIFICATES

As described in Section 3.1, Planning Certificates were obtained for the Site from the Wentworth Shire Council under section 10.7 of the EP&A Act (Attachment A). The Planning Certificates indicate that the Wentworth Shire Council has no record that the land on the Site is significantly contaminated land.

4.4 HISTORICAL AERIAL PHOTOGRAPH REVIEW

Historical aerial photographs from 1984, 1994 and 2004 of the Site were obtained from Google Earth (Attachment E).

The historic aerial photographs show that the Site has generally consisted of native vegetation. No buildings or evidence of potential contaminating activities or contaminated areas were identified in the historic aerial photographs.

4.5 LEASEHOLDER INTERVIEWS

Leaseholder interviews were conducted to identify any known potentially contaminating activities or contaminated areas on the Site. A summary of the interviews conducted with the leaseholders is provided in Table 2.

Table 2
Summary of Leaseholder Interviews

Property/ Leaseholder	Date	Comments
Manilla (Mark and Lindy Withers)	12 November 2019	• The majority of Manilla is used for light intensity rangeland grazing. • No chemicals/fuels stored at Manilla are located in the Site. • No sheep/cattle dips at Manilla are located in the Site. • No landfills at Manilla are located in the Site. • Unaware of any potentially contaminated areas on the Site.
Carstairs (Gary and Stacey Cullinan)	12 November 2019	• The majority of Carstairs is used for light intensity rangeland grazing. • No chemicals/fuels stored at Carstairs are located in the Site. • No sheep/cattle dips at Carstairs are located in the Site. • No landfills at Carstairs are located in the Site. • Unaware of any potentially contaminated areas on the Site.

4.6 SUMMARY OF DESKTOP SITE HISTORY ASSESSMENT

Based on the desktop Site history assessment, no potentially contaminating activities or contaminated areas were identified on the Site.

5 SITE INVESTIGATIONS

Tronox personnel undertook an inspection of the Site on 12 November 2019.

The purpose of the site inspection was to confirm the Site history details and to identify potentially contaminating activities or contaminated areas. A summary of the site investigation is provided below.

The Site consisted of remnant vegetation used for light intensity rangeland grazing. Plates 1 to 3 show examples of typical landforms at the Site.

No agricultural-related infrastructure/equipment, buildings or signs of contamination were observed at the Site.



Plate 1: Area Adjacent the North-East boundary of ML 1621



Plate 2: Area Adjacent the North-West boundary of ML 1621



Plate 3: Area Adjacent the Road Realignment Area

6 CONTAMINATED LAND MANAGEMENT

Based on the outcomes of this Stage 1 Preliminary Investigation, it is considered that no remediation would be required for the Modification.

Notwithstanding the above, in the event that an area of potential land contamination is identified during activities associated with the Modification, work in that immediate area would cease and the area made safe. The unexpected contamination would be assessed by a suitably qualified person and remediation strategies put in place to manage this contamination, if necessary, after approval by the appropriate authority.

The land contamination assessment would be undertaken in accordance with the relevant guidelines (including guidelines under Schedule 6 of the EP&A Act and the NSW *Contaminated Land Management Act, 1997*).

7 CONCLUSIONS AND RECOMMENDATIONS

A Land Contamination Assessment has been prepared to address SEPP 55 and takes the form of a Stage 1 Preliminary Investigation prepared in accordance with the *Managing Land Contamination Planning Guidelines* (DUAP and EPA, 1998) and the *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011).

The objectives of this Stage 1 Preliminary Investigation were to identify any past or present potentially contaminating activities, provide a preliminary assessment of any contamination and, if required, provide a basis for a more detailed investigation. The scope of work conducted for the Stage 1 Preliminary investigation included:

- review of the Site's environmental setting;
- review of the Site's history to identify past potentially contaminating activities or contaminated areas;
- site inspection to identify current potentially contaminating activities or contaminated areas;
- a preliminary assessment of the site contamination; and
- assessment of the suitability of the Site for the proposed use.

The review of Site's history included a desktop Site history assessment including the collection and collation of information from the following sources:

- EPA's Contaminated Land Record of Notices;
- EPA's POEO Act Public Register;
- underground utilities search;
- section 10.7 Planning Certificates;
- historical aerial photographs; and
- interviews with surrounding leaseholders.

No potentially contaminating activities or contaminated areas were identified on the Site during the review of the Site's history.

Tronox personnel undertook an inspection of the Site on 12 November 2019.

No contaminated land or potential sources of contamination were observed during the Site inspection.

Based on the outcomes of this Stage 1 Preliminary Investigation, it is considered that no remediation would be required for the Modification. Notwithstanding the above, in the event that an area of potential land contamination is identified during activities associated with the Modification, work in that immediate area would cease and the area made safe. The unexpected contamination would be assessed by a suitably qualified person and remediation strategies put in place to manage this contamination if necessary after approval by the appropriate authority.

The land contamination assessment would be undertaken in accordance with the relevant guidelines (including guidelines under Schedule 6 of the EP&A Act and the NSW *Contaminated Land Management Act, 1997*).

Based on the above assessment it is assessed that further investigation is not required and that the Site is suitable for the proposed industrial development (i.e. the mine path extension, associated supporting infrastructure and Nob Road realignment).

8 REFERENCES

Bemax Resources (2007) *Snapper Mineral Sands Project Environmental Assessment.*

Department of Urban Affairs and Planning and Environment Protection Authority (1998) *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land*.

Environment Protection Authority (2011) *Guidelines for Consultants Reporting on Contaminated Sites.*

GEO-ENG (2014) *Snapper Mine Production Increase Modification Hydrogeological Review Pooncarie, NSW.*

GEO-ENG (2019) *Snapper Mine Northern Extension Modification Hydrogeological Review Pooncarie, NSW.*

Golder Associates (2007) *Snapper Mineral Sands Project Appendix A Hydrogeological Assessment.* Submitted to BEMAX Resources Limited.

Office of Environment and Heritage (2011) *Guidelines for Consultants Reporting on Contaminated Sites*.

ATTACHMENT A

SECTION 10.7 PLANNING CERTIFICATES

LOT 1926, DP 763904

Wentworth Shire Council
26-28 Adelaide Street WENTWORTH NSW 2648
PO Box 81 WENTWORTH NSW 2648

Our Reference: DOC/19/23136
Your Reference: Snapper - 763904
Contact: Health & Planning Division
Phone: 03 5027 5027
Date: 12 November 2019

Joseph Flanagan
Suite 2 Level 3
24 McDougall Street
MILTON QLD 4064

Email: jflanagan@resourcestrategies.com.au

Dear Joseph

SECTION 10-7 CERTIFICATE 2019-314 - WITHERS 5097 NOB ROAD LOT 1926 DP 763904 POONCARIE

Further to the Application for a Section 10.7 Certificate received on 12 November 2019, please find attached the Planning Certificate 2019-314 providing information on the development standards of the above property including the planning restrictions that apply to the land at the date of issue.

Should you require any further information please contact the Health & Planning Division 03 5027 5027.

Yours faithfully

GEORGE KENENDE
DEVELOPMENT ASSESSMENT OFFICER

Attachment

26- 28 Adelaide Street
Po Box 81
WENTWORTH NSW 2648

Tel: 03 5027 5027
council@wentworth.nsw.gov.au

Notice of a
Planning Certificate under Section 10.7

issued under the *Environmental Planning and Assessment Act 1979* Section 10.7.

Our Ref:	DOC/19/23136
Applicant reference no:	Snapper - 763904
Section 10.7 certificate no:	2019-314
Applicant name:	Joseph Flanagan
Applicant address:	Suite 2 Level 3 No 24 McDougall Street MILTON QLD 4064
Owner name:	NSW Department of Industry – Crown Land
Owner address:	PO Box 2185 DANGAR NSW 2309
Lessee name:	Mark Alexander Withers
Lessee address:	5097 Nob Road Pooncarie NSW 2648
Subject land:	5097 Nob Road Lot 1926 DP 763904 POONCARIE
Date of certificate:	12 November 2019

PROFESSIONAL DISCLAIMER

The attached information has been taken from Council's records and is provided in good faith. When information pursuant to Section 10.7(5) of the Environmental Planning and Assessment Act, 1979 is requested, Council is under no obligation to furnish any information pursuant to that Section. Council draws your attention to Section 10.7(6) of the Act which states that a Council shall not incur any liability in respect of any advice provided in good faith pursuant to sub-section (5). The absence of any reference in this Certificate to any matter affecting the land shall not imply that the land is not affected by any such matter.

In providing this certificate Council has in good faith relied upon information provided to it or sourced from third parties. Where Council has obtained the information from third parties, either exclusively or in conjunction with information held by Council, the Certificate details the source of that third party information. Council cautions against relying upon information in the Certificate sourced from third parties as to its accuracy, applicability to specific lands and its advice and the adoption of prudent land acquisition measures and appropriate professional advice. To the full extent permitted by law Council disclaims liability with respect to any information in this Certificate sourced from third parties. It is strongly recommended that you contact the relevant third parties to confirm the accuracy of the information they have provided.

Council is prepared to provide up to date oral information about matters disclosed throughout, if it does so, it accepts no responsibility for the accuracy of information given and no employee of Council is authorised to bind Council by such information.

Signed: **GEORGE KENENDE**
DEVELOPMENT ASSESSMENT OFFICER
under delegation on behalf of the Shire of Wentworth

DISCLOSURE OF INFORMATION IN RELATION TO THE SUBJECT LAND AS PER SECTION 10.7(2) OF THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

Section 10.7 Certificate No: 2019-314

1. Names of relevant planning instruments and DCPs	
a) The name of each environmental planning instrument that applies to the carrying out of development on the land.	a) Wentworth Local Environmental Plan 2011, dated 16 December 2011.
b) The name of each proposed environmental planning instrument that will apply to the carrying out of development on the land and that is or has been the subject of community consultation or on public exhibition under the Act (unless the Director-General has notified the council that the making of the proposed instrument has been deferred indefinitely or has not been approved).	b) See Annexure 1.
c) The name of each development control plan that applies to the carrying out of development on the land.	c) Wentworth Development Control Plan December 2011.
d) In this clause, proposed environmental planning instrument includes a planning proposal for a LEP or a draft environmental planning instrument.	d) Not applicable
2. Zoning and land use under relevant LEPs For each environmental planning instrument or proposed instrument referred to in clause 1 (other than a SEPP or proposed SEPP) that includes the land in any zone (however described):	
a) the identity of the zone, whether by reference to a name (such as "Residential Zone" or "Heritage Area") or by reference to a number (such as "Zone No 2 (a)")	a) Wentworth Local Environmental Plan (WLEP) 2011 **ZONE: RU1 – Primary Production**
b) the purposes for which the instrument provides that development may be carried out within the zone without the need for development consent,	b) In addition to the controls contained in the *Wentworth Local Environmental Plan 2011*, State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 sets out further circumstances where development consent will be required for development involving certain types of buildings, the demolition of buildings or the subdivision of land. These circumstances may include development that does not require consent under the *Wentworth Local Environmental Plan 2011*.
c) the purposes for which the instrument provides that development may not be carried out within the zone except with development consent,	c) See Annexure 1.
d) the purposes for which the instrument provides that development is prohibited within the zone,	d) See Annexure 1.
e) whether any development standards applying to the land fix minimum land dimensions for the erection of a dwelling-house on the land and, if so, the minimum land dimensions so fixed,	e) 10,000 Hectares
f) whether the land includes or comprises critical habitat,	f) No. This information has been sourced from mapping provided by NSW Environment & Heritage.
g) whether the land is in a conservation area (however described),	g) No. This information has been sourced from mapping provided by NSW Environment & Heritage.
h) whether an item of environmental heritage	h) No.

(however described) is situated on the land.	
2A. Zoning and land use under State Environmental Planning Policy (Sydney Region Growth Centres) 2006 To the extent the land is within any zone (however described) under: a) Part 3 of the State Environmental Planning Policy *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (*the 2006 SEPP*), or b) A Precinct Plan (within the meaning of the 2006 SEPP) or c) A proposed Precinct Plan that is or has been the subject of community consultation or on public exhibition under the Act, the particulars referred to in clause 2(a)-(h) in relation to that land (with reference to "the instrument" in any of those paragraphs being read as a reference to Part 3 of the 2006 SEPP, or the Precinct Plan or proposed Precinct Plan, as the case requires).	Not applicable. Not applicable. Not applicable.
3. Complying development a) The extent to which the land is land on which complying development may be carried out under each of the codes for complying development because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*. b) The extent to which complying development may not be carried out on that land because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of that Policy and the reasons why it may not be carried out under that clause. c) If the council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land, a statement that a restriction applies to the land, but it may not apply to all of the land, and that council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land.	a) Yes - The land is land on which complying development may be carried out. b) Not applicable. c) Not applicable.
4. Coastal protection Whether or not the land is affected by the operation of section 38 or 39 of the *Coastal Protection Act 1979*, but only to the extent that the council has been so notified by the Department of Finance, Services and Innovation.	Not applicable.
4A. Certain information relating to beaches and coasts In relation to a coastal council – whether an order has been made under Part 4D of the *Coastal Protection Act 1979* in relation to temporary coastal protection works (within the meaning of that Act) on the land (or on public land adjacent to that land), except where the council is satisfied that such an order has been fully complied with.	Not applicable.

In relation to a coastal council: a) Whether the council has been notified under section 55X of the *Coastal Protection Act 1979* that temporary coastal protection works (within the meaning of that Act) have been placed on the land (or on public land adjacent to that land), and b) If works have been so placed – whether the council is satisfied that the works have been removed and the land restored in accordance with that Act.	Not applicable.
4B. Annual charges under Local Government Act 1993 for coastal protection services that relate to existing coastal protection works In relation to a coastal council – whether the owner (or any previous owner) of the land has consented in writing to the land being subject to annual charges under section 496B of the *Local Government Act 1993* for coastal protection services that relate to existing coastal protection works (within the meaning of Section 553B of that Act). Note: "Existing coastal protection works" are works to reduce the impact of coastal hazards on land (such as seawalls, revetments, groynes and beach nourishment) that existed before the commencement of section 553B of the *Local Government Act 1993*.	Not applicable.
5. Mine subsidence Whether or not the land is proclaimed to be a mine subsidence district within the meaning of section 15 of the *Mine Subsidence Compensation Act 1961*.	Not applicable.
6. Road widening and road realignment Whether or not the land is affected by any road widening or road realignment under: a) Division 2 of Part 3 of the *Roads Act 1993*, or b) any environmental planning instrument, or c) any resolution of the council.	Not applicable.
7. Council and other public authority policies on hazard risk restrictions Whether or not the land is affected by a policy: a) adopted by the council, or b) adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council, that restricts the development of the land because of the likelihood of land slip, bushfire, tidal inundation, subsidence, acid sulphate soils or any other risk (other than flooding).	Not applicable.
7A. Flood related development controls information a) Whether or not development on that land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related	a) Not applicable.

development controls. b) Whether or not development on that land or part of the land for any other purpose is subject to flood related development controls. c) Words and expressions in this clause have the same meanings as in the Standard Instrument.	b) Not applicable.
8. Land reserved for acquisition Whether or not any environmental planning instrument or proposed environmental planning instrument referred to in clause 1 makes provision in relation to the acquisition of the land by a public authority, as referred to in section 3.15 of the Act.	Not applicable.
9. Contribution plans The name of each contributions plan applying to the land.	Development Contribution Plan
9A. Biodiversity certified land If the land is biodiversity certified land under Part 8 of the *Biodiversity Conservation Act 2016,* a statement to that effect. Note: Biodiversity certified land includes land certified under Part 7AA of the *Threatened Species Conservation Act 1995* that is taken to be certified under Part 8 of the *Biodiversity Conservation Act 2016.*	Terrestrial Biodiversity: Freshwater Lake; Travellers Lake.
10. Biodiversity stewardship sites If the land is a biodiversity stewardship site under a biodiversity stewardship agreement under Part 5 of the *Biodiversity Conservation Act 2016*, a statement to that effect (but only if the council has been notified of the existence of the agreement by the Chief Executive of the Office of Environment and Heritage). Note: Biodiversity stewardship agreements include biobanking agreements under Part 7A of the *Threatened Species Conservation Act 1995* that are taken to be biodiversity stewardship agreements under Part 5 of the *Biodiversity Conservation Act 2016.*	No, Wentworth Shire Council has not been notified of the existence of a biodiversity stewardship agreement by the Office of Environment & Heritage in relation to this property.
10A. Native vegetation clearing set asides If the land contains a set aside area under section 60ZC of the *Local Land Services Act 2013*, a statement to that effect (but only if the council has been notified of the existence of the set aside area by Local Land Services or it is registered in the public register under that section).	No, Wentworth Shire Council has not been notified of the existence of a set aside area by the Local Land Services in relation to this property.
11. Bush fire prone land If any of the land is bush fire prone land (as defined in the Act), a statement that all or, as the case may be, some of the land is bush fire prone land. If none of the land is bush fire prone land, a statement to that effect.	Part Vegetation Category 2 and Part Buffer This information has been sourced from mapping provided by the NSW Rural Fire Service.
12. Property vegetation plans If the land is land to which a property vegetation plan	Not applicable.

approved under Part 4 of the *Native Vegetation Act 2003* (and that continues in force) applies, a statement to that effect (but only if the council has been notified of the existence of the plan by the person or body that approved the plan under that Act).	This information has been sourced from NSW Local Land Services.
13. Orders under Trees (Disputes Between Neighbours) Act 2006 Whether an order has been made under the *Trees (Disputes Between Neighbours) Act 2006* to carry out work in relation to a tree on the land (but only if the council has been notified of the order).	No, Council has not been notified by the Land Environment Court of any orders having been made under the Trees (Disputes Between Neighbours) Act 2006 in relation to this property.
14. Directions under Part 3A If there is a direction by the Minister in force under section 75P (2) (c1) of the Act that a provision of an environmental planning instrument prohibiting or restricting the carrying out of a project or a stage of a project on the land under Part 4 of the Act does not have effect, a statement to that effect identifying the provision that does not have effect	No, there is no direction in force from the Minister under Section 75P (2) (c1) in relation to this property.
15. Site compatibility certificates and conditions for seniors housing If the land is land to which *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* applies: a) A statement of whether there is a current site compatibility certificate (seniors housing), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is current, and (ii) that a copy may be obtained from the head office of the Department, and b) A statement setting out any terms of a kind referred to in clause 18 (2) of that Policy that have been imposed as a condition of consent to a development application granted after 11 October 2007 in respect of the land.	Not applicable. Not applicable.
16. Site compatibility certificates for infrastructure, schools or TAFE establishments a) A statement of whether there is a valid site compatibility certificate (infrastructure) or site compatibility certificate (schools or TAFE establishments), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is valid, and (ii) that a copy may be obtained from the head office of the Department.	Not applicable.
17. Site compatibility certificates and conditions for affordable rental housing a) A statement of whether there is a current site compatibility certificate (affordable rental	Not applicable.

housing), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is current, and (ii) that a copy may be obtained from the head office of the Department. b) A statement setting out any terms of a kind referred to in clause 17 (1) or 38 (1) of *State Environmental Planning Policy (Affordable Rental Housing) 2009* that have been imposed as a condition of consent to a development application in respect of the land.	Not applicable.
18. Paper subdivision information a) The name of any development plan adopted by a relevant authority applies to the land or that is proposed to be subject to a consent ballot. b) The date of any subdivision order that applies to the land. c) Words and expressions used in this clause have the same meaning as they have in Part 16C of the Environmental Planning & Assessment Regulation.	Not applicable. Not applicable.
19. Site verification certificates A statement of whether there is a current site verification certificate, of which the council is aware, in respect of the land and, if there is a certificate, the statement is to include: a) The matter certified by the certificate, and **Note:** A site verification certificate sets out the Secretary's opinion as to whether the land concerned is or is not biophysical strategic agricultural land or critical industry cluster land – see Division 3 of Part 4AA of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007. b) The date on which the certificate ceases to be current (if any), and c) That a copy may be obtained from the head office of the Department.	Not applicable.
20. Loose-fill asbestos insulation If the land includes any residential premises (within the meaning of Division 1A of Part 8 of the *Home Building Act 1989*) that are listed on the register that is required to be maintained under that Division, a statement to that effect.	Not applicable.
21. Affected building notices and building product rectification orders (1) A statement of whether there is any affected building notice of which the council is aware that is in force in respect of the land. (2) A statement of: a) Whether there is any building product rectification order of which the council is aware that is in force in respect of the land and has not been fully complied with, and	Not applicable. Not applicable.

b) Whether any notice of intention to make a building product rectification order of which the council is aware has been given in respect of the land and is outstanding. (3) In this clause: **Affected building notice** has the same meaning as in Part 4 of the Building Products (Safety) Act 2017. **Building product rectification order** has the same meaning as in the Building Products (Safety) Act 2017.	Not applicable.
22. Information regarding Contaminated Land as prescribed by section 59 (2) of the Contaminated Lands Management Act 1997	
(a) Is the land to which the certificate relates significantly contaminated land within the meaning of that Act?	No.
(b) Is the land to which the certificate relates subject to a management order within the meaning of that Act?	No.
(c) Is the land to which the certificate relates the subject of an approved voluntary management proposal within the meaning of that Act?	No.
(d) Is the land to which the certificate relates subject to an ongoing maintenance order within the meaning of that Act?	No.
(e) Is the land to which the certificate relates the subject of a site audit statement within the meaning of that Act?	No.

CERTIFICATE UNDER SECTION 10.7(1) PURSUANT TO SECTION 10.7(5) OF THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

Section 10.7 Certificate No: 2019-314

You are advised that at the date of this certificate the subject land is affected by the following matters:-

Information Requested	Reply
a) Has the Council information which would indicate that the land is subject to slip or of flooding or tidal inundation?	No.
b) Has the Council information which would indicate that the land is subject to slip or subsidence?	No.
c) Is the land subject to a Tree Preservation Order?	No.
d) Has any development consent with respect to the land been granted within the previous five years?	No.
e) Any known non-compliance with matters relating to development approval?	No.
f) Any known non-compliance on matters relating to, or delegated to Council and notices requiring work to be carried out in relation to building and/or health items?	No
g) Any other known matter of which Council is aware that applies to the subject land?	Yes *The following allotments also form part of this assessment – Lot 3429 DP 765718. *The comments and information contained in this certificate relate to the property described in the section "Description of Land". *The information contained in this certificate has been compiled from Council's records – no physical inspection of the property was carried out.

The above information has been taken from the Council's records but Council cannot accept responsibility for any omission or inaccuracy.

Signed: **GEORGE KENENDE**
DEVELOPMENT ASSESSMENT OFFICER
under delegation on behalf of the Shire of Wentworth

Dated: 12 November 2019

LOT 1927, DP 763905

Wentworth Shire Council
26-28 Adelaide Street WENTWORTH NSW 2648
PO Box 81 WENTWORTH NSW 2648

Our Reference: DOC/19/23140
Your Reference: Snapper - 763905
Contact: Health & Planning Division
Phone: 03 5027 5027
Date: 12 November 2019

Joseph Flanagan
Suite 2 Level 3
24 McDougall Street
MILTON QLD 4064

Email: jflanagan@resourcestrategies.com.au

Dear Joseph

SECTION 10.7 CERTIFICATE 2019-315 - CULLINAN HIGH DARLING ROAD LOT 1927 DP 763905 POONCARIE

Further to the Application for a Section 10.7 Certificate received on 12 November 2019, please find attached the Planning Certificate 2019-315 providing information on the development standards of the above property including the planning restrictions that apply to the land at the date of issue.

Should you require any further information please contact the Health & Planning Division 03 5027 5027.

Yours faithfully

GEORGE KENENDE
DEVELOPMENT ASSESSMENT OFFICER

Attachment

26- 28 Adelaide Street
Po Box 81
WENTWORTH NSW 2648

Tel: 03 5027 5027
council@wentworth.nsw.gov.au

Notice of a
Planning Certificate under Section 10.7

issued under the *Environmental Planning and Assessment Act 1979* Section 10.7.

Our Ref:	DOC/19/23140
Applicant reference no:	Snapper - 763905
Section 10.7 certificate no:	2019-315
Applicant name:	Joseph Flanagan
Applicant address:	Suite 2 Level 3 No 24 McDougall Street MILTON QLD 4064
Owner name:	NSW Department of Industry – Crown Land
Owner address:	PO Box 2185 DANGAR NSW 2309
Lessee name:	Gary Colin Cullinan and Stacey Lee Cullinan
Lessee address:	Carstairs Station WENTWORTH NSW 2648
Subject land:	High Darling Road Lot 1927 DP 763905 Pooncarie
Date of certificate:	12 November 2019

PROFESSIONAL DISCLAIMER

The attached information has been taken from Council's records and is provided in good faith. When information pursuant to Section 10.7(5) of the Environmental Planning and Assessment Act, 1979 is requested, Council is under no obligation to furnish any information pursuant to that Section. Council draws your attention to Section 10.7(6) of the Act which states that a Council shall not incur any liability in respect of any advice provided in good faith pursuant to sub-section (5). The absence of any reference in this Certificate to any matter affecting the land shall not imply that the land is not affected by any such matter.

In providing this certificate Council has in good faith relied upon information provided to it or sourced from third parties. Where Council has obtained the information from third parties, either exclusively or in conjunction with information held by Council, the Certificate details the source of that third party information. Council cautions against relying upon information in the Certificate sourced from third parties as to its accuracy, applicability to specific lands and its advice and the adoption of prudent land acquisition measures and appropriate professional advice. To the full extent permitted by law Council disclaims liability with respect to any information in this Certificate sourced from third parties. It is strongly recommended that you contact the relevant third parties to confirm the accuracy of the information they have provided.

Council is prepared to provide up to date oral information about matters disclosed throughout, if it does so, it accepts no responsibility for the accuracy of information given and no employee of Council is authorised to bind Council by such information.

Signed: **GEORGE KENENDE**
DEVELOPMENT ASSESSMENT OFFICER
under delegation on behalf of the Shire of Wentworth

DISCLOSURE OF INFORMATION IN RELATION TO THE SUBJECT LAND AS PER SECTION 10.7(2) OF THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

Section 10.7 Certificate No: 2019-315

1. Names of relevant planning instruments and DCPs	
a) The name of each environmental planning instrument that applies to the carrying out of development on the land.	a) Wentworth Local Environmental Plan 2011, dated 16 December 2011.
b) The name of each proposed environmental planning instrument that will apply to the carrying out of development on the land and that is or has been the subject of community consultation or on public exhibition under the Act (unless the Director-General has notified the council that the making of the proposed instrument has been deferred indefinitely or has not been approved).	b) See Annexure 1.
c) The name of each development control plan that applies to the carrying out of development on the land.	c) Wentworth Development Control Plan December 2011.
d) In this clause, proposed environmental planning instrument includes a planning proposal for a LEP or a draft environmental planning instrument.	d) Not applicable.
2. Zoning and land use under relevant LEPs For each environmental planning instrument or proposed instrument referred to in clause 1 (other than a SEPP or proposed SEPP) that includes the land in any zone (however described):	
a) the identity of the zone, whether by reference to a name (such as "Residential Zone" or "Heritage Area") or by reference to a number (such as "Zone No 2 (a)")	a) Wentworth Local Environmental Plan (WLEP) 2011 **ZONE: RU1 – Primary Production**
b) the purposes for which the instrument provides that development may be carried out within the zone without the need for development consent,	b) In addition to the controls contained in the *Wentworth Local Environmental Plan 2011*, State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 sets out further circumstances where development consent will be required for development involving certain types of buildings, the demolition of buildings or the subdivision of land. These circumstances may include development that does not require consent under the *Wentworth Local Environmental Plan 2011*.
c) the purposes for which the instrument provides that development may not be carried out within the zone except with development consent,	c) See Annexure 1.
d) the purposes for which the instrument provides that development is prohibited within the zone,	d) See Annexure 1.
e) whether any development standards applying to the land fix minimum land dimensions for the erection of a dwelling-house on the land and, if so, the minimum land dimensions so fixed,	e) 10,000 Hectares
f) whether the land includes or comprises critical habitat,	f) No. This information has been sourced from mapping provided by NSW Environment & Heritage.
g) whether the land is in a conservation area (however described),	g) No. This information has been sourced from mapping provided by NSW Environment & Heritage.
h) whether an item of environmental heritage	h) No.

(however described) is situated on the land.	
2A. Zoning and land use under State Environmental Planning Policy (Sydney Region Growth Centres) 2006 To the extent the land is within any zone (however described) under: a) Part 3 of the State Environmental Planning Policy *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (*the 2006 SEPP*), or b) A Precinct Plan (within the meaning of the 2006 SEPP) or c) A proposed Precinct Plan that is or has been the subject of community consultation or on public exhibition under the Act, the particulars referred to in clause 2(a)-(h) in relation to that land (with reference to "the instrument" in any of those paragraphs being read as a reference to Part 3 of the 2006 SEPP, or the Precinct Plan or proposed Precinct Plan, as the case requires).	Not applicable. Not applicable. Not applicable.
3. Complying development a) The extent to which the land is land on which complying development may be carried out under each of the codes for complying development because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*. b) The extent to which complying development may not be carried out on that land because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of that Policy and the reasons why it may not be carried out under that clause. c) If the council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land, a statement that a restriction applies to the land, but it may not apply to all of the land, and that council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land.	a) Yes - The land is land on which complying development may be carried out. b) Not applicable. c) Not applicable.
4. Coastal protection Whether or not the land is affected by the operation of section 38 or 39 of the *Coastal Protection Act 1979*, but only to the extent that the council has been so notified by the Department of Finance, Services and Innovation.	Not applicable.
4A. Certain information relating to beaches and coasts In relation to a coastal council – whether an order has been made under Part 4D of the *Coastal Protection Act 1979* in relation to temporary coastal protection works (within the meaning of that Act) on the land (or on public land adjacent to that land), except where the council is satisfied that such an order has been fully complied with.	Not applicable.

In relation to a coastal council: a) Whether the council has been notified under section 55X of the *Coastal Protection Act 1979* that temporary coastal protection works (within the meaning of that Act) have been placed on the land (or on public land adjacent to that land), and b) If works have been so placed – whether the council is satisfied that the works have been removed and the land restored in accordance with that Act.	Not applicable.
4B. Annual charges under Local Government Act 1993 for coastal protection services that relate to existing coastal protection works In relation to a coastal council – whether the owner (or any previous owner) of the land has consented in writing to the land being subject to annual charges under section 496B of the *Local Government Act 1993* for coastal protection services that relate to existing coastal protection works (within the meaning of Section 553B of that Act). Note: "Existing coastal protection works" are works to reduce the impact of coastal hazards on land (such as seawalls, revetments, groynes and beach nourishment) that existed before the commencement of section 553B of the *Local Government Act 1993*.	Not applicable.
5. Mine subsidence Whether or not the land is proclaimed to be a mine subsidence district within the meaning of section 15 of the *Mine Subsidence Compensation Act 1961*.	Not applicable.
6. Road widening and road realignment Whether or not the land is affected by any road widening or road realignment under: a) Division 2 of Part 3 of the *Roads Act 1993*, or b) any environmental planning instrument, or c) any resolution of the council.	Not applicable.
7. Council and other public authority policies on hazard risk restrictions Whether or not the land is affected by a policy: a) adopted by the council, or b) adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council, that restricts the development of the land because of the likelihood of land slip, bushfire, tidal inundation, subsidence, acid sulphate soils or any other risk (other than flooding).	Not applicable.
7A. Flood related development controls information a) Whether or not development on that land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related	a) Not applicable.

development controls. b) Whether or not development on that land or part of the land for any other purpose is subject to flood related development controls. c) Words and expressions in this clause have the same meanings as in the Standard Instrument.	b) Not applicable.
8. Land reserved for acquisition Whether or not any environmental planning instrument or proposed environmental planning instrument referred to in clause 1 makes provision in relation to the acquisition of the land by a public authority, as referred to in section 3.15 of the Act.	Not applicable.
9. Contribution plans The name of each contributions plan applying to the land.	Development Contribution Plan
9A. Biodiversity certified land If the land is biodiversity certified land under Part 8 of the *Biodiversity Conservation Act 2016,* a statement to that effect. Note: Biodiversity certified land includes land certified under Part 7AA of the *Threatened Species Conservation Act 1995* that is taken to be certified under Part 8 of the *Biodiversity Conservation Act 2016.*	Not applicable.
10. Biodiversity stewardship sites If the land is a biodiversity stewardship site under a biodiversity stewardship agreement under Part 5 of the *Biodiversity Conservation Act 2016*, a statement to that effect (but only if the council has been notified of the existence of the agreement by the Chief Executive of the Office of Environment and Heritage). Note: Biodiversity stewardship agreements include biobanking agreements under Part 7A of the *Threatened Species Conservation Act 1995* that are taken to be biodiversity stewardship agreements under Part 5 of the *Biodiversity Conservation Act 2016.*	No, Wentworth Shire Council has not been notified of the existence of a biodiversity stewardship agreement by the Office of Environment & Heritage in relation to this property.
10A. Native vegetation clearing set asides If the land contains a set aside area under section 60ZC of the *Local Land Services Act 2013*, a statement to that effect (but only if the council has been notified of the existence of the set aside area by Local Land Services or it is registered in the public register under that section).	No, Wentworth Shire Council has not been notified of the existence of a set aside area by the Local Land Services in relation to this property.
11. Bush fire prone land If any of the land is bush fire prone land (as defined in the Act), a statement that all or, as the case may be, some of the land is bush fire prone land. If none of the land is bush fire prone land, a statement to that effect.	Part Vegetation Category 1, Part Vegetation Category 2 and Part Buffer This information has been sourced from mapping provided by the NSW Rural Fire Service.
12. Property vegetation plans If the land is land to which a property vegetation plan	Not applicable.

approved under Part 4 of the *Native Vegetation Act 2003* (and that continues in force) applies, a statement to that effect (but only if the council has been notified of the existence of the plan by the person or body that approved the plan under that Act).	This information has been sourced from NSW Local Land Services.
13. Orders under Trees (Disputes Between Neighbours) Act 2006 Whether an order has been made under the *Trees (Disputes Between Neighbours) Act 2006* to carry out work in relation to a tree on the land (but only if the council has been notified of the order).	No, Council has not been notified by the Land Environment Court of any orders having been made under the Trees (Disputes Between Neighbours) Act 2006 in relation to this property.
14. Directions under Part 3A If there is a direction by the Minister in force under section 75P (2) (c1) of the Act that a provision of an environmental planning instrument prohibiting or restricting the carrying out of a project or a stage of a project on the land under Part 4 of the Act does not have effect, a statement to that effect identifying the provision that does not have effect	No, there is no direction in force from the Minister under Section 75P (2) (c1) in relation to this property.
15. Site compatibility certificates and conditions for seniors housing If the land is land to which *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* applies: a) A statement of whether there is a current site compatibility certificate (seniors housing), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is current, and (ii) that a copy may be obtained from the head office of the Department, and b) A statement setting out any terms of a kind referred to in clause 18 (2) of that Policy that have been imposed as a condition of consent to a development application granted after 11 October 2007 in respect of the land.	Not applicable. Not applicable.
16. Site compatibility certificates for infrastructure, schools or TAFE establishments a) A statement of whether there is a valid site compatibility certificate (infrastructure) or site compatibility certificate (schools or TAFE establishments), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is valid, and (ii) that a copy may be obtained from the head office of the Department.	Not applicable.
17. Site compatibility certificates and conditions for affordable rental housing a) A statement of whether there is a current site compatibility certificate (affordable rental	Not applicable.

housing), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include: (i) the period for which the certificate is current, and (ii) that a copy may be obtained from the head office of the Department. b) A statement setting out any terms of a kind referred to in clause 17 (1) or 38 (1) of *State Environmental Planning Policy (Affordable Rental Housing) 2009* that have been imposed as a condition of consent to a development application in respect of the land.	Not applicable.
18. Paper subdivision information a) The name of any development plan adopted by a relevant authority applies to the land or that is proposed to be subject to a consent ballot. b) The date of any subdivision order that applies to the land. c) Words and expressions used in this clause have the same meaning as they have in Part 16C of the Environmental Planning & Assessment Regulation.	Not applicable. Not applicable.
19. Site verification certificates A statement of whether there is a current site verification certificate, of which the council is aware, in respect of the land and, if there is a certificate, the statement is to include: a) The matter certified by the certificate, and **Note:** A site verification certificate sets out the Secretary's opinion as to whether the land concerned is or is not biophysical strategic agricultural land or critical industry cluster land – see Division 3 of Part 4AA of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007. b) The date on which the certificate ceases to be current (if any), and c) That a copy may be obtained from the head office of the Department.	Not applicable.
20. Loose-fill asbestos insulation If the land includes any residential premises (within the meaning of Division 1A of Part 8 of the *Home Building Act 1989*) that are listed on the register that is required to be maintained under that Division, a statement to that effect.	Not applicable.
21. Affected building notices and building product rectification orders (1) A statement of whether there is any affected building notice of which the council is aware that is in force in respect of the land. (2) A statement of: a) Whether there is any building product rectification order of which the council is aware that is in force in respect of the land and has not been fully complied with, and	Not applicable. Not applicable.

b) Whether any notice of intention to make a building product rectification order of which the council is aware has been given in respect of the land and is outstanding. (3) In this clause: **Affected building notice** has the same meaning as in Part 4 of the Building Products (Safety) Act 2017. **Building product rectification order** has the same meaning as in the Building Products (Safety) Act 2017.	Not applicable.
22. Information regarding Contaminated Land as prescribed by section 59 (2) of the Contaminated Lands Management Act 1997	
(a) Is the land to which the certificate relates significantly contaminated land within the meaning of that Act?	No.
(b) Is the land to which the certificate relates subject to a management order within the meaning of that Act?	No.
(c) Is the land to which the certificate relates the subject of an approved voluntary management proposal within the meaning of that Act?	No.
(d) Is the land to which the certificate relates subject to an ongoing maintenance order within the meaning of that Act?	No.
(e) Is the land to which the certificate relates the subject of a site audit statement within the meaning of that Act?	No.

CERTIFICATE UNDER SECTION 10.7(1) PURSUANT TO SECTION 10.7(5) OF THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

Section 10.7 Certificate No: 2019-315

You are advised that at the date of this certificate the subject land is affected by the following matters:-

Information Requested	Reply
a) Has the Council information which would indicate that the land is subject to slip or of flooding or tidal inundation?	No.
b) Has the Council information which would indicate that the land is subject to slip or subsidence?	No.
c) Is the land subject to a Tree Preservation Order?	No.
d) Has any development consent with respect to the land been granted within the previous five years?	No.
e) Any known non-compliance with matters relating to development approval?	No.
f) Any known non-compliance on matters relating to, or delegated to Council and notices requiring work to be carried out in relation to building and/or health items?	No.
g) Any other known matter of which Council is aware that applies to the subject land?	Yes *The following allotments also form part of this assessment – Lots 1,2,3,4,5 & 7 DP 756934; Lot 5563 DP 768473; Lot 5628 DP 768527; Lot 5537 DP 768447 & Lot 5538 DP 768448 *The comments and information contained in this certificate relate to the property described in the section "Description of Land". *The information contained in this certificate has been compiled from Council's records – no physical inspection of the property was carried out.

The above information has been taken from the Council's records but Council cannot accept responsibility for any omission or inaccuracy.

Signed: **GEORGE KENENDE**
DEVELOPMENT ASSESSMENT OFFICER
under delegation on behalf of the Shire of Wentworth

Dated: 12 November 2019

ATTACHMENT B

NEW SOUTH WALES ENVIRONMENT PROTECTION AUTHORITY
CONTAMINATED LAND RECORD OF NOTICES SEARCH

Search results

Your search for:LGA: Wentworth Shire Council

Search Again
Refine Search

did not find any records in our database.

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the planning process.

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

... more search tips

More information about particular sites may be available from:

- The POEO public register
- The appropriate planning authority: for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act.

See What's in the record and What's not in the record.

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.
This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act. In addition the EPA may be regulating contamination at the site through a licence under the Protection of the Environment Operations Act 1997. You may wish to search the POEO public register

18 October 2019

ATTACHMENT C

NEW SOUTH WALES ENVIRONMENT PROTECTION AUTHORITY NEW SOUTH WALES
PROTECTION OF THE ENVIRONMENT OPERATIONS ACT, 1997
PUBLIC REGISTER SEARCH

Search results

Your search for: **General Search** with the following criteria

Suburb - pooncarie

returned 4 results

Export to excel 1 of 1 Pages Search Again

Number	Name	Location	Type	Status	Issued date
12799	CRISTAL MINING AUSTRALIA LIMITED	NOB ROAD, POONCARIE, NSW 2648	POEO licence	Issued	21 Dec 2007
1506384	CRISTAL MINING AUSTRALIA LIMITED	NOB ROAD, POONCARIE, NSW 2648	s.58 Licence Variation	Issued	10 Jul 2012
1507283	CRISTAL MINING AUSTRALIA LIMITED	NOB ROAD, POONCARIE, NSW 2648	s.58 Licence Variation	Issued	10 Jul 2012
1582370	CRISTAL MINING AUSTRALIA LIMITED	NOB ROAD, POONCARIE, NSW 2648	s.58 Licence Variation	Issued	26 Aug 2019

18 October 2019

For business and industry

For local government

Contact us

- 131 555 (tel:131555)
- info@epa.nsw.gov.au (mailto:info@epa.nsw.gov.au)
- EPA Office Locations (https://www.epa.nsw.gov.au/about-us/contact-us/locations)

Accessibility (https://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/help-index)
Disclaimer (https://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/disclaimer)
Privacy (https://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/privacy)
Copyright (https://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/copyright)

Find us on (https://au.linkedin.environment-protection-authority-

ATTACHMENT D

DIAL BEFORE YOU DIG SEARCH

ESSENTIAL ENERGY

CABLE/PIPE LOCATION

No assets were found in the search area

COMPANY NAME:	Resource Strategies
ATTENTION:	Mr Joseph Flanagan
EMAIL:	jflanagan@resourcestrategies.com.au
SEARCH LOCATION:	Nob Rd Pooncarie NSW 2648
SEQUENCE NO:	90199485
DATE:	Friday, 18 October 2019

Provision of Plans:
Please find enclosed plans depicting approximate locations of **Essential Energy** assets in the search location***. The excavator must not assume that there may not be assets owned by other network operators in the search location.***

Underground assets searched for	Underground assets found
Essential Energy Electrical	☐
Essential Energy Water & Sewerage	☐

Plans are updated from time to time to record changes to underground assets and may be updated by Essential Energy without notice. In the event that excavation does not commence within 28 days of receipt of a plan, a new plan should be obtained.

The excavator must retain the plans on site for the duration of the works.

The excavator shall report all damage made to Essential Energy assets immediately. Note that damage includes gouges, dents, holes and gas escapes.

IN CASE OF EMERGENCY OR TO REPORT DAMAGE:
PHONE 13 20 80

DISCLAIMER

Please be aware that plans may **not** reflect alterations to surface levels or the position of roads, buildings, fences etc. **Cable and pipe locations are approximate** and the plans are **not** suitable for scaling purposes. *Essential Energy does not retain plans for privately-owned underground electrical or water & sewerage assets located on private property.* ***Privately-owned underground electrical assets located on private property are the responsibility of the owner.***

The plans have been prepared for Essential Energy's sole use and benefit. **Essential Energy cannot and does not warrant the accuracy or completeness of the plans**. Essential Energy supplies them at no cost with the object of reducing the serious risk of unintentional damage being caused to its cables and pipes. **Essential Energy does not accept any responsibility for any omissions, inaccuracies or errors in the plans, or any reliance place on the material. Any reliance placed on any plan provided in response to your request is at your own risk.**

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 5730 Port Macquarie NSW 2444
Telephone: 13 23 91 Facsimile: 1800 354 636

Essential Energy retains all intellectual and industrial property rights which exists or may exist in or with respect to the plan(s). The material provided is not to be copies or distributed beyond you.

You release Essential Energy from and against all claims, demands, actions and proceedings arising out of or in any way related to the use of the provided material.

Location of Assets on Site:
The plans indicate only that cables and pipes may exist in the general vicinity – they do not pinpoint the exact location of the cables and pipes.

If it is found that the location of cables or pipes on the plans can be improved, please notify Essential Energy on 13 23 91 (or fax 1800 354 636).

All individuals have a duty of care they must observe when working in the vicinity of underground cables and pipes. It is the **excavator's responsibility to visually expose the underground cables and pipes manually**, **ie. by using hand-held tools and non-destructive pot-holing techniques prior to any mechanical excavation.** The excavator will be held responsible for all damage caused to the Essential Energy network or cables and pipes, and for the costs associated with the repair of any such damage. The excavator will also be held responsible for all damage caused to any persons.

When digging in the vicinity of underground assets, persons should observe the requirements of the applicable Codes of Practice published by the NSW Work Cover Authority or Safe Work Australia, and any amendments from time to time by the Authorities, including although not limited to:

- Excavation Work
- Managing Electrical Risks in the workplace
- How to manage and control asbestos in the workplace

(Please refer to https://www.workcover.nsw.gov.au/law-and-policy/legislation-and-codes/codes-of-practice).

When digging in the vicinity of **electrical assets** persons should observe the requirements of the **Electricity Supply Act 1995.**
Persons excavating near live underground electrical reticulation and/or earthing cables **must exercise extreme caution at all times and adhere to the requirements of Essential Energy's Electrical Safety Rules.** (These are available on our website: http://www.essentialenergy.com.au/content/safety-community and include

- **Work near Essential Energy's Underground Assets:**
  http://www.essentialenergy.com.au/asset/cms/pdf/contestableWorks/CEOP8041.pdf , and
- **Asbestos Fact Sheet**:
  http://www.essentialenergy.com.au/asset/cms/pdf/safety/AsbestosFactSheet.pdf

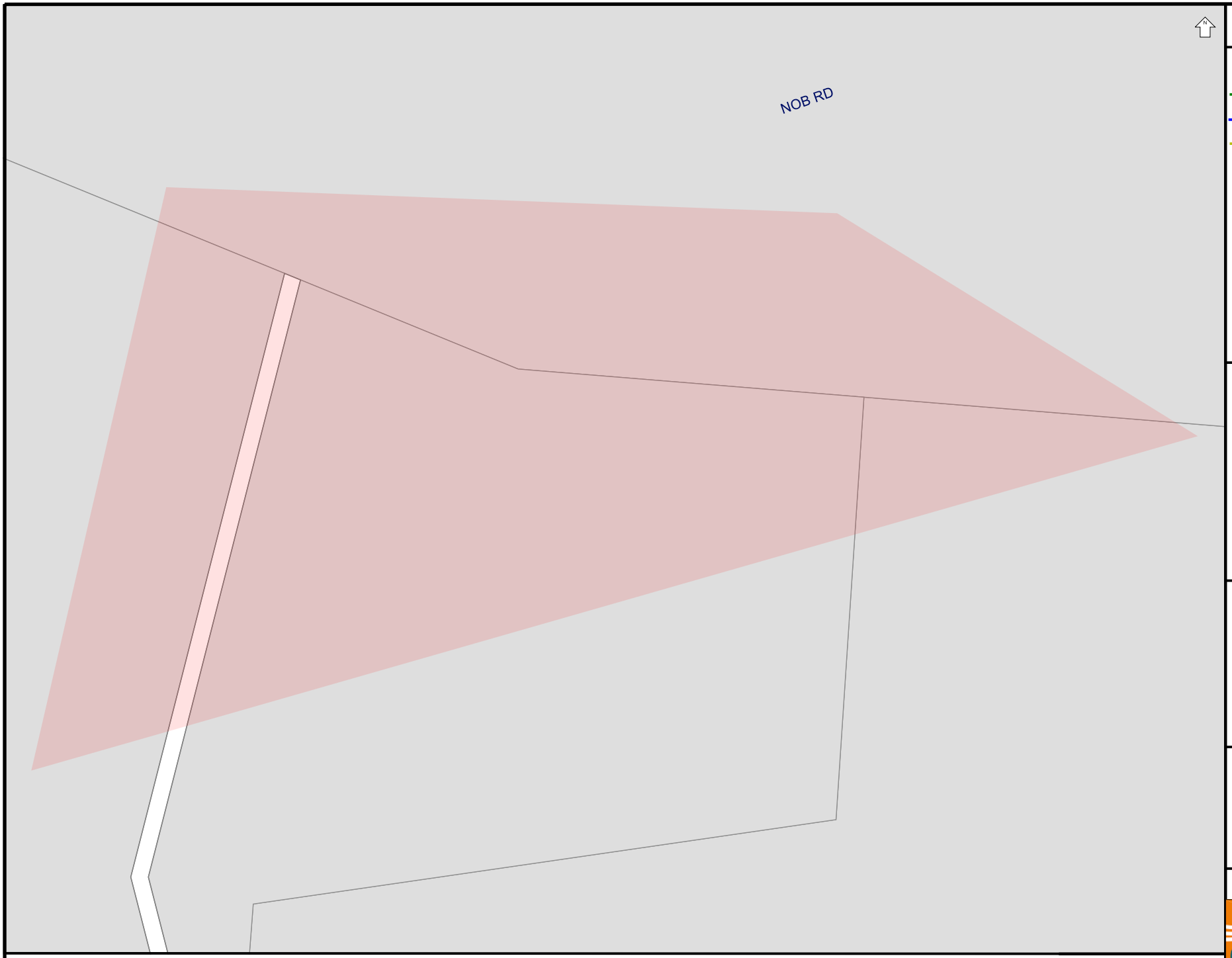
In some situations these procedures call for work to be performed by authorised staff.
Should there be any doubt as to the exact location of any underground electrical assets, and the potential for conflict with live underground cables caused by excavation at your work site, you should contact **13 23 91** to arrange for an on-site visit by an Essential Energy representative**.** No construction or mechanical excavation work is to commence prior to this on-site visit and approval being obtained.

When digging in the vicinity of **water or sewer assets** persons should observe the requirements of the **Water Management Act 2000.**
Should there be any doubt as to the exact location of any underground water and sewer assets, and the potential for conflict with underground water and sewer pipes caused by excavation at your work site, you should contact **13 23 91** to arrange for an on-site visit**.** No construction or excavation work is to commence prior to this on-site visit and approval being obtained.

Prior Notification:
Please note that for excavation depths greater than 250mm near power poles and stays you should allow for **advance notice** in your construction program to permit Essential Energy time to allocate the necessary field resources to carry out the inspection at the site a **minimum of fourteen (14) working days prior to work commencing**. This service may incur a fee and this can be negotiated with the local Area Coordinator at the time of making the appointment. Failure to give reasonable notice to the local Area Coordinator may result in disruption to Essential Energy's planned works program in the district and could incur an extra charge over and above the normal rate for this service.

For further information please call 13 23 91.

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PO Box 5730 Port Macquarie NSW 2444
Telephone: 13 23 91 Facsimile: 1800 354 636



Overhead wires not shown
LOOK UP & LIVE!

LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit
- Area of Interest

Critical Assets

Contact Essential Energy on 13 23 91

- Zone Substation
- Underground Cable
- Underground Fibre

Proposed Works

- Area of proposed works

Proposed assets are shown as orange symbols

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE. If details are incorrect, please notify Essential Energy on 13 23 91 (or fax 1800 354 636)

ISSUE DATE: 18/10/2019

You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

A4 | SCALE: 1:17648

Job Number: 18311358 Sequence number: 90199485 Job location: Nob Rd, Pooncarie Map Centre: 142° 6' 28.6", -33° 24' 2.0"

essential energy

ATTACHMENT E

HISTORICAL AERIAL PHOTOGRAPHS


Snapper Mine Area
Historical Image - 1984
Google Earth
Image Landsat / Copernicus
N
7 km


Snapper Mine Area
Historical Image - 1994
Google Earth
Image Landsat / Copernicus
N
7 km


Snapper Mine Area
Historical Image - 2004
Google Earth
Image Landsat / Copernicus
N
7 km