



# TRONOX

## Cooljarloo West Titanium Minerals Project

Preliminary Environmental Review

Prepared for  
Tronox Management Pty Ltd  
by Strategen

May 2013



**STRATEGEN**  
environmental consultants



# **Cooljarloo West Titanium Minerals Project**

Preliminary Environmental Review

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May 2013

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**Client:** Tronox Management Pty Ltd

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Client Review	D.Panickar / M.Brook	Electronic	8/02/2013
Draft Report	B	Client Review	D.Panickar / M.Brook	Electronic	21/03/2013
Final Draft Report	C	Client Review	D.Panickar / M.Brook	Electronic	10/05/2013
Final Report	0	Submission to EPA	D.Panickar / M.Brook	Electronic	13/05/2013

Filename: TIW12246\_01 R003 Rev 0 - 14 May 2013

## Table of contents

<b>1. Introduction</b>	<b>3</b>
1.1 Proposal outline	3
1.1.1 Location	3
1.2 Purpose of document	3
1.3 Proponent details	4
<b>2. Proposal description</b>	<b>7</b>
2.1 Summary	7
2.2 Key Proposal characteristics	7
2.3 Project schedule and life	8
2.4 Relationship between the Proposal and the existing Cooljarloo Project	8
<b>3. Existing environment</b>	<b>9</b>
3.1 Physical environment	9
3.1.1 Climate	9
3.1.2 Landform and soils	9
3.1.3 Surface water and groundwater	10
3.2 Biological environment	10
3.2.1 Vegetation and flora	10
3.2.2 Fauna	13
3.3 Wetlands and groundwater dependent ecosystems	14
3.3.1 Wetlands	14
3.3.2 Groundwater dependent ecosystems	14
3.4 Social environment	15
3.4.1 Aboriginal and European heritage	15
3.4.2 European heritage	15
<b>4. Community and other stakeholder consultation program</b>	<b>17</b>
<b>5. Potential environmental impacts and management</b>	<b>18</b>
5.1 Key environmental factors	18
5.1.1 Groundwater	18
5.1.2 Surface water (wetlands and watercourses)	18
5.1.3 Vegetation and flora	19
5.1.4 Terrestrial fauna	19
5.1.5 Subterranean fauna	19
5.1.6 Mine closure	19
5.2 Other environmental factors	19
5.3 Summary of likely environmental control instruments	20
<b>6. Reference List</b>	<b>22</b>

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## List of tables

Table 1	Key characteristics	7
Table 2-2	Physical elements	7
Table 2-3	Operational elements	7
Table 4	Vegetation associations in the Proposal Area.	10
Table 5	Threatened and priority flora species recorded in the Proposal Area	12
Table 6	Vegetation communities identified within the Study area	12
Table 7	Summary of vertebrate fauna survey results (Bamford 2010)	13
Table 8	Statutory and environmental management controls for the Proposal	20

## List of figures

Figure 1	Regional location of Cooljarloo West	5
Figure 2	Proposal Disturbance Envelope	6
Figure 3	Climatic data for Cooljarloo West	9
Figure 4	Surface water features and wetlands	11
Figure 5	Geomorphic wetlands	16

## List of appendices

Appendix 1	Flora and vegetation survey 2009
Appendix 2	Terrestrial fauna studies at Cooljarloo West 2010

# 1. Introduction

## 1.1 Proposal outline

Tronox Pty Limited (Tronox) proposes to develop the Cooljarloo West Titanium Minerals Mine (the Proposal), 175 km north of Perth (see Figure 1), and involves the dredge mining of three orebodies: Woolka, Harrier and Kestrel.

The Proposal will require the movement of the mining dredge and ore processing plant (concentrator) from the existing Cooljarloo Mine to Cooljarloo West and back again via flotation across an open channel (approximately 6 km long and 100 m wide). The Proposal will largely utilise existing Cooljarloo facilities.

### 1.1.1 Location

The Proposal is located on the Swan Coastal Plain in Western Australia, approximately 175 km north of Perth within the Shire of Dandaragan and 30 km from the town of Dandaragan (see Figure 1). Disturbances associated with implementation of the Proposal will be confined within the boundaries of a Proposal Area situated west of the existing Cooljarloo Mine (see Figure 2). The majority of the Proposal is located on tenements held by Tronox under the *Mining Act 1978* (Mining Act).

## 1.2 Purpose of document

The Proposal is being referred to the Environmental Protection Authority (EPA) under section 38 of the *Environmental Protection Act 1986* (EP Act). The Proposal meets the following criteria set out in the WA Government *Environmental Impact Assessment Part IV Divisions 1 and 2 Administrative Procedures 2012*:

- the Proposal has regional and/or State-wide impact
- the Proposal has several significant environmental issues or factors, some of which are considered to be complex or of a strategic nature
- substantial and detailed assessment of the Proposal is required to determine whether, and if so how, the environmental issues could be managed
- the level of interest in the Proposal warrants a public review period.

On this basis, Tronox is proceeding on the presumption that the level of assessment will be Public Environmental Review (PER).

The Proposal will be referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of this document is to provide information in support of the referral to assist the EPA reach a decision regarding the level of assessment of the Proposal. The document is in the form of a preliminary environmental review, utilising project and study information currently available.

Tronox would prepare an environmental impact assessment (EIA) document in accordance with an environmental scoping document (ESD) to be prepared by either Tronox or the EPA immediately following setting of the level of assessment. The EIA document would be submitted to the EPA for its consideration and subsequent assessment.

In addition, this document also describes the relationship between the Proposal and the existing Cooljarloo Project.

### 1.3 Proponent details

The proponent is Tronox Management Pty Ltd (Tronox).

Tronox Management Pty Ltd is a wholly owned subsidiary of Tronox Limited, the world's largest fully integrated producer of titanium ore and titanium dioxide (TiO<sub>2</sub>) and a significant producer of mineral sands. Tronox also produce electrolytic and specialty chemicals for the paper and battery industries and has operations in Australia, South Africa, the Netherlands and the United States of America.

Tronox Operations in Western Australia were previously held under a joint venture between Exxaro and Tronox, known as Tiwest Joint Venture. In the 2011, Tronox acquired the Exxaro 50% interest in the Tiwest Joint Venture, which has lead to the subsequent relabelling of Tiwest Joint Venture to Tronox Management Pty Ltd.

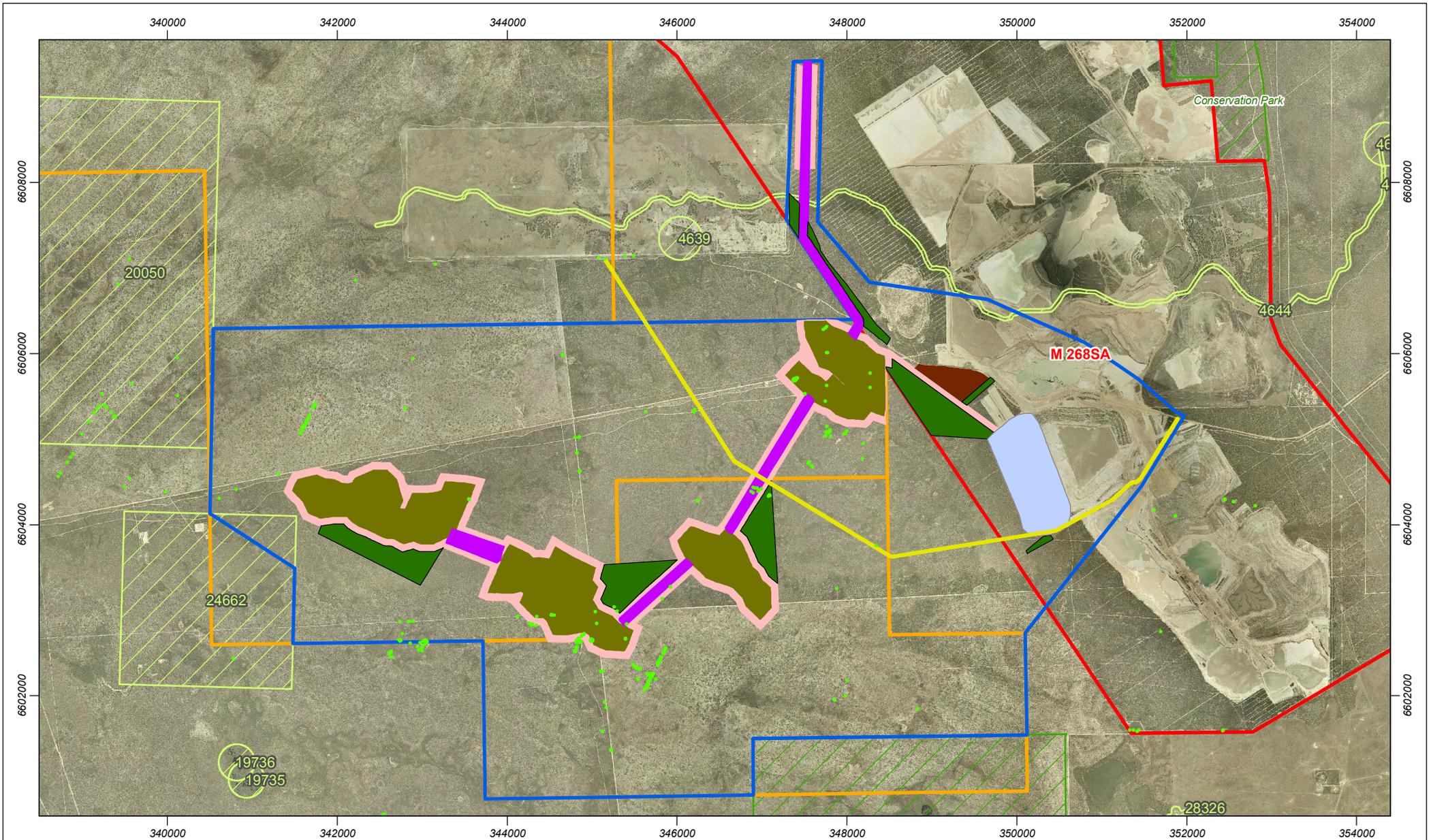
Tronox operations in Western Australia comprise:

- Cooljarloo mining operation, located 170 km north of Perth, where the company produces heavy mineral concentrates from dredging and dry mining operations
- Chandala processing plant, located 60 km north of Perth, where ilmenite, rutile, leucosene and zircon are split from the heavy mineral concentrate (ilmenite is refined to synthetic rutile at Chandala, producing activated carbon as a by-product)
- Kwinana processing plant, located 30 km south of Perth, where synthetic rutile is processed to titanium dioxide pigment then stored for use or sale in the domestic market or shipped to overseas markets
- corporate offices at Bentley
- product handling and shipping facilities at Henderson and Bunbury Port.

The Proponent contact details for the Proposal are:

Mr Nick Sibbel, Environmental Approvals Manager  
Tronox Management Pty Ltd  
Chandala Processing Plant  
742 Brand Highway, Muchea 6501  
PO Box 22, Muchea 6501 Western Australia  
Phone: (08) 9571 9342  
Mobile: 0407 445 178





**Figure 2 Indicative Proposal**

Scale 1:60,497 at A4  
 0 0.25 0.5 0.75 1 1.25 Kilometers  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 2/05/2013  
 Author: JCrute  
 Source: Aboriginal Heritage: DIA 2012. All other data: Client 2011-2013.

**Legend**

- Threatened flora
- Public road diversion
- Overburden
- Topsoil stockpile
- Transfer channel
- Plant location
- Pits
- Infrastructure without buffers
- Development Envelope
- Mining Lease
- Exploration Licence
- Aboriginal heritage sites
- Reserve



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## 2. Proposal description

### 2.1 Summary

Tronox currently operates a mineral sands mine at Cooljarloo located 175 km north of Perth. The existing Cooljarloo Project was approved under the EP Act in 1988 (Statement 37, as modified by Statements 557 and 790) and EPBC Act in 2000 (2000/23, 2007/3556).

This Proposal is a component of the Tronox Rapid Growth Projects plan, which includes increasing the mining and downstream processing rates. This Proposal involves mining the Harrier, Woolka and Kestrel ore bodies (Figure 2).

### 2.2 Key Proposal characteristics

Key characteristics relevant to the Proposal are presented in Table 1. Refer to Figure 2 for the conceptual layout of the Proposal.

The maximum disturbance footprint will be approximately 2250 ha.

Table 1 Key characteristics

<b>Proposal title</b>	Cooljarloo West Titanium Minerals Project
<b>Proponent name</b>	Tronox Management Pty Ltd
<b>Short description</b>	The Proposal is for an open cut (dredge) mineral sands mine approximately 170 km north of Perth. The mining would over a 6 year life span (depending on market demands).

Table 2-2 Physical elements

Element	Location	Extent
Proposal Disturbance Envelope	Figure 1	Up to approximately 2250 ha within a Disturbance Envelope of 4925 ha
Native vegetation disturbance	Figure 1	Up to approximately 2250 ha at the mine site within the Disturbance Envelope

Table 2-3 Operational elements

Element	Location	Extent
Water supply	Figure 1	Up to approximately 16 GL/yr from groundwater
Tailings and Overburden	Figure 1	Overburden in mine voids or ex-pit dumps Clay/slimes and sand tails into mine voids/Tailings Storage Facility (TSF)

The Proposal comprises the following major components:

1. Construction of a water filled transportation channel approximately 6 km long and 100 m wide to float the mining dredge and processing plant.
2. Construction of infrastructure corridors including roads, pipeline and powerline corridors.
3. Abstraction of groundwater (from existing sources) to supply mining activities.
4. Construction of temporary topsoil and, temporary and permanent, overburden stockpiles.
5. Dredge mining of the Kestrel, Harrier and Woolka deposit for approximately six years, expected to commence in 2016.
6. Tailings (sand and clay slimes) disposal.
7. Movement of dredge and concentrator from Cooljarloo West to Cooljarloo, expected to take place in 2021.

The sections of the diversion channels will be constructed sequentially as the dredge moves from the Kestrel to the Woolka deposit. As built, all sections will remain open for the duration the project to allow removal of the dredge back to the existing Cooljarloo orebody at completion.

### **2.3 Project schedule and life**

Construction is planned to commence in Q1 2015 with production commencing in Q2 2016. The Proposal is anticipated to have a mine life of approximately six years, with the dredge and concentrator expected to return to the existing Cooljarloo orebodies in 2021, when the resources at Cooljarloo West are exhausted.

### **2.4 Relationship between the Proposal and the existing Cooljarloo Project**

This Proposal is a discreet standalone project that does not require the approval of any other project. Due to the relationship to the existing Tronox Cooljarloo Project there are advantages in having the environmental approvals for this Proposal and the existing Project combined. As such, while it is expected that this Proposal will be assessed as a standalone proposal, the EIA assessment document (assumed to be a PER) may propose a consolidated statement that covers the existing Project and this Proposal. The proposed statement would modernise the existing statement but not alter the existing Project in any way. Therefore neither the PER nor the proposed statement will include any form of impact assessment of the existing Project and not alter the intent of the existing approval.

## 3. Existing environment

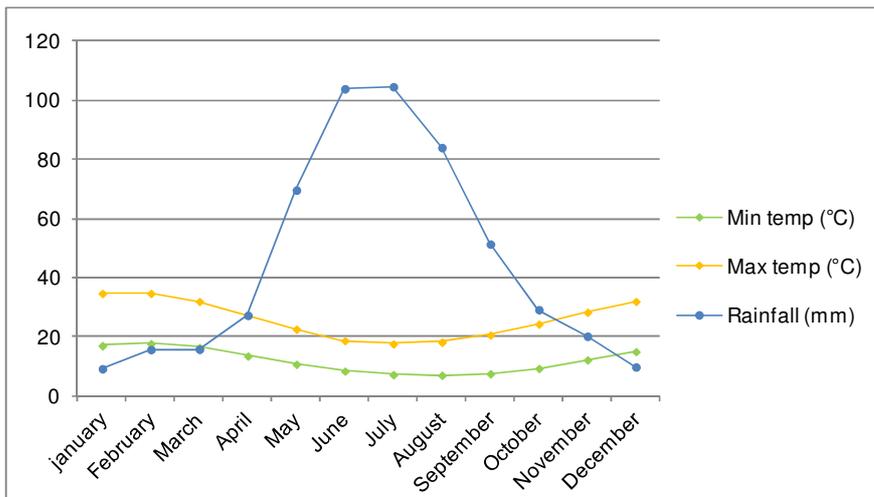
### 3.1 Physical environment

#### 3.1.1 Climate

The Proposal is located in the north of the Southwest Land Division of WA, which is broadly defined as the area south of a line between Kalbarri in the northwest and Esperance in the southeast. This division experiences a Mediterranean type climate with hot dry summers and cool wet winters. Weather patterns are dominated by the regular passage of rain bearing cold fronts from the Indian Ocean in winter, and dry easterly air flows from inland areas in summer. Rainfall progressively declines in northerly and easterly directions (i.e. as distance from the coast increases).

The nearest Bureau of Meteorology (BoM) weather station, measuring both rainfall and temperature to the Proposal Area is Badgingarra Research Station (Site number 009037 located approximately 38 km to the northeast of the Proposal Area). Relevant climate data from this station (temperature and rainfall) is presented in Figure 3. Average annual rainfall at Badgingarra is 551.6 mm with average maximum temperatures ranging from 17.6°C in July to 34.7°C in both January and February. The majority of rainfall at this site is received during the period May to September.

Figure 3 Climatic data for Cooljarloo West



Source: Badgingarra Research Station BOM (2013)

#### 3.1.2 Landform and soils

The Proposal Area is located within the Swan Coastal Plain geomorphological division in Western Australia and is situated on the Bassendean sand complex. This complex is characterised as a gently undulating landscape consisting of sand dunes, inter-dune basins and swales (Blandford 2004). Dissected remnant hills bound the Proposal Area to the east.

Soils within the Proposal Area can be divided into two zones: surface sands and a deeper clay layer. Surface sands are evident to a depth of 5 m within the area and vary considerably in terms of particle arrangement. A clay zone lies beneath the surface sands, which is present at varying depths throughout the Proposal Area. This zone contains sediment with elevated clay contents from both the Kaolinite and Smectite groups. Ferricrete gravels are often associated with this clay zone and can be traced to historic laterisation within the region (Blandford 2004).

### 3.1.3 Surface water and groundwater

The Proposal Area is drained by watercourses originating on the Dandaragan Plateau and the Arrowsmith Region. All watercourses, including Mullering Brook in the Proposal Area and Minyulo Brook to the south, are seasonal streams terminating in large swamps or lakes in the Bassendean dunes. Several permanent and seasonal lakes and swamps occur in interdunal depressions in the Bassendean Dunes, such as Emu Lakes to the south east of the Proposal Area (Kern 1989) (Figure 4). There are two main regional aquifer systems in the vicinity of the Project Area: the Superficial Formations and the Yarragadee Formation.

The Superficial Formations comprise alternating layers of sands and clays, which form an unconfined to semi-confined anisotropic groundwater flow system (Kern 1989). This aquifer extends from ground surface to a depth ranging from 18 m to 50 m (Parsons Brinckerhoff 2011). Fluvial deposits derived from Mullering Brook and other watercourses are also associated with this formation, which is recharged via direct infiltration of rainfall and upward leakage of groundwater from the Yarragadee Formation.

The Yarragadee Formation is predominantly comprised of sandstone and forms both the thickest and most extensive aquifer system within the region (Parsons Brinckerhoff 2011). This aquifer is overlain in part by the Superficial Formations and is recharged via direct infiltration of rainfall through the Superficial Formations.

## 3.2 Biological environment

The Proposal Area is located within the Swan Coastal Plain biogeographic region (bioregion) of Western Australia in accordance with the Interim Biogeographic Regionalisation for Australia (IBRA) classification system. The Swan Coastal Plain bioregion is described as a low-lying coastal plain mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Allocasuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *A. obesa*-marri woodlands and melaleuca shrublands, are extensive only in the south (Environment Australia 2000).

Tronox has commenced a number of detailed biological studies for the Proposal. These studies include flora and vegetation, vertebrate and short-range endemic fauna, and subterranean fauna.

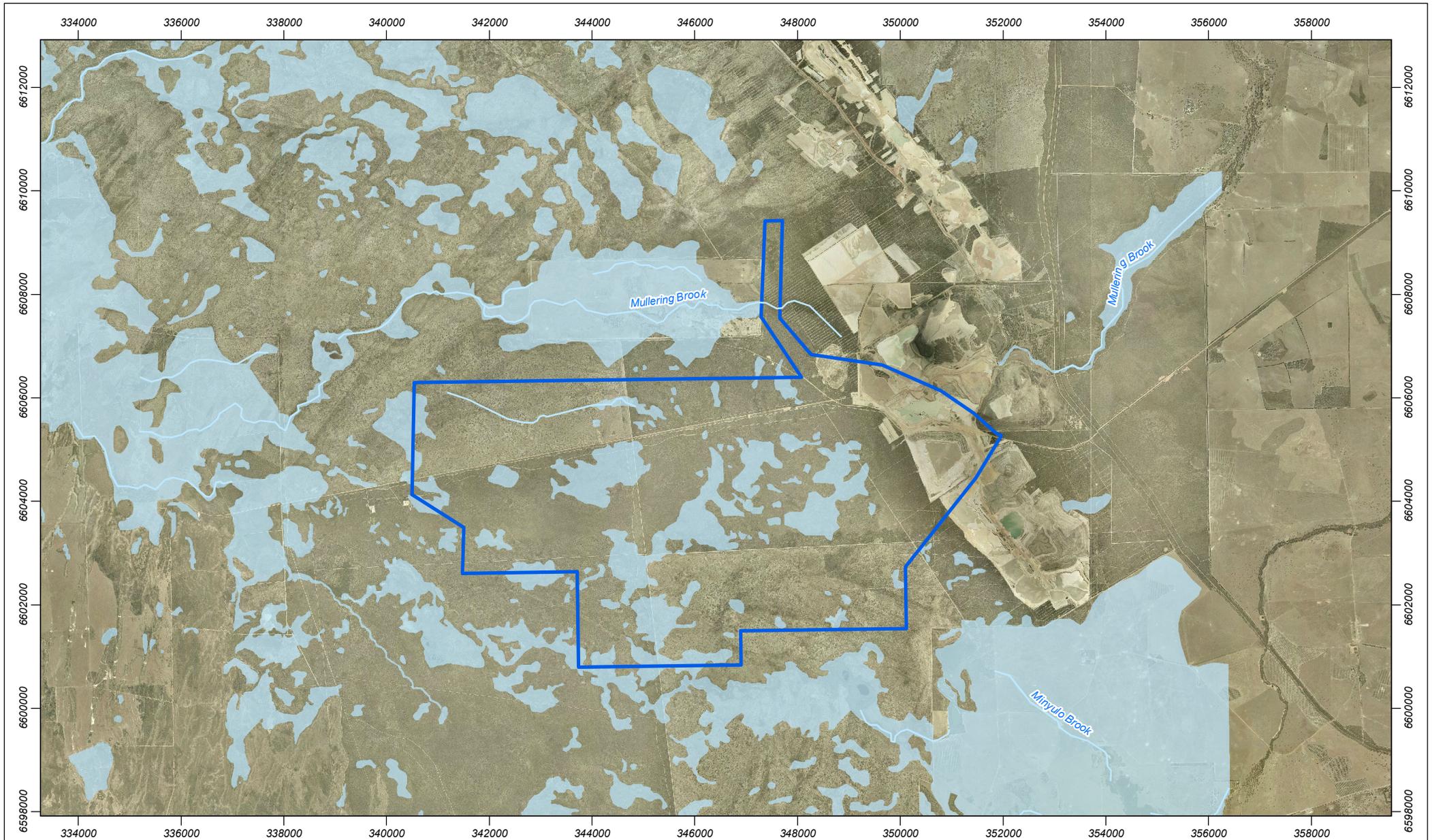
### 3.2.1 Vegetation and flora

The Proposal Area occurs within the Irwin Botanical District, within the Southwest Botanical Province (Beard 1990). Plants within this district are predominantly from the Proteaceae (*Grevillea*, *Banksia*), Myrtaceae (*Eucalyptus*, *Melaleuca*), Fabaceae (*Acacia*), Casuarinaceae (*Casuarina*, *Allocasuarina*), Chenopodiaceae (salt bushes), Poaceae (grasses) and annually, Asteraceae (daisies) families.

Shepherd et al. (2002) identified three vegetation associations within the Proposal Area as described in Table 4, which also presents the pre-European extent, current extent and reservation status of vegetation associations related to physiognomy in the Cooljarloo West Proposal Area.

Table 4 Vegetation associations in the Proposal Area.

Vegetation association	Description	Current extent (ha)	Percentage of pre-European extent remaining	Percentage held within IUCN Class reserves
129	Bare areas; drift sand	60 576	63.6	45.8
1026	Mosaic: shrublands; <i>Acacia rostellifera</i> , <i>A. cyclops</i> (in the south) & <i>Melaleuca cardiophylla</i> (in the north) thicket/ shrublands; <i>Acacia lasiocarpa</i> & <i>Melaleuca acerosa</i> heath	63 149	89.3	53.0
1030	Low woodland; <i>Banksia attenuata</i> & <i>B. menziesii</i>	91 250	65.6	14.6



**Figure 4 Surface water features and wetlands**

Scale 1:100,000 at A4  
 0 0.5 1 1.5 2 2.5 km  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 2/05/2013  
 Author: JCrute  
 Source: Rivers: Geoscience Australia 2012. All other data: Client 2011-2013.

- Legend**
-  Rivers
  -  Development Envelope
  -  Wetlands



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A total of 29 priority flora species and five threatened flora species were recorded within the Proposal Area between 2005 and 2009. The majority of these species are also present outside of the Proposal Area (Appendix 1). Table 5 lists all recorded threatened species and their frequency of occurrence within the Proposal Area.

Table 5 Threatened and priority flora species recorded in the Proposal Area

Species	Conservation status	No. of locations
<i>Andersonia gracilis</i>	T	>350
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	T	36
<i>Eremophila glabra</i> subsp. <i>chlorella</i>	T	3
<i>Eucalyptus johnsoniana</i> <sup>^</sup>	T	1
<i>Macarthuria keigheryi</i>	T	154

<sup>^</sup> Species occurrence may be erroneous.

A total of 22 vegetation communities have been mapped within the Study area (Woodman 2009) (Table 6) (Appendix 1), none of which are Threatened Ecological Communities. It is possible that a small number of the mapped vegetation communities could have a restricted distribution, which can only be determined after further research.

Table 6 Vegetation communities identified within the Study area

Community type	Community identifier	Description
Forest	F1	Low Forest of <i>Casuarina obesa</i> and <i>Melaleuca</i> spp. over scattered low shrubs on brown sandy loam on lower slopes and drainage flats
Woodland	W1	Low Woodland to Dense Low Forest of <i>Melaleuca raphiophylla</i> over Low Sedges on brown sand over clay in basins
	W2	Low Woodland to Low Forest of <i>Eucalyptus rudis</i> or <i>Corymbia calophylla</i> and <i>Melaleuca</i> spp. over Low Scrub or Scrub on grey or brown sand or clay on lower slopes, drainage lines and basins
	W3	Low Woodland to Low Forest of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> with occasional <i>Eucalyptus todtiana</i> over Heath dominated by <i>Eremaea pauciflora</i> and/or <i>Hibbertia hypericoides</i> on brown or grey sand on lower to midslopes
	W4	Open Low Woodland of <i>Banksia attenuata</i> , <i>Banksia menziesii</i> and <i>Melaleuca preissiana</i> over Low Heath on brown sand in swales and low rises
	W5	Low Woodland to Low Forest of <i>Banksia prionotes</i> over Low Scrub or Heath dominated by <i>Acacia spathulifolia</i> on brown over yellow sand on low rises
	W6	Low Woodland to Low Forest of <i>Banksia prionotes</i> and <i>Banksia attenuata</i> over Heath on yellow sand on upper slopes
	W7	Open Low Woodland of <i>Banksia ilicifolia</i> , <i>Banksia menziesii</i> and <i>Banksia attenuata</i> over Heath on brown sand on lower slopes
	W8	Woodland dominated by <i>Eucalyptus decipiens</i> subsp. <i>decipiens</i> over mixed shrubs and herbs on grey sand on lower slopes
Thicket	T1	Scrub to Thicket dominated by <i>Melaleuca lateriflora</i> subsp. <i>acutifolia</i> on brown or grey clay or loamy clay in basins
	T2	Thicket of <i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i> over Open Low Sedges on grey clay in basins
	T3	Scrub to Thicket dominated by <i>Acacia saligna</i> , <i>Viminaria juncea</i> and <i>Melaleuca raphiophylla</i> (stunted form) on grey or brown sand over clay on lower slopes, drainage lines and minor basins
	T4	Scrub to Thicket dominated by <i>Melaleuca raphiophylla</i> and <i>Melaleuca viminea</i> subsp. <i>viminea</i> on brown or grey sand over clay in basins
	T5	Thicket of <i>Melaleuca lateritia</i> and <i>Melaleuca teretifolia</i> over rushes and sedges on grey clay in a swamp
Heath	H1	Low Scrub to Heath dominated by <i>Melaleuca brevifolia</i> on brown sand over clay in drainage lines and basins

Community type	Community identifier	Description
	H2	Heath to Thicket of a mix of species including <i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i> , <i>Acacia cyclops</i> , <i>Melaleuca viminea</i> subsp. <i>viminea</i> and <i>Regelia ciliata</i> on brown or grey clay in basins
	H3	Heath to Thicket dominated by <i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i> or <i>Melaleuca systema</i> on yellow or white sand on dunes
	H4	Heath dominated by a mix of species including <i>Banksia telmatiaea</i> , <i>Regelia ciliata</i> and <i>Melaleuca seriata</i> with occasional Scrub or Open Scrub of <i>Hakea obliqua</i> subsp. <i>parviflora</i> on grey or brown sand on lower slopes, flats and drainage basins
	H5	Heath dominated by <i>Allocasuarina humilis</i> and <i>Melaleuca seriata</i> with emergent <i>Eucalyptus tottiana</i> and <i>Nuytsia floribunda</i> on brown sand on midslopes
	H6	Heath of <i>Allocasuarina microstachya</i> and <i>Banksia armata</i> var. <i>armata</i> on brown silty sand over laterite on low rises
	H7	Low Heath dominated by <i>Gastrolobium oxylobioides</i> and <i>Hakea</i> spp. on brown sand over laterite on midslopes and low rises
Samphire salt pan	S1	Samphire salt pans dominated by <i>Tecticornia indica</i> subsp. <i>bidens</i> and/or <i>Sarcocornia ?blackiana</i> on brown or grey clay in basins

Further details on vegetation and flora are detailed in Appendix 1.

### 3.2.2 Fauna

#### *Terrestrial fauna*

*Banksia* woodlands and heaths present within the Proposal Area provide suitable habitat for a range of terrestrial fauna. Terrestrial faunal studies have been conducted for Tronox in the Cooljarloo area since 1986. This has led to a substantial database being developed which has complemented recent terrestrial fauna surveys within the Proposal Area (Bamford 2010). Seven faunal habitat types have been identified within the Proposal Area (Bamford 2010):

1. *Banksia* low woodland on stabilised sand-dunes;
2. Scrub-heath on undulating sands;
3. Low heath on flats, clay-peat or calcareous soils over limestone (sensitive to hydrological changes);
4. Tall heath of flats (sensitive to hydrological changes);
5. Riparian woodland (very limited, sensitive to hydrological changes);
6. Samphire wetland (one location, very restricted, sensitive to hydrological changes); and
7. Riverine associations (sensitive to hydrological changes).

Faunal surveys conducted by Bamford Ecological Consultants have recorded 197 vertebrate fauna within the Proposal Area. Table 7 summarises the results from these surveys.

Table 7 Summary of vertebrate fauna survey results (Bamford 2010)

Taxon	Number of species expected	Number of species recorded	Number of conservation significant fauna recorded
Fish	5	5	2
Frogs	11	10	1
Reptiles	56	45	
Birds	157	127	12
Mammals	24	20	3
<b>Total</b>	<b>253</b>	<b>197</b>	<b>18</b>

The faunal assemblage from this survey is typical of the northern Swan Coastal Plain assemblage (Kitchener *et al.* 1978) with distinct influences of wetland areas. Conservation significant fauna recorded within the Proposal Area can also be found outside of the area, especially those of the avian variety, which tend to be migratory birds in most cases (Bamford 2010).

Further description of fauna identified during investigations within the Proposal Area are provided in Appendix 2.

### *Short range endemic invertebrate fauna*

Short range endemic invertebrate fauna (SREs) are rare within the Proposal Area. Surveys conducted by Bamford Ecological Consultants have not recorded any SREs that are expected to occur in the area (Bamford 2010). A small number of SRE millipedes have been recorded in the areas surrounding the Proposal Area, but none have been recorded within the Proposal Area. While there appears to be suitable habitat for SREs within the Proposal Area, the physical and biological landscape does not contain any relictual or discontinuous habitats that are normally associated with SRE invertebrates (Harvey 2002; Bennelongia 2012a).

### *Subterranean fauna*

Desktop surveys by Bennelongia Environmental Consultants have identified potential stygofauna habitats within the Proposal Area (Bennelongia 2012b). It is expected that stygofauna will most likely occur in fissures in the superficial aquifer underlying the Proposal Area. There are at least five species of stygofauna expected to occur within a 50 km x 50 km area surrounding the Proposal Area, which reflects the low level of survey intensity in the region. Troglifauna are considered unlikely to occur within the Proposal Area due to the high watertable and lack of air spaces associated with the soils of the area. Furthermore, over 92% of troglifauna specimens from the surrounding region have all been collected from caves, which do not occur within the Proposal Area (Bennelongia 2012b)

## 3.3 Wetlands and groundwater dependent ecosystems

### 3.3.1 Wetlands

Wetlands within the Proposal Area have been described on a broad scale by Semeniuk Research Group (1994). These wetlands form an element of the Minyulo Suite, which are a group of consanguineous wetlands comprising Mullering and Minyulo brooks, Emu Lakes and smaller sumplands, damplands and seasonal creeks located between brooks within the Bassendean dunes (Figure 5). Typical surface water within this suite ranges from fresh to hyposaline with pH ranging from 6.9–10. Mullering and Minyulo brooks are both regionally significant as they support a high proportion of water dependent flora and act as a flushing mechanism for associated wetlands (Semeniuk Research Group 1994). Wetlands within the Proposal Area can be highly variable in terms of appearance and composition. Woodman (2009) identified multiple wetland vegetation communities within the Proposal Area that are associated with the complex soils and stratigraphy of the region.

### 3.3.2 Groundwater dependent ecosystems

Limited numbers of studies focussing on groundwater dependent ecosystems (GDEs) have been conducted within the region surrounding the Proposal Area. As a result, the closest known GDE to the Proposal Area is located 800 m to the east of the boundary of tenement E70/2345 (Rutherford *et al.* 2005). This GDE is known as Site 76: Cooljarloo Spring which comprises Guildford Sands and alluvium associated with a shallow watertable.

*Banksia* woodlands, which factor prominently within the Proposal Area, have been the subject of several studies that have assessed the groundwater dependence of composite species (Groom et al. 2001; Zencich et al. 2002; Canham 2011). Froend and Sommer (2010) have shown that the health and abundance of *Banksia* woodland species with shallow depth to groundwater decrease with declining water tables. None of these studies were conducted within the Proposal Area, which highlights the need for more detailed investigations within the area.

### 3.4 Social environment

The Proposal is located within the Shire of Dandaragan (Wheatbelt region), 30 km from the town of Dandaragan. The majority of the local population is employed in agriculture and fishing industries in the region.

#### 3.4.1 Aboriginal and European heritage

The sandplain between Moore River and Hill River was populated by pre contact Yued People. In the proximity of Minyulo Brook alone, there are twenty registered Aboriginal sites. Minyulo Brook itself has mythological significance because of its associations with the Waugal creation myth (de Gand 2010).

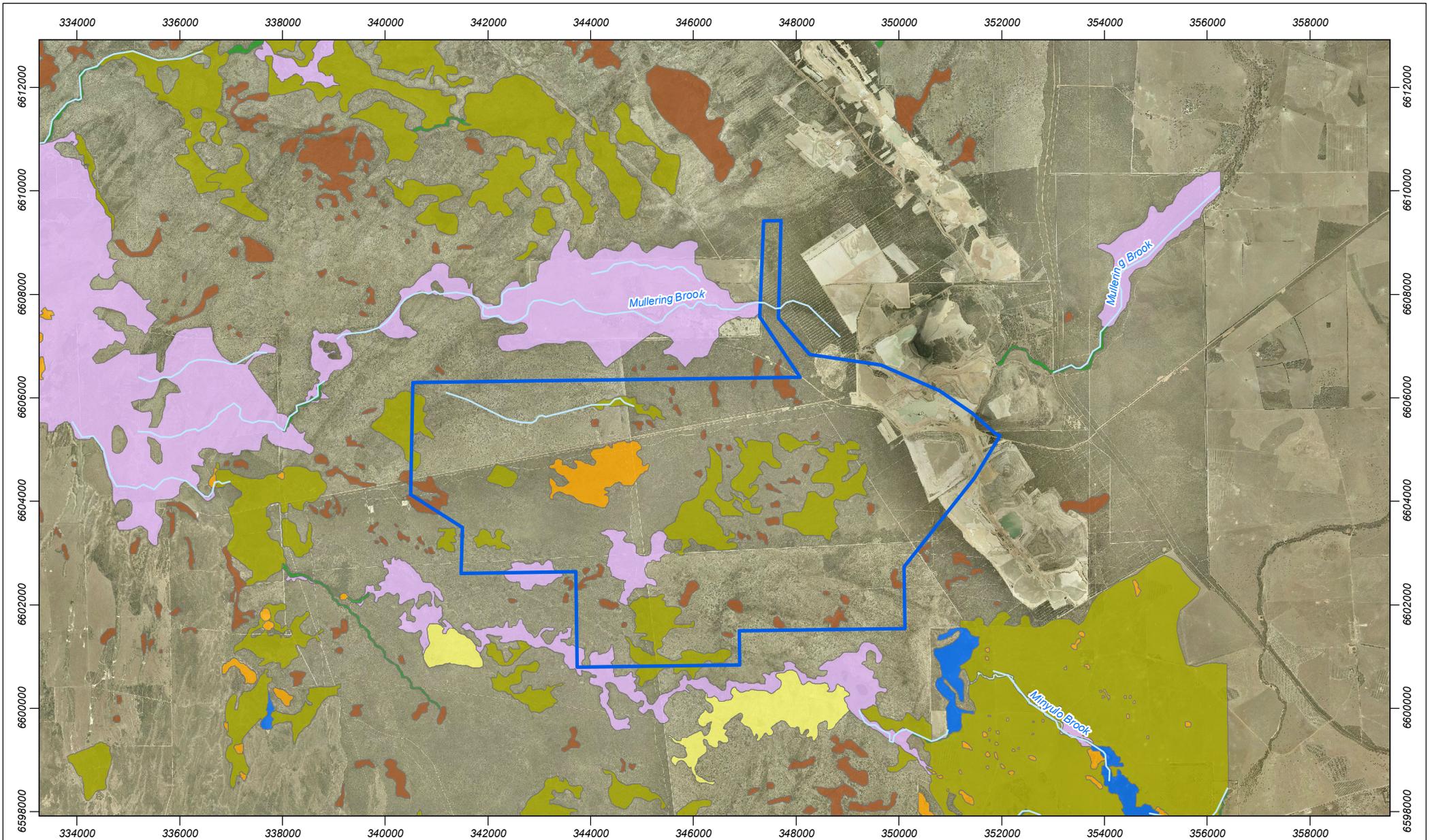
Significant Aboriginal heritage sites in the Proposal Area and surrounds include (Figure 2):

- Muduldu Myer (Site ID 24662) – 50 by 50 m area with artefact scatter of chert cutting stones, and igneous and limestone grindstones.
- *Yuccan Djoorly* (aka Prickle Lake) (Site ID 19735) – ceremonial site where turtles frequent which forms important food source for the *Yeud*.
- *Dwert Djoorly* (aka Dog Hole) (Site ID 19736) – ceremonial site where dingoes frequent, and which is an important food source for the *Yeud*.

Recent ethnographic and archaeological surveys that have been undertaken in the area have not identified any additional significant sites.

#### 3.4.2 European heritage

One Commonwealth Heritage property was identified by a search of the EPBC Act Protected Matters search database: the Lancelin Defence Training Area (DSEWPaC 2012a). This property is situated on Mimegarra Rd, Lancelin (DSEWPaC 2012b), approximately 25 km north of Lancelin township and 11 km south of the southern extent of the Proposal Area.



**Figure 5 Geomorphic wetlands**

Scale 1:100,000 at A4  
 0 0.5 1 1.5 2 2.5 km  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 2/05/2013  
 Author: JCrute  
 Source: Rivers: Geoscience Australia 2012. All other data: Client 2011-2013.

**Legend**

- |                      |                               |            |            |
|----------------------|-------------------------------|------------|------------|
| Rivers               | <b>Wetland Classification</b> | Dampland   | Palusplain |
| Development Envelope | Barlkarra                     | Floodplain | River      |
|                      | Creek                         | Lake       | Sumpland   |



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## 4. Community and other stakeholder consultation program

Stakeholders, identified through ongoing experience with existing mineral sands mining operations, are listed below:

### *Government Agencies*

- Office of the Environmental Protection Authority (OEPA)
- Department of Environment and Conservation (DEC)
- Department of Sustainability, Environment, Water, Population and Communities (SEWPaC, formerly Department of Environment, Water, Heritage and Arts)
- Department of Water (DoW)
- Department of State Development (DSD)
- Department of Mines and Petroleum (DMP)
- Department of Planning (DoP, formerly Department of Planning and Infrastructure)
- Department of Regional Development and Lands (RDL)
- Department of Indigenous Affairs (DIA)
- Department of Health (DoH)
- Department of Agriculture and Food (DAF)
- Main Roads Western Australia
- Western Power
- Mineral Sands Agreement Rehabilitation Coordination Committee (MSARCC)
- Shire of Dandaragan.

### *Non-government agencies*

- Conservation Council WA
- Iluka Resources
- Wildflower Society of Western Australia.

### *Community*

- Yued Group (Native Title Claimants)
- neighbouring landowners
- Cataby/Cooljarloo community
- apiarists
- wildflower pickers.

Tronox will continue to consult with specific agencies as required throughout the assessment process for the Proposal (and lifetime of the project). Consultation with the Yued Group will also be ongoing throughout the assessment process (and the lifetime of the project).

## 5. Potential environmental impacts and management

The PER will contain an assessment of the environmental factors with potential to be affected by the Proposal, in terms of the aspects of the Proposal with potential to cause environmental impact, and the management measures proposed to mitigate those impacts. A preliminary risk analysis of the Proposal has identified the key and other environmental factors expected to require addressing in the PER, as set out in the following section. These factors are suggested as the factors to be identified in the ESD to be prepared following determination of the level of assessment.

### 5.1 Key environmental factors

Based on an analysis of the aspects and potential impacts of the Proposal, the following environmental factors were assessed as being of sufficient significance to be considered key factors:

- groundwater
- surface water (wetlands and watercourses)
- vegetation and flora
- terrestrial fauna
- subterranean fauna
- mine closure.

The aspects and impacts associated with each of these factors are discussed in the following sections.

#### 5.1.1 Groundwater

The following aspects and associated environmental impacts are relevant to groundwater:

1. **Excavation and dredge mining:** may alter groundwater levels and flow, potentially affecting GDEs. Groundwater may also be saline and/or sodic which may result in contamination of surface water and/or perched groundwater. Potential acid sulphate soils (PASS) may be exposed to oxygen, potentially affecting groundwater quality, with consequent impacts on GDEs.
2. **Abstraction of groundwater:** on-site water supply has the potential to affect GDEs and other groundwater users in the area through drawdown. Potential acid sulphate soils (PASS) may be exposed to oxygen, potentially affecting groundwater quality, with consequent impacts on GDEs.
3. **Hydrocarbon spills:** have the potential to affect groundwater quality.

#### 5.1.2 Surface water (wetlands and watercourses)

The following aspects and associated environmental impacts are relevant to wetlands and/or watercourses:

1. **Excavation and dredge mining:** will intersect the watertable and potentially obstruct surface water flows which may alter groundwater levels as well as surface and subsurface flows to wetlands and/or watercourses. Excavation and dredge mining may also be required within wetland boundaries.
2. **Runoff from disturbed areas and overburden dumps:** may result in increased sediment transport to wetlands and/or watercourses.
3. **Re-alignment of Mullering Brook:** may affect surface water values and associated habitats.

### 5.1.3 Vegetation and flora

The following aspects and associated environmental impacts are relevant to vegetation and flora:

1. **Clearing of vegetation:** will directly reduce the extent of vegetation communities, including vegetation communities of local conservation significance and conservation significant flora species.
2. **Excavation, dredge mining and abstraction of water:** will alter groundwater levels, which may affect groundwater dependent vegetation.
3. **Vehicle movements and earthworks:** may spread weeds and dieback and increase bushfire risk.
4. **Dust generation:** due to earthworks, mining and vehicle movements has the potential to smother vegetation.

### 5.1.4 Terrestrial fauna

The following aspects and associated environmental impacts are relevant to terrestrial fauna:

1. **Clearing of vegetation:** will directly disturb fauna habitat and may result in the loss of individual terrestrial fauna.
2. **Excavation, dredge mining and abstraction of water:** will alter groundwater levels which may affect groundwater dependent vegetation which constitutes habitat for fauna
3. **Vehicle movements:** may result in the injury or fatality of individual terrestrial fauna, especially less mobile species.
4. **Human activities:** may cause and increase in introduced predator species populations (i.e. foxes and cats).

### 5.1.5 Subterranean fauna

The following aspects and associated environmental impacts are relevant to subterranean fauna:

1. **Mining excavations:** may remove potential subterranean fauna habitat and has the potential to result in the associated loss of individual fauna.
2. **Excavation, dredge mining and abstraction of water:** will alter groundwater levels which may reduce the extent of stygofauna habitat and has the potential to result in individual losses of fauna as well as population fragmentation.
3. **Hydrocarbon spills:** have the potential to degrade the habitat for subterranean fauna through surface and/or groundwater contamination.

### 5.1.6 Mine closure

Unsuitable reconstruction of landforms post-closure could result in ongoing erosion and an inappropriate soil profile. This may prevent the establishment of biological ecosystems, pose contamination hazards and affect end land uses.

## 5.2 Other environmental factors

The other relevant environmental factors requiring consideration in an EIA are:

- air quality (dust)
- dieback mapping and management
- visual amenity.

### 5.3 Summary of likely environmental control instruments

A number of statutory instruments are relevant to the regulatory controls of environmental impacts associated with this Proposal. Table 8 outlines the controls that either currently exist or are anticipated to be put in place to govern the management of the Proposal for each environmental factor. The controls include:

- potential implementation conditions as per any Ministerial Statement
- requirements of the Tronox EMP or Closure Plan
- conditions of the DEC (Environmental Management Division) Works Approval (under Part V of the EP Act) for construction of works on prescribed premises
- conditions of the DEC (Environmental Management Division) Licence (under Part V of the EP Act) for the operation of activities on prescribed premises (ore processing, landfill and sewage facility)
- conditions of the Licences to 'Take Water' (under *Rights in Water and Irrigation Act 1914* (WA))
- conditions/requirements of any other relevant legislation and regulations.
- relevant Tronox standards and guidelines.

Table 8 Statutory and environmental management controls for the Proposal

Factor	Topic	Potential Statement Conditions (Part IV)	Works Approval/ Licence (Part V)	Mining Proposal / Tenement Conditions (Mining Act)	Other relevant legislation and regulations
Key environmental factors					
Groundwater	Excavation and dredge mining.			✓	
	Abstraction of groundwater				✓ Licence under RIWI Act
	Control of drawdown/mounding impacts	✓			
	Operation of tailing facility.			✓	
	Hydrocarbons		✓		
Surface water (wetlands and watercourses)	Excavation and dredge mining	✓			✓ Licence under RIWI Act
	Runoff from disturbed areas and overburden dumps				
	Interaction with Mullering Brook		✓		
Vegetation and flora	Clearing of vegetation	✓			✓ Wildlife Conservation Act & EPBC Act
	Control of drawdown/mounding impacts	✓			
	Hygiene management			✓	
	Dust generation		✓		
Terrestrial fauna	Clearing of vegetation:	✓			✓ Wildlife Conservation Act & EPBC Act
	Vehicle movements				
	Human activities				
Subterranean fauna	Excavation, dredge mining and abstraction of water	✓			

Factor	Topic	Potential Statement Conditions (Part IV)	Works Approval/ Licence (Part V)	Mining Proposal / Tenement Conditions (Mining Act)	Other relevant legislation and regulations
	Hydrocarbon spills		✓		
Closure	Decommissioning, decontamination/remediation, and rehabilitation			✓	
Other environmental factors					
Noise	Emissions of noise		✓		
Dust and air emissions	Dust generation		✓		
Greenhouse gases	Emissions reduction				✓ NGER Act, Clean Energy Act, EEO Act
	Reporting				✓ NGER Act, Clean Energy Act, EEO Act
Radiation	Radiation emissions		✓		✓ Mines Safety and Inspection Act
Indigenous heritage	Disturbance of indigenous heritage sites				✓ Aboriginal Heritage Act Heritage Protection agreements
Acid sulfate soils	Exposure of acid sulfate soils			✓	✓ Contaminated Sites Act
Non-mineral waste	Liquid waste (including sewage)		✓		✓ Health Act
	Solid waste disposal (landfill)		✓		✓ Health Act
Fire	Fire outbreaks				

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## List of Appendices

The following appendices are found on CD-ROM inside the back cover of this report

### Appendix 1: Flora and vegetation survey 2009

- *Cooljarloo West Project Area Flora and Vegetation Assessment, report* prepared for Tiwest Pty Ltd, 2009. (Woodman Environmental Consulting 2009).

### Appendix 2: Terrestrial fauna studies at Cooljarloo West 2010

- *Fauna Values of Tiwest's Cooljarloo West Project Area, report* prepared for Tiwest Pty Ltd, 2010. (Bamford Consulting Ecologists 2010).