RioTinto

Mesa H
Visual Impact Assessment

	Name	Signature	Date
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Summary

The Rio Tinto Iron Ore GIS Team conducted the Visual Impact Assessment (VIA) for the proposed Mesa H Iron Ore Mine, located approximately 18km west of Pannawonica. Field work was undertaken in July and August of 2016 and the assessment was undertaken as part of the environmental impact assessment for the Proposed Mesa H Iron Ore Project.

The VIA was conducted in three phases:

- Desktop Assessment (Analysis)
- Field Assessment (Photo Locations)
- Visual Impact (Photo Montage)

Results show present, operational and closure photo montages to illustrate the indicative visual impact of the proposed operations at Mesa H.

Introduction

This report outlines the Mesa H VIA scope, methodology and results. The GIS Team was engaged to prepare a VIA report, which was developed in conjunction with several other environmental studies and reports to provide an overview of the likely impacts.

1.1 Objective & Scope

The overall objective was to assess the visual impact of the proposed mining operations at Mesa H and illustrate these impacts through photo montages. The key objectives were to:

- Analyse landscape within the development area
- Identify points of interest where potential impact may occur
- Conduct field trip to identified points to photograph
- Illustrate potential visual amenity impacts of mining stages through photo montages

1.3 Study Area

Mesa H is located approximately 18km west of Pannawonica and is adjacent to the existing Mesa J Mine (refer Figure 1).

The Pannawonica Access Road runs to the north Mesa H project area and provides access tracks to the area. This road is sealed and is the main access road to the town of Pannawonnica.

The Robe River lies immediately north and west of the project area, and Jimmawurrada Creek to the east of the project area (refer Figure 2).

1.4 Regulatory Context

The following regulatory documents and relevant sections within them were consulted as part of this work to provide context and guidance on completing a Visual Impact Assessment.

Environmental Projection Authority (EPA) and the Environmental Protection Act 1986
Amenity: “To ensure that impacts to amenity are reduced as low as reasonably practicable”.

The Western Australian Planning Commission’s (WAPC) State Planning Policy No. 2:
Environment and Natural Resource Policy for Western Australia (WAPC 2003)
“consider the need for a landscape or visual impact assessment for development proposals that may impact upon sensitive landscapes”.

The WAPC’s Pilbara Planning and Infrastructure Framework (WAPC 2012)
“protect and manage the region’s cultural heritage, arts including indigenous significant places, and landscapes of significance”.

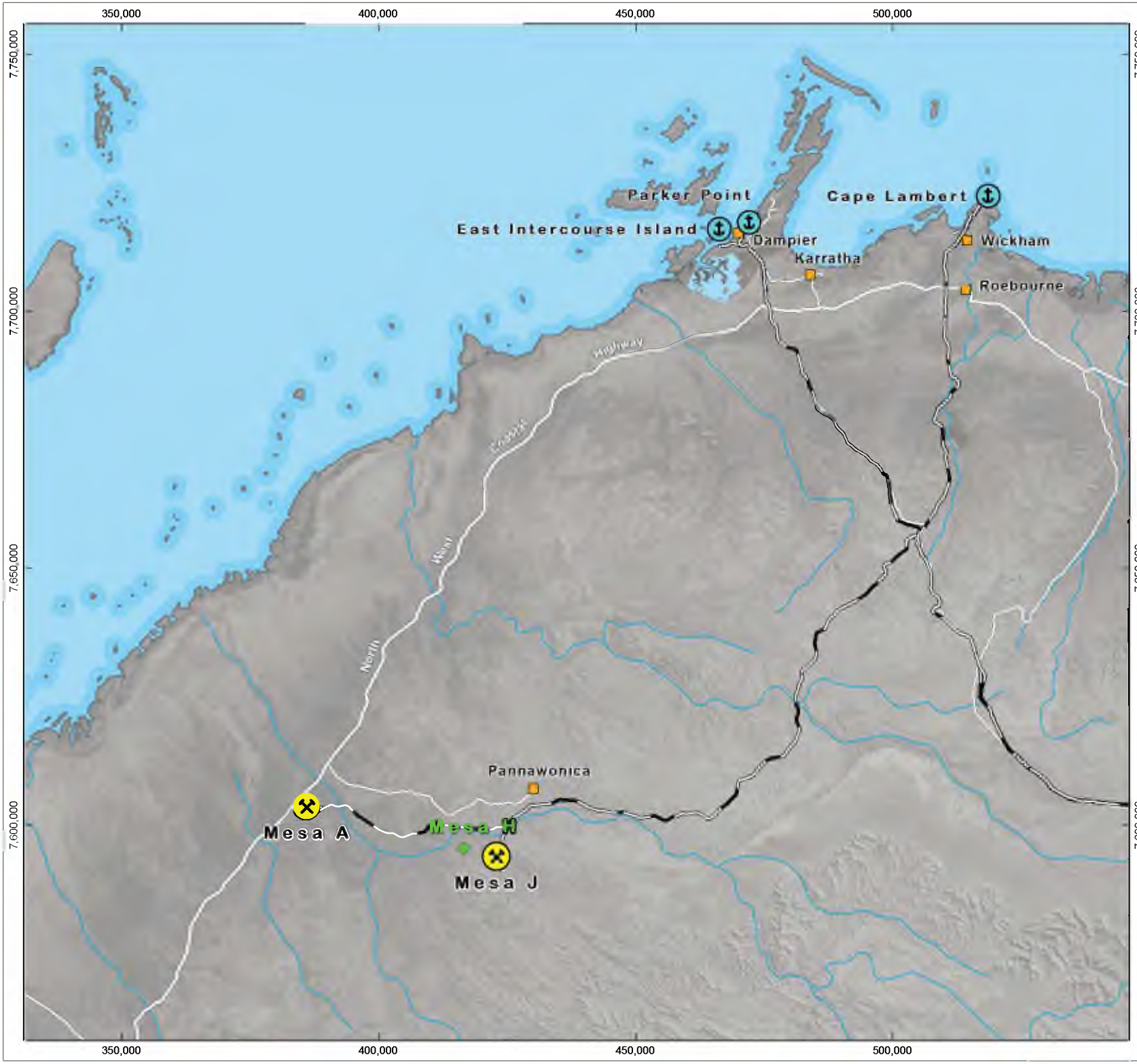

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Figure 1

Regional Location of Mesa H

Drawn: T.Linklater
Plan: PDE0155371v1
Date: April 2018

Proj: GDA 1994 MGA Zone 50
Scale: 1:1,000,000 @ A4
gisteam@riotinto.com

Legend

- Mesa H
- Rio Tinto Mine
- Rio Tinto Port
- Town
- Rio Tinto Railway
- Highway
- Major Road
- Major Rivers

0 10 20 30 40 50
Kilometers

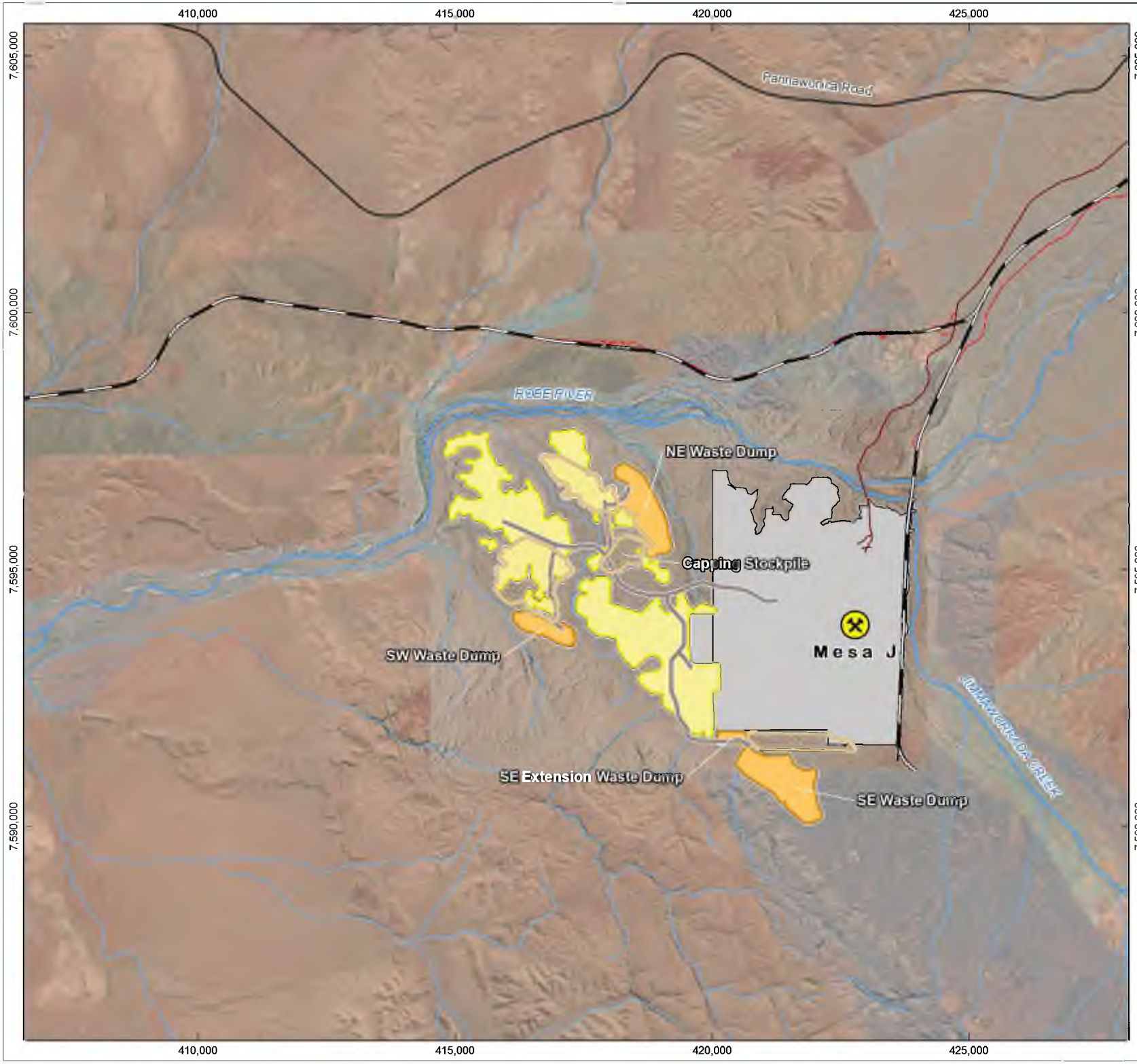

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Figure 2

Project Layout of Mesa H

Drawn: T.Linklater
Plan: PDE0155371v1
Date: July 2018

Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @ A4
gisteam@riotinto.com

Legend

- Rio Tinto Mine
- Current Mesa J Mine
- Rio Tinto Railway
- Major Road
- Site Road
- Rail Access Road
- Robe River
- Creek

Proposed Mine Layout

- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road

0 1 2 3 4 5
Kilometers

Methodology

The methodology used to assess the impact to the landscape and visual amenity was conducted in three phases. This process included the following:

2.1 Desktop Assessment

The aim the desktop assessment was to produce a terrain model of the study area with the proposed infrastructure overlaid. This model was then used to conduct a viewshed analysis using the proposed infrastructure to identify potential visual impacts across the model domain. The viewshed analysis output was then combined with existing spatial data such as heritage, environment and cadastral layers to guide the selection of locations for capture of images.

Viewshed Analysis

To perform the viewshed analysis, the ArcGIS Viewshed tool within ArcMap was used. This tool can be found under Spatial Analyst > Surface > Viewshed within the Arc Toolbox.

A viewshed analysis identifies cells within a raster image (ASCII terrain model) that can be seen from any number of observer points or lines (infrastructure polylines). The identified cells are given a value of 1 for visible or 0 for not visible. This project had more than one observer point so more than 20 values have been entered. The viewshed analysis provides the starting point for all further visual impact assessment work.

The study area terrain model was created from LiDAR data and the proposed infrastructure data in Global Mapper and loaded into ArcGIS in ASCII format.

Figure 03: Viewshed Analysis Control Factors

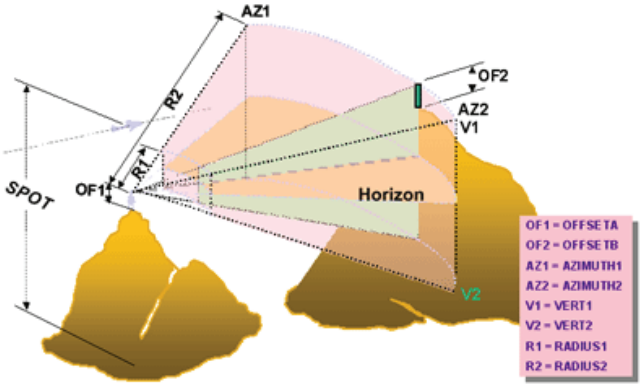
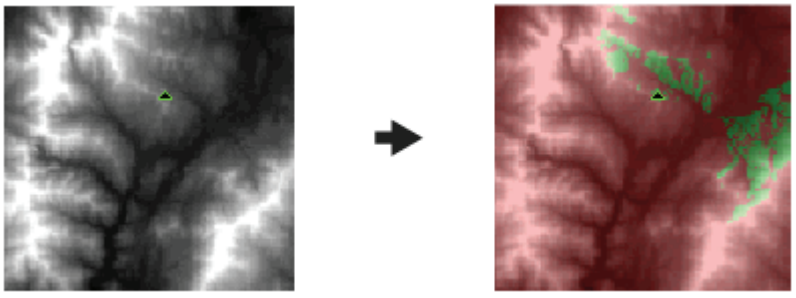


Figure 04: Viewshed Analysis Input vs Output



Input Surface with Observer Point

Output Viewshed

Output

The viewshed analysis output was then used to create a cartographic map for the study team to easily identify potential visual impacts and help determine the locations for capture of photographs.

Photo Location Selection

The study team consisted of Studies, Environment, Closure, Heritage and GIS. All teams worked together with GIS to identify and select locations for capture of images. Locations for the capture of images were selected based upon:

- proximity to significant heritage or environmental values
- line of sight to significant heritage or environmental values
- proximity to areas with public access

Traditional owner consultation was also undertaken to identify significant sites around the study area. Once all locations were selected, a field trip assessment was planned and undertaken over three days within the study area.

2.2 Field Assessment

A field assessment was conducted to capture data and photographs from selected locations around the study area, with the photographic views focusing on the proposed infrastructure such as dumps and stockpiles. Comprehensive data collection was undertaken at each location to allow for photo montages to be produced in the next phase.

Tools used in field work

Canon Digital Camera EOS 200 D
Accessories: Tripod, Stabiliser, Compass, Measuring Tape
ArcGIS Collector App (IOS Iphone)
Magellan GPS Unit
Paperwork (manual field notes)

Field Trip

Field work was undertaken in conjunction with another Rio Tinto project for the purpose of Visual Impact Assessment, this occurred in November 2017.

At each photograph location, assessment was made on the ground for accessibility and view aspect, which resulted in minor changes to photograph locations to ones agreed upon in desktop assessment. Once location and direction of photo was agreed, 3 photos of the same view were taken to reduce the risk of poor photo clarity and recorded both manually and digitally.

Data Collection

The data shown in Table 1 were collected from each photograph location to assist in the next phase of the assessment.

Table 1 - Data collected at each photograph location

Site No. and Name	Identified in desktop assessment
Date/Time	Date and time of day
Photo Number	Unique photo number as multiple taken from each point
GPS Co-ordinates	Actual photo location for GPS unit
Bearing	Direction of the photo with the aid of compass
Camera Height	Height of the camera from ground level
Atmospheric Conditions	Weather and lighting
Description of View	Vegetation cover and infrastructure within the area
Comments	Additional detail

Field Photos Review

Once field work was complete, the study team reviewed the adjusted photograph locations and selected photos that would best illustrate the potential visual impact.

2.3 Visual Impact Assessment process

Photo montages were generated from the photographs selected to best illustrate the potential visual impact of the proposed development. Generation of the photo montages involved a multistep process of data creation, view setup, image rendering, output and final mock up. Software required for this process were; Global Mapper, Microstation V8i, ArcGIS Desktop, Adobe Photoshop and Adobe InDesign.

The following sections outline the process to create the final photo montage showing the current view, operational view and closure view along with any relevant supporting data.

Data

The terrain model created desktop assessment was used in the final phase to create surface features, for the purpose of lining up these features in the montage view.

The first feature captured was the bearing of the photo point (field data collection); then a 3D profile of the surface along the bearing alignment was created in 3D DXF line format (see Figure 05 & 06). Additionally, landmark topography in each photo was captured from the terrain model in 3D Mesh DXF format to assist in the final alignment. All photos required the bearing and at least two 3D Mesh DXF models to successfully line up the photo.

Figure 05: Global Mapper Model Bearing

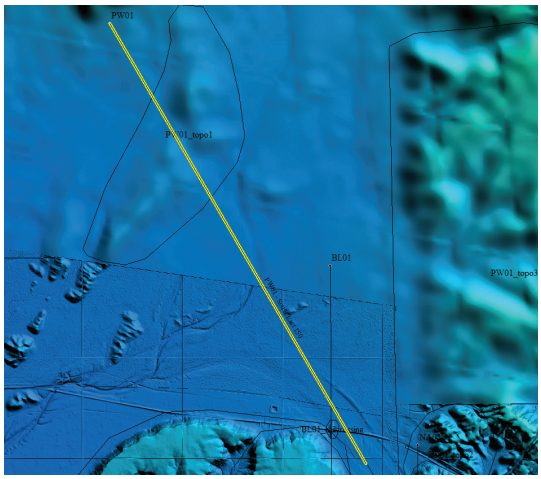
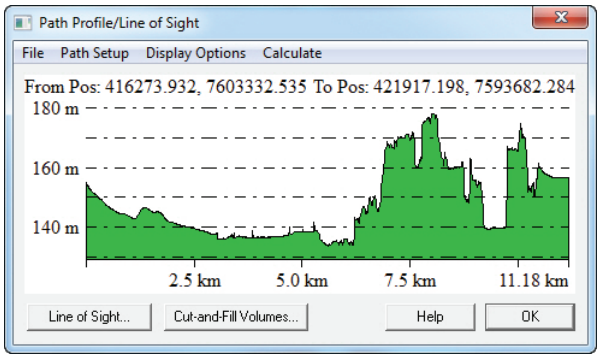


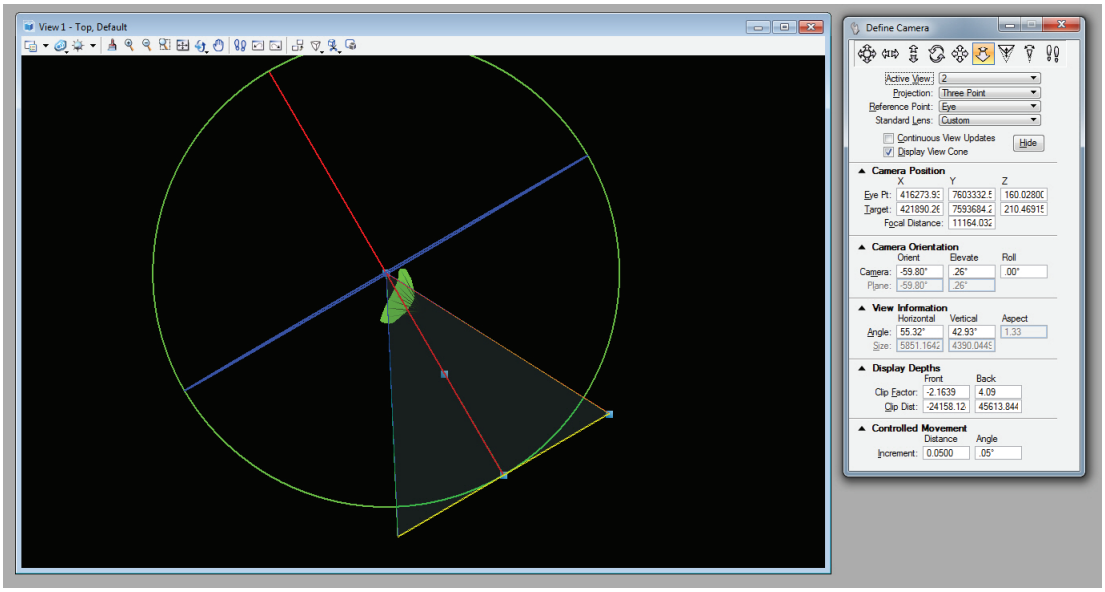
Figure 06: Global Mapper Model 3D Profile



Montage Setup

Once data were captured in Global Mapper, a montage was created in Microstation. The photo size was kept proportional to actual size, then a view was created in the image by using the Define Camera alignment tools in the construction view (see Figure 07).

Figure 07: Microstation Construction View and Camera Define Tools



The Define Camera alignment tools allowed the montage view to be altered by units distance and degrees in all directions which gave more control to exactly line up features in the image.

Figure 08: Montage View - after alignment completed

Montage Rendering

The next step was to add the proposed infrastructure to the montage view in Microstation, these data were provided from the Mine Planning Engineers and converted to 3D Mesh DXF. The rendering tool was then applied to convert the proposed infrastructure line strings to surface areas (see Figure 09). The image was then exported from Microstation to a JPG format.

Figure 09: Rendered View

Montage Output

To create the final image, the original photo was loaded into Adobe Photoshop and the rendered image from Microstation was overlaid to show the location of the proposed infrastructure. A realistic texture (of proposed infrastructure) was then placed under the original image and parts of the image were erased to expose texture in the proposed infrastructure location (See Figure 10). The final image was then exported from Adobe Photoshop to JPG format. A closure version was also created to show rehabilitated infrastructure.

Figure 10: Texture Exposed on Original Image in Adobe Photoshop

Final Mock Up

The Current View, Operations View, Closure View were then combined into the final mock up in Adobe InDesign with location map and photo location details as the final output for the Visual Impact Assessment.

Results

The results section outlines a description of the maps and figures produced during the Visual Impact Assessment. The final output produced 15 figures showing the potential visual impact of the Mesa H mine development.

3.1 Desktop Assessment

The desktop assessment resulted in the output maps of the Planned Photo Locations and Viewshed Analysis. These assisted the team into the second phase of the Visual Impact Assessment.

Figure 11 - Planned Photo Locations

Figure 12 - Viewshed Analysis - Map shows the blue shaded area shows all locations where any component of the Mesa H mine development may be visible based on the topography of the area and the dimensions of the proposed infrastructure.

3.2 Field Assessment

Sites with the greatest potential for visual impact and sites of interest were selected from the view shed analysis for field assessment. The field assessment resulted in a map of actual photo locations taken on the ground. These altered slightly from planned location in some cases due to access or view aspect. This data was used in the final phase of the Visual Impact Assessment.

Figure 13 - Actual Photo Locations

3.3 Visual Impact

The final output from this assessment was to show the visual impact of the Mesa H mine development, the following figures outline how each view will be impacted visually.

Figure 14 - BL01

Figure 15 - Jimmawurrada Creek

Figure 16 - Mesa H

Figure 17 - Mesa H

Figure 18 - Northern Access

Figure 19 - Pannawonnica Road

Figure 20 - Robe River

Figure 21 - Robe River

Figure 22 - Robe River

Figure 23 - Robe River

Figure 24 - Robe River

Figure 25 - Robe River

Figure 26 - Robe River

Figure 27 - Robe River

Figure 28 - Six Mile Well

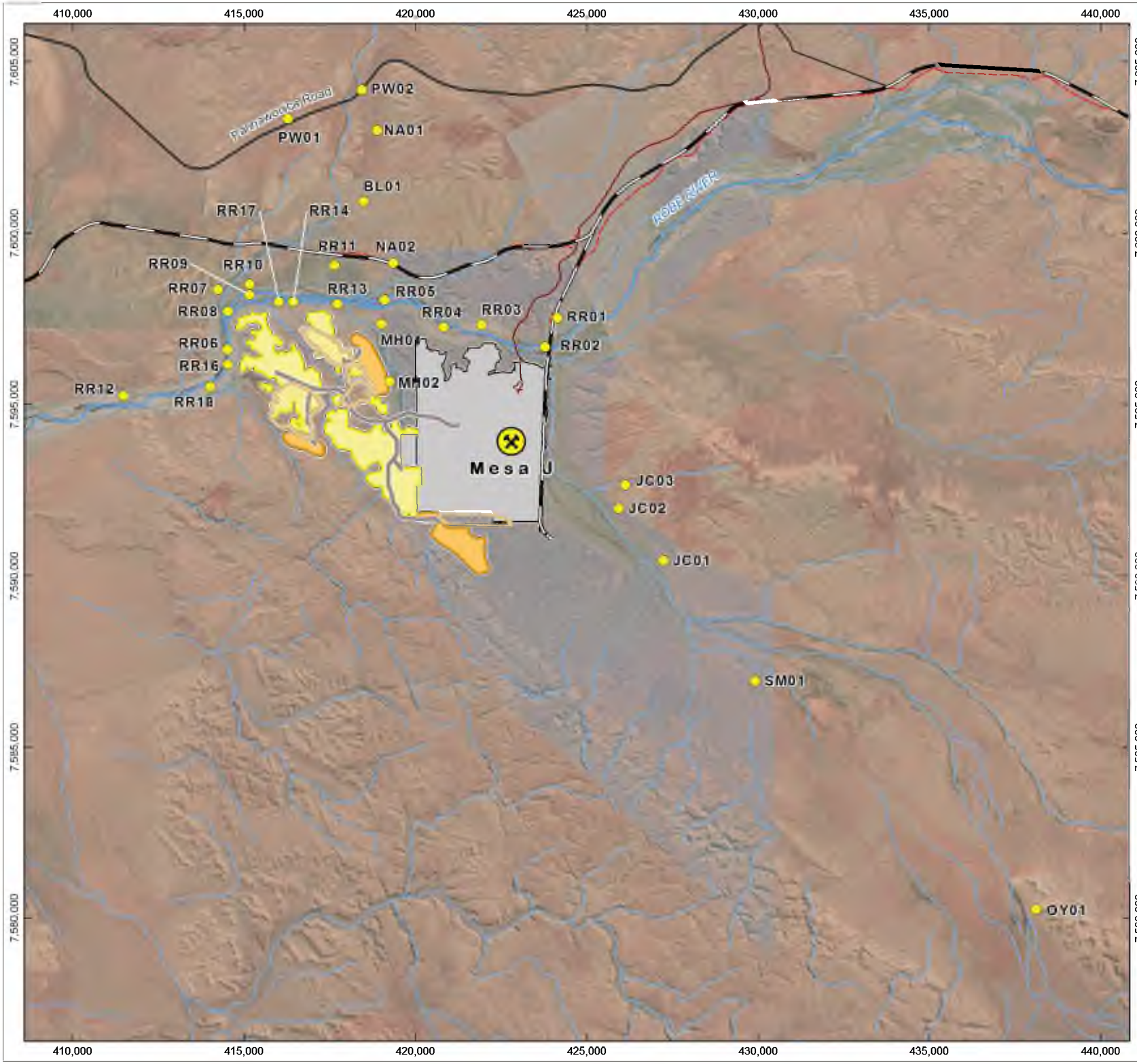


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Figure 11

Proposed Photo Locations

Drawn: T.Linklater
Plan: PDE0155371v1
Date: April 2018

Proj: GDA 1994 MGA Zone 50
Scale: 1:150,000 @ A4
gisteam@riotinto.com

Legend

- Proposed Photo Locations
- Rio Tinto Mine
- Current Mesa J Mine
- Rio Tinto Railway
- Major Road
- Minor Road
- Site Road
- Rail Access Road
- Robe River
- Creek

Proposed Mine Layout

- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road

N

0 2 4 6 8
Kilometers

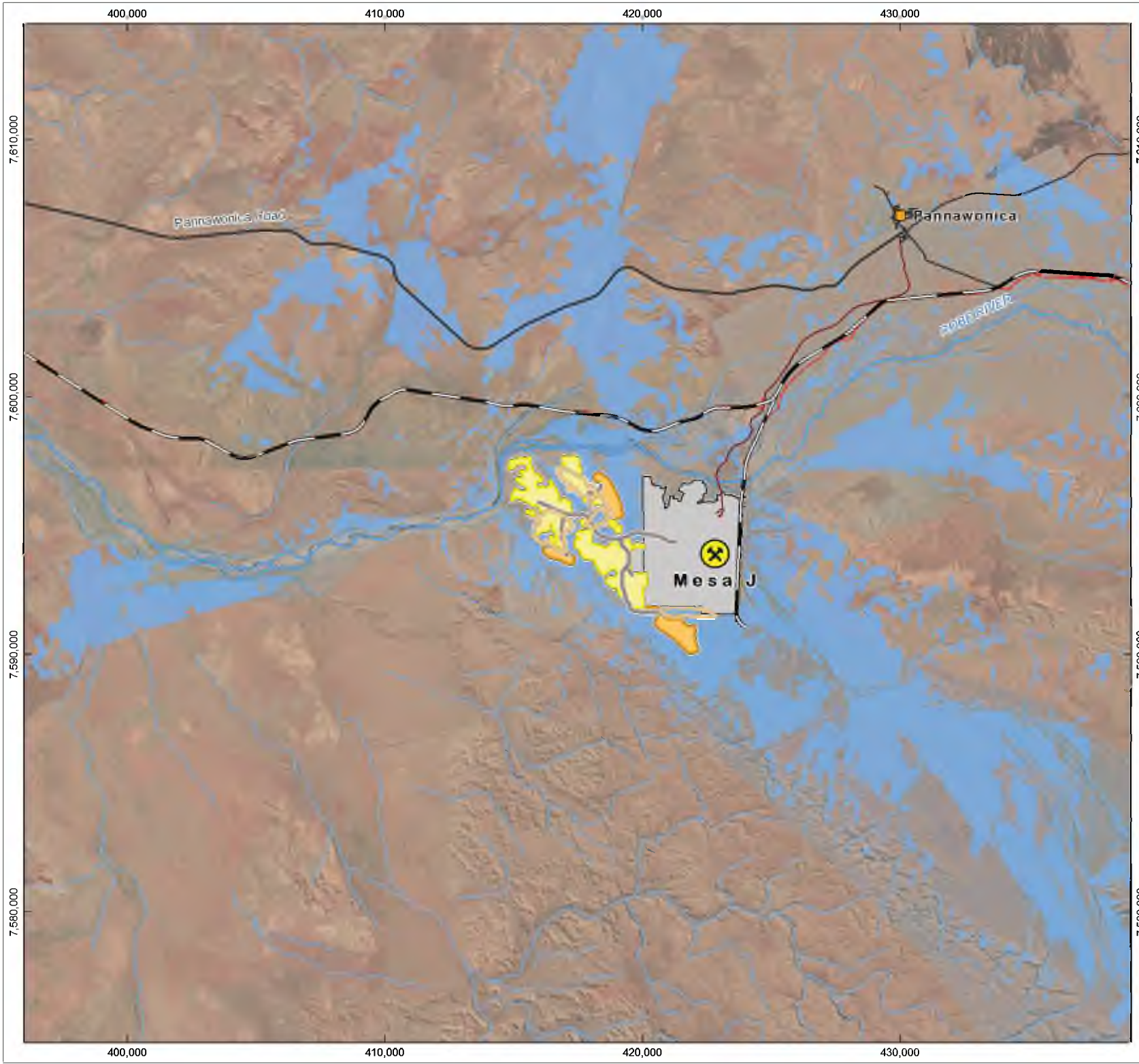

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Figure 12

Viewshed Analysis

Drawn: T.Linklater
Plan: PDE0155371v1
Date: April 2018

Proj: GDA 1994 MGA Zone 50
Scale: 1:200,000 @ A4
gisteam@riotinto.com

Legend

- Rio Tinto Mine
- Town
- Viewshed Analysis
- Current Mesa J Mine
- Rio Tinto Railway
- Major Road
- Minor Road
- Site Road
- Rail Access Road
- Robe River
- Creek

Proposed Mine Layout

- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road

N

0 2 4 6 8 10
Kilometers

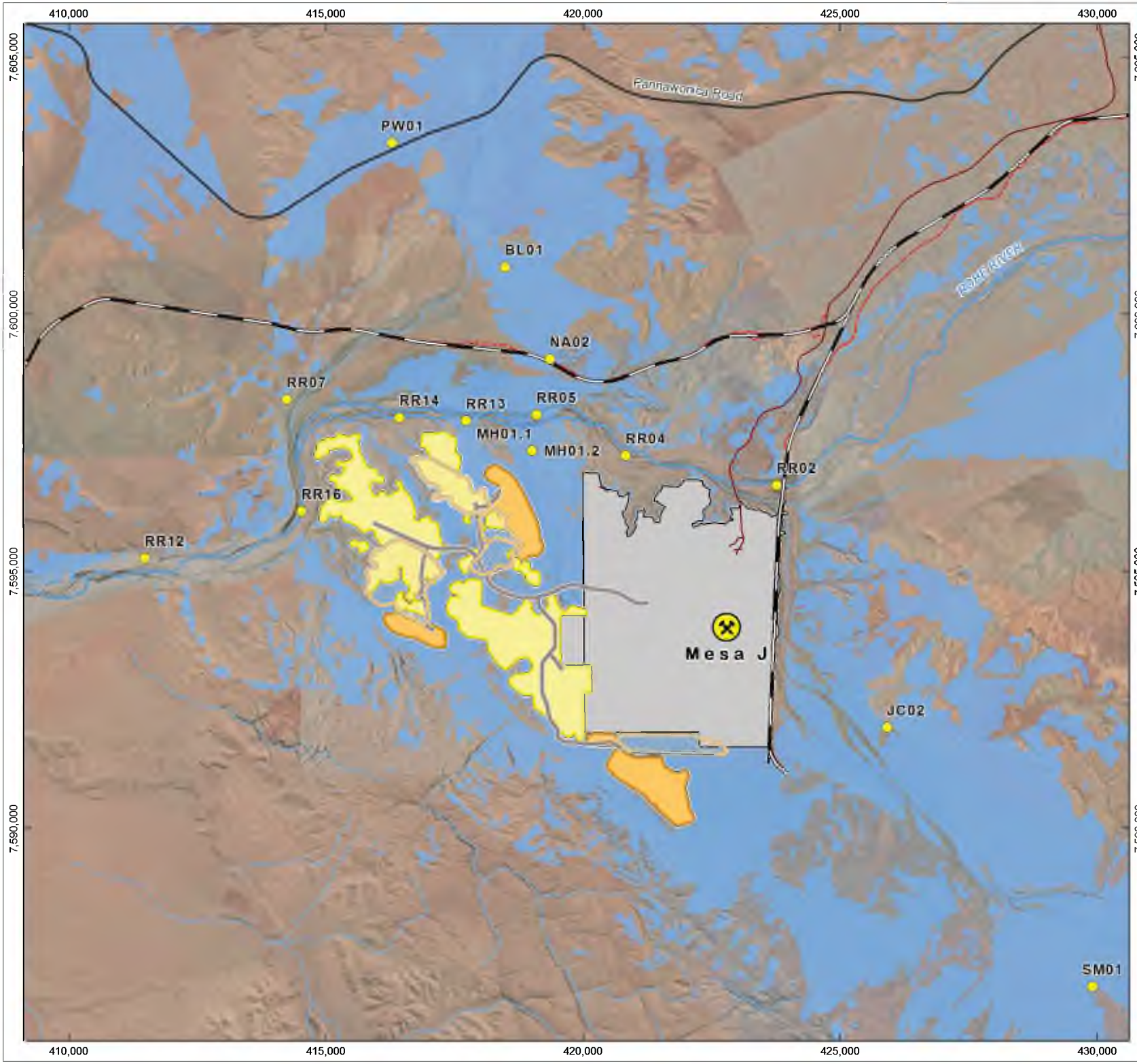

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Figure 13

Actual Photo Locations

Drawn: T.Linklater
Plan: PDE0155371v1
Date: May 2018

Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @ A4
gisteam@riotinto.com

Legend

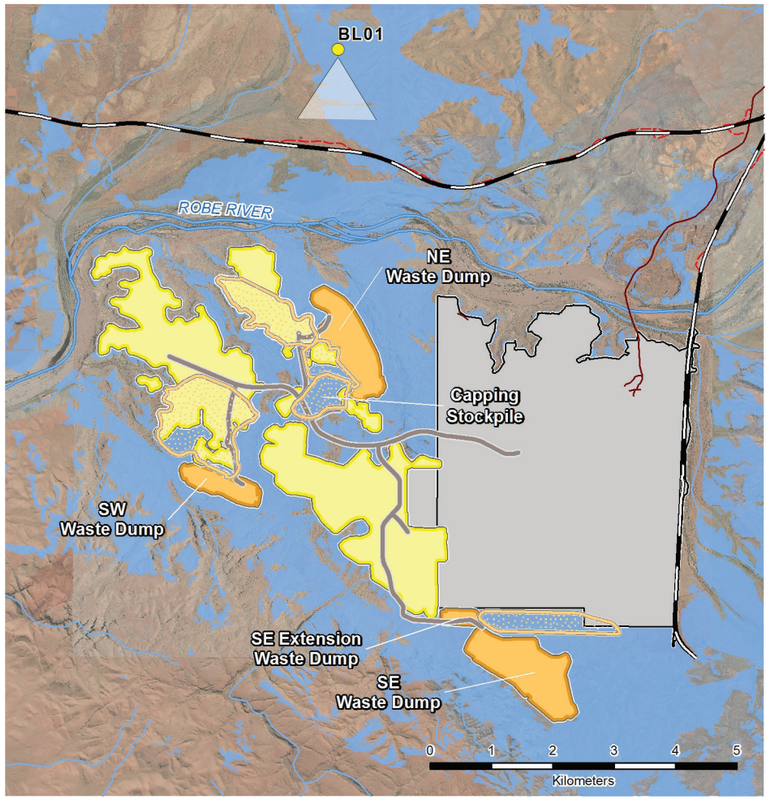
- Actual Photo Locations
- Rio Tinto Mine
- Viewshed Analysis
- Current Mesa J Mine
- Rio Tinto Railway
- Major Road
- Site Road
- Rail Access Road
- Robe River
- Creek

Proposed Mine Layout

- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road

0 1 2 3 4 5
Kilometers

Location Map



Viewpoint Characteristics

Name	01 - BL01
Direction	South (Bearing 180°)
Description	Elevated hill looking towards Mesa H escarpment with low vegetation cover. Clear view along flat ground across railway line.
Site Significance	The site has cultural significance for the Kuruma Marthudunera People.
Comments	The photo was taken from highest point.

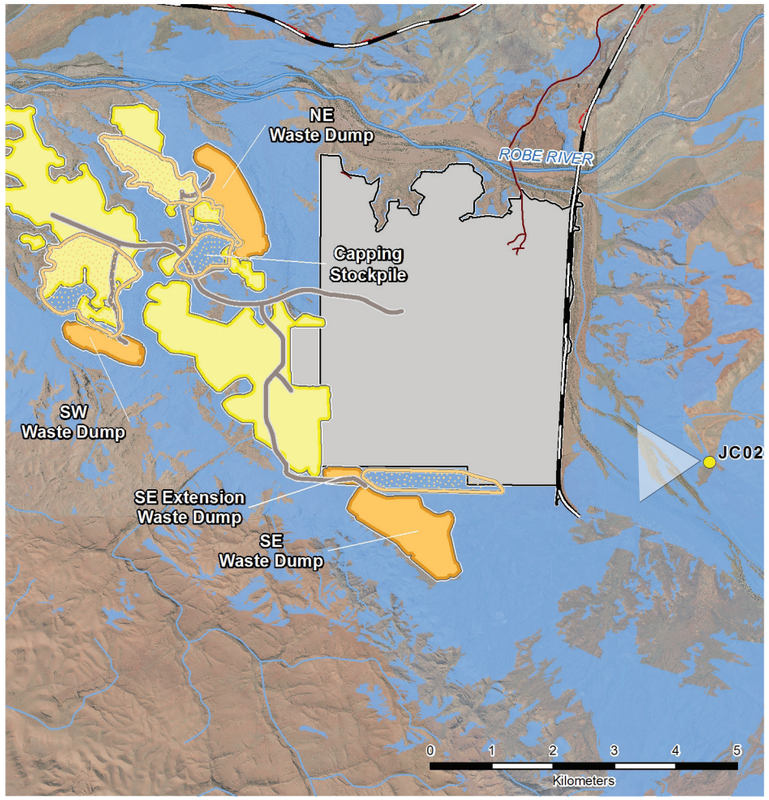
Figure 14 - BL01

Current View

Operations View

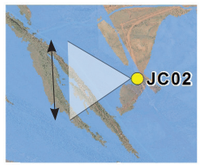
Closure View

Location Map



Legend

- JC02
- Viewshed Analysis
- Robe River
- Creek
- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road
- Rio Tinto Railway
- Site Road
- Rail Access Road



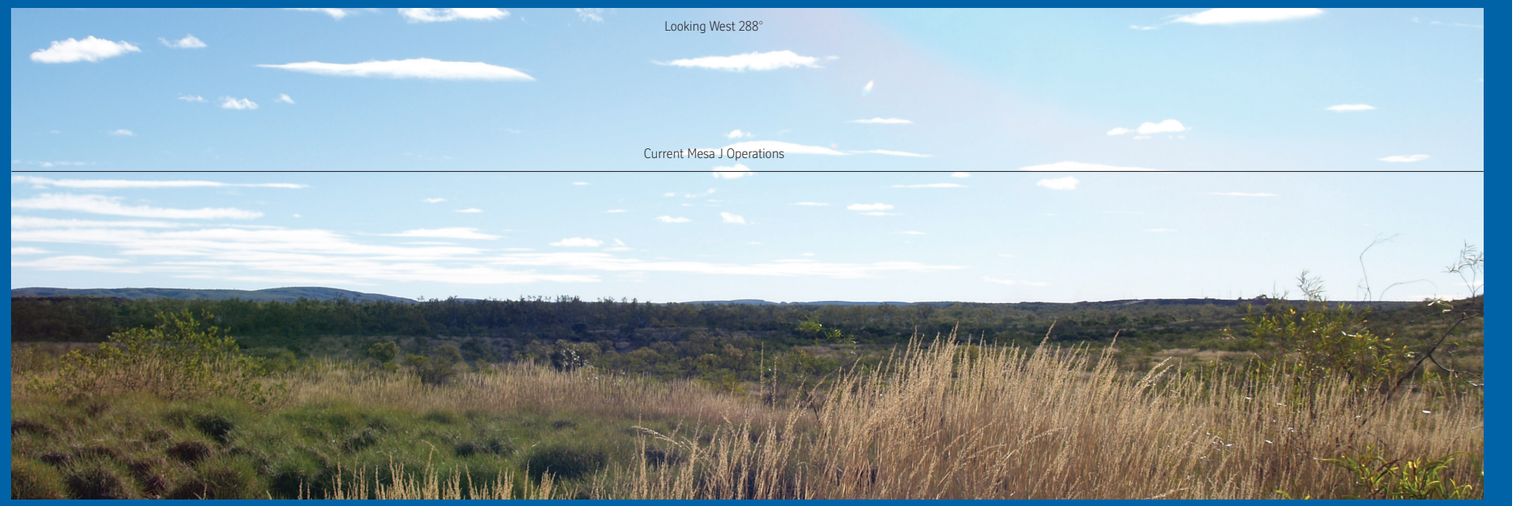
View Aspect

Viewpoint Characteristics

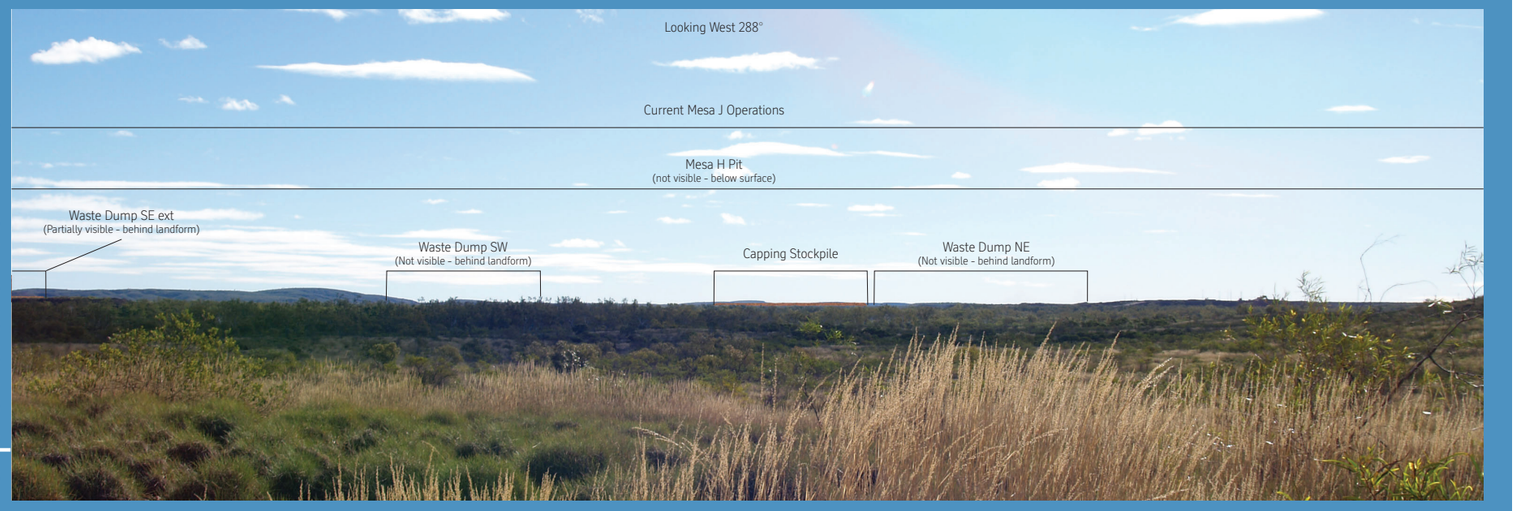
Name	03 - JC02 - Jimmawurrada Creek
Co-ordinates	425,917.43 mE / 7,591,963.07 mN
Direction	West (Bearing 288°)
Description	Western view across creek (above treeline) with clear view of Mesa J operations to the north west. Powerline alignment above photo location.
Site Significance	Creek in the Robe Valley.
Comments	The photo was taken on slightly elevated on crest in road.

Figure 15 - Jimmawurrada Creek

Current View

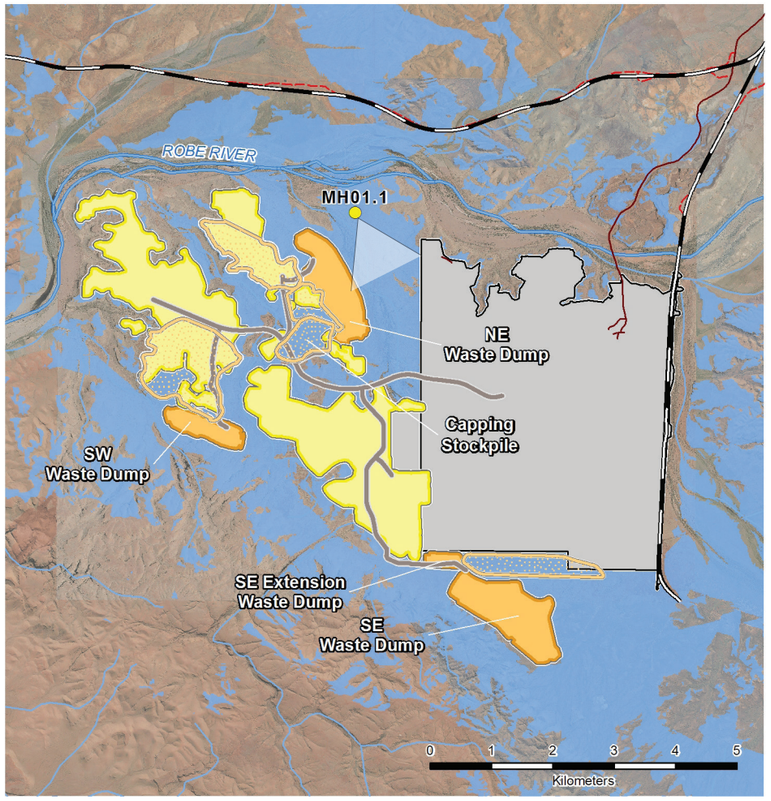


Operations View



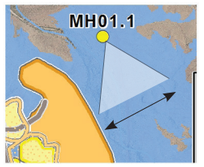
Closure View

Location Map



Legend

- MH01.1
- Viewshed Analysis
- Robe River
- Creek
- Pit
- Waste Dump
- Topsoil/Subsoil Stockpile
- Haul Road
- Rio Tinto Railway
- Site Road
- Rail Access Road



View Aspect

Viewpoint Characteristics

Name	05 - MH01.1 - Mesa H
Direction	South East (Bearing 140°)
Description	Small eleveated hill looking towards Mesa H escarpment, high level of vegetation coverage.
Site Significance	Significant cultural heritage site for the Kuruma Marthudunera People.
Comments	Photo was taken inside the Kuruma Marthudunera People site boundary, looking towards proposed waste dump.

Figure 16 - Mesa H

Current View

Operations View

Closure View