Rio Tinto Exploration Pty. Limited

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A member of the Rio Tinto Group

Combined Annual Report for Period 1 October 2012 to 30 September 2013, EL4662, EL4870, EL4871, EL4872, EL4873 and EL4874, Gippsland Mineral Sands Project, Victoria

Exploration Report No. 29569

Tenement Holder:	Rio Tinto Exploration Pty Limited
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KEYWORDS

Bairnsdale, Gippsland Basin, Miocene, Pliocene, Heavy Mineral Sand, Titanium, Rutile, Ilmenite, Zircon, Resource Estimate, Scoping Study, Divestment

1. SUMMARY

This is the annual exploration report for EL4662, EL4870, EL4871, EL4872, EL4873 and EL4874 for the year ending 30 September 2013. These six granted tenements, along with EL4666, EL4735 and EL4875 comprise the Gippsland Mineral Sands Project in eastern Victoria. The tenements are 100% owned by Rio Tinto Exploration Pty Ltd (RTX).

RTX is exploring the project area for heavy mineral sand deposits within the Miocene-Pliocene Boisdale Formation on the northern margin of the eastern Gippsland Basin. The Miocene-Pliocene Boisdale Formation contains concentrations of heavy mineral sands comprised of zircon, ilmenite, altered ilmenite, rutile, anatase and leucoxene.

No field-based exploration activities were carried out by RTX during the current reporting period. Consultants R.J. Robbins & Associates completed a Scoping Study Report for the Gippsland Minerals Sands Project in December 2012 on behalf of Oresome Australia Pty Ltd (Oresome). Some conclusions from the report are as follows:

- The potential mining operation is viable but is dependent on mitigation of the risks associated with a suitable water supply.
- Metallurgical scoping test work confirmed that the "metallurgical results are sound" and products of acceptable quality, with acceptable mineral recoveries could be produced from the Glenaladale Main ore. The resource products (ie, ilmenite, HiTi and zircon) could be sold on the market ("*end use market opportunities*").
- The total inferred Heavy Mineral resource is estimated to be 1% HM cutoff is 1,170Mt at 2.2% HM, 24.4% Slimes and 38Mt contained HM.
- The inferred resource for Valuable Heavy Minerals (VHM), that includes zircon, rutile, altered ilmenite, leucoxene and monazite, is 360Mt at 2.7% HM, 24.7% Slimes and 9.7Mt contained HM.
- Heavy mineral proportions of the VHM ore are estimated at 15% zircon, 4% rutile, 50% other Ti-minerals (ie, ilmenite, altered ilmenite, leucoxene) and 0.6% monazite.
- Expected average grade of the deposits is between 2-7-3.5% total heavy minerals inclusive of zircon, ilmenite and HiTi products.
- Given the nature of the orebody (in relation to the water table), a dry mining technique is deemed the only practical option available for any proposed mining operation.
- Capital Costs to develop the project would be approximately $271.5 million.
- Operating Cost per annum would be approximately $80.3 million.
- The NPV is approximately $170-190 million.
- The IRR is approximately 25-30%.
- There are some environmental issues requiring further investigation.

During the year RTX reviewed the R.J. Robbins & Associates report provided by Oresome. The report did not affect RTX's decision to divest the Gippsland Project on the basis that the resources were unlikely to meet the minimum criteria for a Rio Tinto mining business. The project data was collated, packaged and presented to various interested parties. The project tenements are subject to ongoing commercial negotiations related to the divestment.

2. INTRODUCTION

This is the annual exploration report for EL4662, EL4870, EL4871, EL4872, EL4873 and EL4874 for the year ending 30 September 2013. These six granted tenements, along with EL4666, EL4735 and EL4875 comprise the Gippsland Mineral Sands Project in the eastern Gippsland Basin of eastern Victoria. The tenements are 100% owned by Rio Tinto Exploration Pty Ltd (RTX). The easternmost tenements, EL4666, EL4735 and EL4875, are subject to a separate annual report, ie, RTX Report No 29570.

The Gippsland Mineral Sands Project is located near the towns of Bairnsdale and Orbost and lie within the boundaries of the Bairnsdale SJ 55-7 1:250,000 map sheet. The tenement locations are presented on plan pCom13_030.pdf.

Access is via the Princess Highway and numerous secondary roads heading northwards into the project area. Access around the project is via well maintained roads and tracks.

RTX is exploring the project area for heavy mineral sand deposits within the Miocene-Pliocene Boisdale Formation. The project is currently being divested.

Oresome Australia Pty Ltd (Oreseome), a wholly owned subsidiary of Metallica Minerals Limited entered into a “Right to Explore and Option to Purchase Agreement” with RTX for the Gippsland Mineral Sands Project commencing 25 August 2011. In the agreement Oresome had the exclusive right to explore, for a period of 12 months, for heavy mineral sands and the option to purchase a 100% interest in the EL’s at any time during the term of the Agreement. The Option to Purchase period was subsequently extended to 14 December 2012. At the end of the Option to Purchase period, Oresome opted to hand the project back 100% to RTX.

3. LICENCE DETAILS

Exploration licence details for all of the Gippsland Mineral Sand Project tenements are presented in Table 1. It includes the licence details for EL4666, EL4735 and EL4875 that are subject to a separate annual report, ie, RTX Report No 29570.

Table 1: Licence Details

Code	Name	Jurisdiction	Type	Resources	Status	Application Date	Grant Date	Expiry Date	Area
EL4662	Stockdale	Victoria	EL	MS	Active	30/05/2002	31/10/2002	30/10/2014	320.0 Blocks
EL4666	Tostaree	Victoria	EL	MS	Active	30/05/2002	27/05/2010	26/05/2015	92.0 Blocks
EL4735	Nowa Nowa East	Victoria	EL	MS	Active	14/01/2003	27/05/2010	26/05/2015	180.0 Blocks
EL4870	Gippsland Gap 1	Victoria	EL	MS	Pending Renewal	22/03/2005	27/05/2010	26/05/2013	2.0 Blocks
EL4871	Gippsland Gap 2	Victoria	EL	MS	Active	22/03/2005	27/07/2005	26/07/2014	4.0 Blocks
EL4872	Gippsland Gap 3	Victoria	EL	MS	Pending Renewal	22/03/2005	27/05/2010	26/05/2013	2.0 Blocks
EL4873	Gippsland Gap 4	Victoria	EL	MS	Active	22/03/2005	27/07/2005	26/07/2014	6.0 Blocks
EL4874	Gippsland Gap 5	Victoria	EL	MS	Active	22/03/2005	27/05/2010	26/05/2015	25.0 Blocks
EL4875	Gippsland Gap 6	Victoria	EL	MS	Active	22/03/2005	27/07/2005	26/07/2014	20.0 Blocks

4. PREVIOUS EXPLORATION

In the early 1970’s Strahan Sands reported minor mineral sand concentrations with high proportions of ziron and rutile in Pleistocene dune and barrier sands extending inland from Ninety-Mile beach in south east Victoria.

In the early 1980’s BHP noted the presence of heavy mineral concentrations within sand units while drilling for lignite.

RTX began exploring the Gippsland Project area for mineral sands in 2002. Early surface sampling identified mineral sand concentrations of up to 11.4% heavy minerals in a large area extending 50km east-west. From 2003 to 2007 RC drilling was carried out that culminated in an inferred resource estimate of 636Mt containing 22.7Mt heavy minerals, which includes 3.78Mt of zircon. The resource estimate included the Stockdale, Glenaladale and Mossiface deposits. The heavy mineral assemblage consists of zircon, ilmenite, rutile and leucoxene.

During the year ending 30 September 2008 RTX completed its final RC drilling program as well as metallurgical and QEMSCAN test work on two bulk samples. The drilling increased the potential resource size. The metallurgical and QEMSCAN work indicated the following:

- The lower part of the sequence contains elevated slimes of 25-26% and THM of 2.9% to 4.2%.
- Zircon content is 17-19% and the production of a zircon concentrate is feasible.
- QEMSCAN studies on titanium minerals indicate that the high SG TiO_2 fraction is dominantly a mixture of anatase and rutile frequently aggregated with silicate and quartz components. Consequently, the production of a clean high SG TiO_2 fraction may not be feasible.

During the year ending 30 September 2009 RTX carried out a review of the project and decided to divest the project because the resources were unlikely to meet the minimum criteria for a Rio Tinto mining business. The project data was collated, packaged and presented to various interested parties. Other than the divestment activities, limited work was completed on the project from October 2009 to August 2011.

Oresome, a wholly owned subsidiary of Metallica Minerals Limited entered into a “Right to Explore and Option to Purchase Agreement” with RTX for the Gippsland Mineral Sands Project commencing 25 August 2011. In the agreement Oresome had the exclusive right to explore, for a period of 12 months, for heavy mineral sands and the option to purchase a 100% interest in the EL’s at any time during the term of the Agreement. The Option to Purchase period was subsequently extended to 14 December 2012.

During the year ending 30 September 2012 Oresome completed aircore drilling, resource calculations and undertook Scoping Studies (Duck, 2012). A total of 43 aircore holes, totalling 2290m, were drilled to test the Glenaladale and Mossiface areas. Each of the exploration holes were duplicated for metallurgical bulk sampling. Metallurgical scoping test work and development of a conceptual process flow diagram confirmed that titanium mineral sand products of acceptable quality could be produced.

5. GEOLOGY

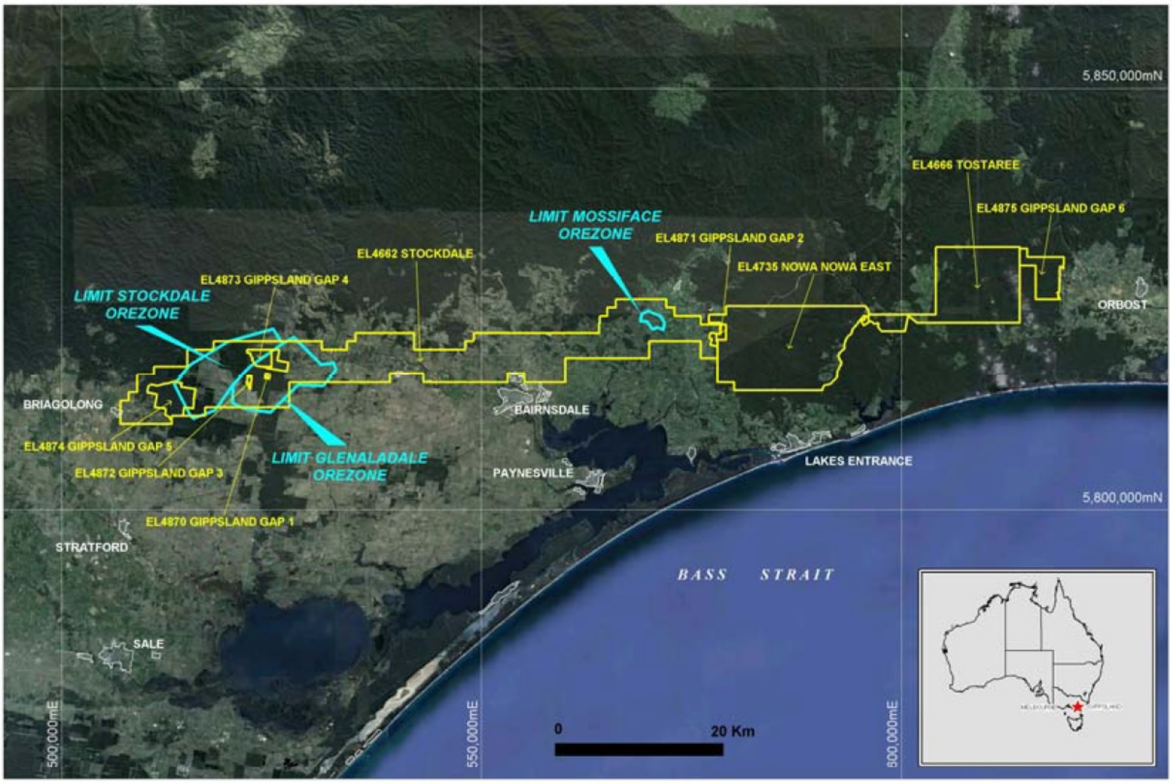
The Gippsland Mineral Sands Project area covers Miocene-Pliocene sediments on the northern margin of the eastern Gippsland Basin. The stratigraphy of the Gippsland Basin is presented in Table 2.

The Miocene-Pliocene Boisdale Formation contains concentrations of titanium heavy mineral sands. The heavy mineral assemblage is comprised of zircon, altered ilmenite, rutile, anatase and leucoxene.

The Lakes Entrance Platform consisting of Palaeozoic basement of the eastern Australian highlands lies to the north of the Gippsland Basin. These rocks also form the basement to the Gippsland Basin sediments.

The majority of the inferred mineral sand resources within the project area are contained within EL4662 but also extend across, or into, EL4870, EL4872, EL4873 and EL4874 (see Figure 1).

Figure 1. Location of Heavy Mineral Resources



6. EXPLORATION ACTIVITIES FOR THE YEAR ENDING 30TH SEPTEMBER 2013

On 14 December 2012, at the end of the Option to Purchase period, Oresome opted to hand the project back 100% to RTX.

No field-based exploration activities were carried out by RTX during the year ending 30 September 2013.

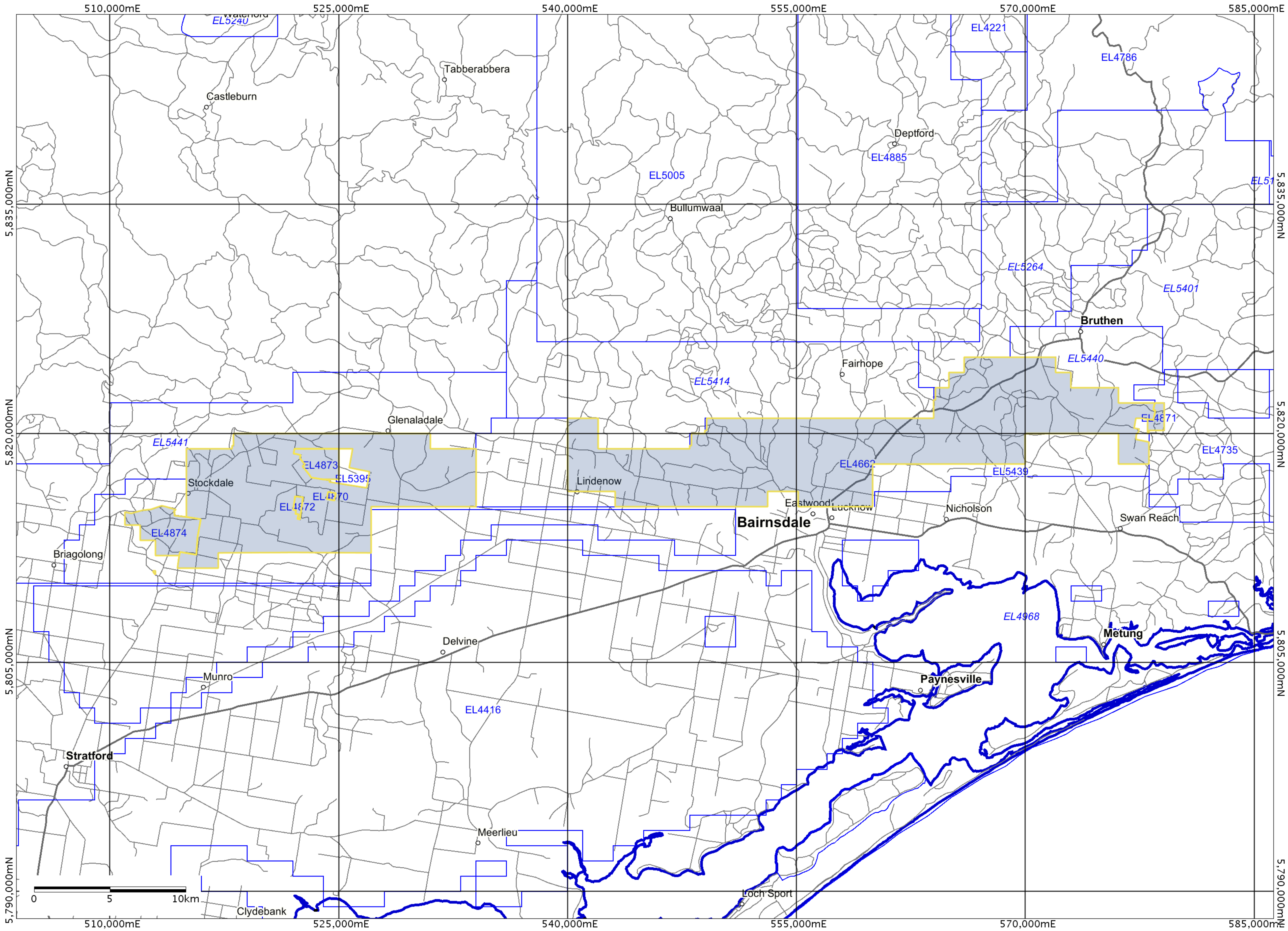
Consultants R.J. Robbins & Associates completed a Scoping Study Report on the Gippsland Minerals Sands Project in December 2012 on behalf of Oresome. This report (581-PM-REP-0000-8024_RevC_Scoping Study Report.pdf) is provided in Appendix 1.

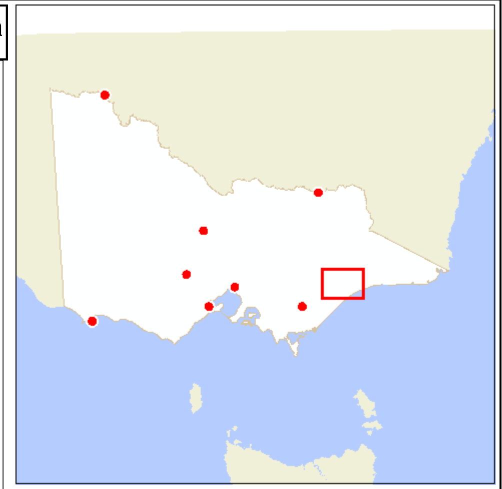
Some conclusions from the Scoping Study Report are as follows:

- The potential mining operation is viable but is dependent on mitigation of the risks associated with a suitable water supply.
- Metallurgical scoping test work confirmed that the “metallurgical results are sound” and products of acceptable quality, with acceptable mineral recoveries could be produced from the Glenaladale Main ore deposit. The resource products (ie, ilmenite, HiTi and zircon) provided “end use market opportunities”.

Department of State Development,
Business and Innovation

Tenement Location Plan





Legend

Towns (250K)
Large Town
Town

Current Mineral Exploration Licences

Roads (250K)
Major Roads
Other Roads

Victoria Boundary
Coastline
Boundary

GN
MN

GDA

State Government Victoria

Disclaimer: This map is a snapshot generated from Victoria Government data. This material may be of assistance to you but the State of Victoria does not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for error, loss or damage which may arise from reliance upon it. All persons accessing this information should make appropriate enquiries to assess the currency of the data.

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Map Created Thu Feb 13 2014 14:38:05 GMT+1100 (EST)

Map Scale:	1:250,000
Projection:	MGA 55

- The total inferred Heavy Mineral resource is estimated to be 1% HM cutoff is 1,170Mt at 2.2% HM, 24.4% Slimes and 38Mt contained HM.
- The inferred resource for Valuable Heavy Minerals (VHM), that includes zircon, rutile, altered ilmenite, leucoxene and monazite, is 360Mt at 2.7% HM, 24.7% Slimes and 9.7Mt contained HM.
- Heavy mineral proportions of the VHM ore are estimated at 15% zircon, 4% rutile, 50% other Ti-minerals (ie, ilmenite, altered ilmenite, leucoxene) and 0.6% monazite.
- Expected average grade of the deposits is between 2-7-3.5% total heavy minerals inclusive of zircon, ilmenite and HiTi products.
- The proposed process plant and processing methodologies are unremarkable and common place to the industry.
- Transport of product will not be a problem.
- An assessment of the risks (planning and environmental) indicated that the only unquantifiable risk was securing a water supply.
- There are some environmental issues requiring further investigation.
- Given the nature of the orebody (in relation to the water table), a dry mining technique is deemed the only practical option available for any proposed mining operation.
- Capital Costs to develop the project would be approximately $271.5 million.
- Operating Cost per annum would be approximately $80.3 million.
- The NPV is in the order of $170-190 million.
- The IRR is approximately 25-30%.

During the year RTX reviewed the R.J. Robbins & Associates Scoping Study Report provided by Oresome. The report did not affect RTX's decision to divest the Gippsland Project on the basis that the project was unlikely to meet the minimum criteria for a Rio Tinto mining business. The project data was collated, packaged and presented to various interested parties. The project tenements are subject to ongoing commercial negotiations related to the divestment.

7. CONCLUSIONS AND RECOMMENDATIONS

Drilling completed since 2003 has defined a large resource (1.17Bt at 2.2% HM) of heavy mineral sands within the Gippsland Mineral Sands Project in eastern Victoria.

A Scoping Study of the project by Robbins and Associates on behalf of Oresome completed in December 2012 has indicated that the Glenaladale Main resource has good potential to become an economically viable mining operation if a dependable water supply can be located.

Oresome opted to hand the project back to RTX at the end of its option agreement with RTX.

The Gippsland Mineral Sands Project does not meet Rio Tinto's minimum mining business criteria. Consequently, the project is currently being divested by RTX.

REFERENCES

Duck, B.H. 2012 Combined Annual Report for ELs4662, 4870, 4871, 4872, 4873 and 4874, for the Period Ending 30th September 2012, Gippsland Basin Mineral Sands Project, Eastern Gippsland Basin, Victoria. Oresome Australia Pty Ltd.

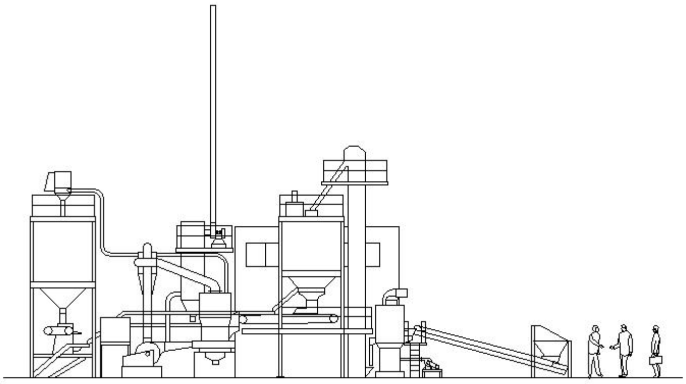
LOCALITY

Bairnsdale	SJ55-07	1:250 000

LIST OF DPO'S

APPENDIX 1

581-PM-REP-0000-8024_RevC_Scoping Study Report.pdf



R. J. ROBBINS & ASSOCIATES

SCOPING STUDY REPORT

Oresome Australia Pty Ltd
Gippsland Mineral Sands Project

December 2012

Document No: 581-PM-REP-0000-8024
Prepared by R. J. Robbins & Associates

DESIGN ENGINEERS & PROJECT MANAGERS

Mining & Mineral Processing • Specialised Equipment

Document History and Status

Revision	Date Issued	Prepared	Checked	Approved	Revision Description
A		SC	MR	RR	Initial Issue
B		SC	MR	RR	Amend Exec Summary
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ABBREVIATIONS

AMC	AMC Consultants Pty Ltd
AMMA	Australian Metals and Mining Association
CUP	Concentrate Upgrade Plant
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
FEL	Front End Loader
HM	Heavy Minerals
HMC	Heavy Mineral Concentrate
HMS	Heavy Mineral Sands
HR	High Tension Roll Separator
IRR	Internal Rate of Return
LIMS	Low Intensity Magnetic Separator
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MPV	Multi-Purpose Vessels
MSP	Mineral Separation Plant
MUP	Mining Unit Plant
NPV	Net Present Value
PFD	Process Flow Diagram
RFQ	Request For Quotation
Rio Tinto	Rio Tinto Exploration Pty Ltd
Robmet	Robbins Metallurgical
ROM	Run Of Mine
TDS	Total Dissolved Solids
TIA	Traffic Impact Assessment
TSF	Tailings Storage Facility
VHM	Valuable Heavy Minerals
WCP	Wet Concentrator Plant
WHIMS	Wet High Intensity Magnetic Separator
TZMI	TZMI Minerals International Pty Ltd

EXECUTIVE SUMMARY

Oresome Australia Pty Ltd "Oresome" is examining the potential of a Heavy Mineral Sands (HMS) project in Gippsland, Victoria. The deposit is presently 100% owned by Rio Tinto Exploration Pty Ltd (Rio Tinto) and Oresome have entered into a Right to Explore and Option to Purchase Agreement with Rio Tinto.

This agreement gives Oresome the exclusive right to explore the Rio Tinto exploration licences comprising the Gippsland HMS project for a period of twelve months, commencing 25 August 2011.

Robbins in preparing this report, provide it for the sole purpose of Oresome making an internal decision on whether to proceed with securing the Gippsland leases by procuring them from Rio Tinto.

Review of Deposit and Metallurgy

The Gippsland ore bodies lie in south-east Victoria and consist of nine exploration licences covering a total area of approximately 620 km^2. Exploration to date has included surface sampling and drilling within the Stockdale-Glenaladale area located about 35 km west of the town of Bairnsdale and Mossiface area located 20 km east-northeast of Bairnsdale.

Based on preliminary test work results by Robbins Metallurgical (Robmet) on the Glenaladale resource, preliminary process flow sheets incorporating gravity concentration and magnetic separation techniques, typical of those used in the mineral sands beneficiation process, have been developed.

Given the nature of the orebody (in relation to the water table) a dry mining technique is deemed the only practical option available for any proposed mining operation.

Mining

AMC Consultants Pty Ltd (AMC) were engaged by Oresome to prepare a resource block model and Mineral Resource estimate, suitable for reporting in accordance with the JORC Code, for the Glenaladale Deposit.

Process Plants

Robbins has based the conceptual design of the key processing facilities as follows:-

- Heavy mineral concentrate grade of 3.5%
- Glenaladale test work only (not Mossiface)
- 7400 hours per annum operation (85% availability)
- 1500 tonnes per hour mining rate.
- Two mobile Mining Unit Plants (MUP's);
- Wet Concentrator Plant (WCP);
- Concentrate Upgrade Plant (CUP;
- Mineral Separation Plant (MSP); and
- Auxiliary support plant and equipment.

Financials

- Capital Estimate carries a confidence factor of -10/+35% and has been calculated as follows:
  - $221,011,239 Direct costs.
  - $16,100,000 Indirect costs.
  - $34,342,230 Contingency of 15%
- Operating Estimate has been calculated at $80,340,532 per annum exclusive of all taxes and duties.
- The NPV / IRR calculations are exclusive of the following:
  - Royalties (currently 2.75% of Net Market Value in Victoria)
  - Duties and Taxes
  - Depreciation
  - Funding
  - OPEX escalation
- NPV calculated at between AUD 170 – 190 Million
- IRR calculated at between 25 – 30%

Marketing

The product quality assessment of the Glenaladale resource products, namely, Ilmenite, HiTi and zircon have all been identified as having end-use market opportunities.

Risks

AECOM were commissioned to undertake a preliminary constraints, opportunities and process assessment for the Gippsland HMS Project. A preliminary risk workshop held at AECOM's Melbourne office was aimed at identifying planning and environmental risks which may make the project unviable or cause decision making authorities to refuse statutory planning and/or environmental applications.

Robbins carried out an internal preliminary risk assessment relating to the processing plants, infrastructure and mining.

All risks were categorised and only the water supply was found to carry a weighting that is unquantifiable until results of further investigations, currently underway, are available.

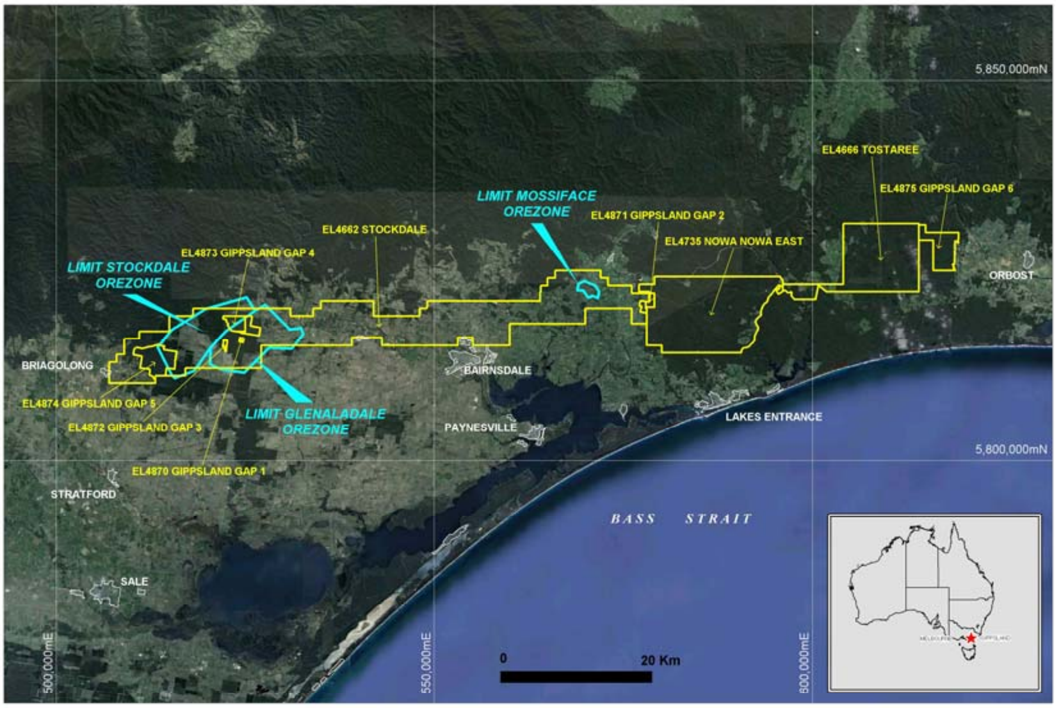
Summary

Investigations, risks workshops and third party reporting has identified that this potential operation is viable dependant on mitigation of the risks associated with securing a suitable water supply.

1 INTRODUCTION

The Gippsland HMS project lies in south-east Victoria and consists of nine granted exploration licences covering a total area of approximately 620 km^2. Exploration to date has included surface sampling and drilling within the Stockdale-Glenaladale area located about 35 km west of the town of Bairnsdale and Mossiface area located 20 km east-northeast of Bairnsdale.

Expected average grade of these deposits is between 2.7 – 3.5% total heavy mineral, inclusive of zircon, Ilmenite and HiTi products.



GIPPSLAND, VICTORIA TENEMENTS (HELD BY RIO TINTO EXPLORATION PTY LTD)
MINERAL SANDS OREZONES

Figure 1.1 Gippsland, Victoria Tenements

Oresome commissioned R.J. Robbins & Associates “Robbins” to produce an upper level scoping study for the Gippsland HMS project as a due diligence prior to proceeding further and procuring the leases.

Robbins broad scope for this work is outlined below:

- Development of Process Flow Diagrams (PFD) based on 3.5% head grade. (as advised by Oresome)
- Investigate Freight and Logistics of products from Gippsland Mineral Separation Plant (MSP)
- Investigate HV power distribution to site
- Investigate Gas supply availability
- Investigate slimes management / tailings disposal methodology
- Calculate approximate plant power draw for formulating operating cost estimates

- Preliminary overall mine access layout
- Completion of a capital cost estimate using recent historical pricing (+/-35%)
- Develop operating cost estimate
- Completion of a preliminary works schedule
- Receive free issued reports from Oresome's nominated sub contractors / third parties for Mining, Environmental and Marketing and incorporate in overall study

Receive free issued data from Oresome for Water Supply.

1.1 Location

Bairnsdale and Sale are the closest most populated towns to the resource accommodating approximately 11,280 people and 13,330 people, respectively. The Princes Highway runs through both Bairnsdale and Sale.

Bairnsdale is predominantly an agricultural area whereas Sale is more industrial. Industries represented within this area range from timber, wool, dairy and other agriculture related industries.

The towns of Bairnsdale and Sale have shopping and banking facilities and are serviced daily via road and rail transport.

1.2 Climatic Conditions

Climatic conditions for the localized area were not readily available. However, climatic data was available for the nearby town of Bairnsdale as per the tables below.

Table 1.1: Climatic Conditions Bairnsdale – Long Term averages

Source – Bureau of Meteorology

Month	Max Temp ºC	Min Temp ºC	Rainfall mm
January	25.8	12.8	48.9
February	25.4	12.8	50.8
March	23.8	11.1	44.7
April	20.7	8.5	56.5
May	17.5	6.7	46.4
June	15.0	4.8	58.6
July	14.5	3.9	50.2
August	15.7	4.5	36.4
September	17.6	5.8	53.4
October	19.7	7.5	60.7
November	21.7	9.6	81.9
December	23.5	11.1	60.1

Table 1.2: Climatic Conditions Bairnsdale – Monthly Records

Source – Bureau of Meteorology

Month	Max Temp °C	Min Temp °C	Rainfall mm
January	44.0	4.2	111.3
February	46.2	3.5	206.8
March	40.8	2.0	144.0
April	37.5	0.5	181.0
May	29.4	-3.0	225.4
June	25.0	-3.2	322.6
July	22.4	-3.5	182.0
August	27.0	-4.5	65.0
September	32.6	-2.2	172.7
October	34.9	-1.0	123.0
November	43.5	1.6	275.6
December	41.0	3.1	153.0

2 BACKGROUND

The Gippsland HMS project tenements cover fossil strandlines of the Miocene-Pliocene shallow marine sand units of the Boisdale Formation which on-lap the Palaeozoic basement at the southern margin of the eastern Australian Highlands.

Historical HMS exploration has included surface sampling, significant drilling undertaken in 2004, 2005 and 2008 and eight drill bulk samples at various locations in the project area.

These samples were subjected to gravity separation and metallurgical test work at the Downer-EDI facility at Carrara on Queensland's Gold Coast. An understanding of the characteristics of the zircon, rutile and ilmenite components of the Gippsland HMS deposits was developed from this work.

Table 2.1 is a compilation of the Gippsland Basin Resources, using a 2%THM cut-off, as detailed in the Rio Tinto Report RD_2007_07.

Table 2.1: Compilation of Gippsland Basin Resources

	Glenaladale Main Ore Zone	Glenaladale West Ore Zone	Stockdale Ore Zone	Mossiface Ore
# Blocks	219	289	293	165
Surface (Km^2)	8.86	11.59	11.75	1.64
Thickness Minimum (m)	3.73	4.41	4.74	5.11
Thickness Maximum (m)	41.83	8.84	26.39	26.2
Thicknes Average (m)	15.7	6.56	12.8	11.45
Sand Volume (Mm^3)	137	76	150	18.9
Sand Tonnage (Mt)	230	121	255	30
% THM	3.76%	4.22%	2.98%	2.84%
THM Tonnage (Mt)	8.76	5.44	7.6	0.91
% Slimes	24.70%	21.50%	22.21%	16.12%
Minerals				
% Ti_Minerals (THM)	44.8%	34.3%	54.3%	39.5%
TI_Minerals Tonnage (Mt)	3.90	1.86	4.13	0.36
% Rutile (THM)	6.0%	5.1%	6.6%	9.0%
Rutile Tonnage (Mt)	0.52	0.28	0.5	0.082
% Zircon (THM)	18.1%	14.9%	14.7%	28.5%
Zircon Tonnage (Mt)	1.60	0.81	1.11	0.26
% Monazite (THM)	1.6%	1.4%	1.3%	5.8%
Monazite Tonnage (Mt)	0.14	0.08	0.10	0.052
Overburden				
Minimum (m)	3.1	3.6	6.4	2.5
Maximum (m)	42.5	50.5	54.1	62.2
Average (m)	27.3	27.5	25.4	17.1
Volume (Mm^3)	240	318	298	28.2
Tonnage (Mt)	380	510	477	45.2

3 FLOWSHEET

3.1 Process Flowsheet

Process flowsheets have been developed based on the metallurgical test work completed by Robmet as described in section 3.2, with the full set of reports and process flowsheets, as listed below, included as Appendix 1.

486-PM-REP-0000-8003 Rev B – Metallurgical Scoping Test Report

487-PM-MEM-0000-8003 Rev A - Recoveries

487-PM-MEM-0000-8004 Rev A - Solubility Data

487-PM-MEM-0000-8005 Rev A - Product Qualities

648-PM-REP-0000-8005 Rev A - Further Testing

3.2 Testwork Summary

3.2.1 Conceptual Process Flow Development Testwork

Oresome provided Robmet with two bulk samples taken from its Glenaladale Main and Mossiface mineral sands project with the bulk sample from Glenaladale Main utilized for conceptual process development test work and the bulk sample from Mossiface utilized to ascertain variation.

Head analyses data completed on the as received, homogenised bulk samples indicate Glenaladale Main bulk sample to contain 26.7% slimes (-38micron) and 2.7% heavy mineral (mineral with a specific gravity of >2.85sg), whilst Mossiface contained 18.2% slimes and 1.9% heavy mineral.

Mineralogical analyses of the heavy mineral with respect valuable heavy mineral are included as per Table 3.1 below.

Table 3.1: Mineralogical Analyses of Heavy Mineral

	Ilmenite	Leucoxene	Rutile	Zircon
Glenaladale Main	32	32	2.5	16
Mossiface	29	23.5	0.5	28

Data depicted above indicate Mossiface although having lower heavy mineral concentration, contains higher levels of valuable zircon and lower levels of leucoxene/rutile as compared to Glenaladale Main. Not with standing this the Mossiface mineral sands project area is significantly smaller in area and contained heavy mineral than the Glenaladale Main mineral sands project area. As such focussing on Glenaladale Main for process development and Mossiface as variation testing for future supplementation is appropriate.

Metallurgical scoping test work completed, utilizing typical mineral sands processing methodologies and standard mineral sands processing equipment confirmed that potential products of acceptable quality could be produced from both Glenaladale Main and Mossiface with potential product chemical analyses as summarized in Tables 3.2 and 3.3 below.

Table 3.2: Glenaladale Main Produced Products

	TiO2	Fe2O3	SiO2	Al2O3	ZrO2+HfO2	U XRF	Th XRF
Primary Zircon	0.14	0.05	32.7	0.1	65.5	391	222
Secondary Zircon	0.79	0.07	31.2	0.1	62.5	448	279

	TiO2	Fe2O3	SiO2	Al2O3	Cr2O3	ZrO2+HfO2	U XRF	Th XRF
HiTi 70	80.9	7.4	6.3	1.8	0.6	0.2	36	123
HiTi 80	83.7	7.0	1.9	1.1	3.6	0.1	16	74
Primary Ilmenite	48.4	46.4	0.8	0.8	0.8	0.1	0.0	36.8

Table 3.3: Mossiface Produced Products

	TiO2	Fe2O3	SiO2	Al2O3	ZrO2+HfO2	U XRF	Th XRF
Primary Zircon	0.10	0.03	33.80	0.31	63.00	415	217
Secondary Zircon	0.73	0.04	32.60	0.24	65.20	514	269

	TiO2	Fe2O3	SiO2	Al2O3	Cr2O3	ZrO2+HfO2	U XRF	Th XRF
HiTi 70	-	-	-	-	-	-	-	-
HiTi 80	-	-	-	-	-	-	-	-
Primary Ilmenite	57.0	36.8	0.8	0.5	0.6	0.1	27	102

Produced primary zircon product is of typical premium zircon quality with the exception of the Uranium (U) and Thorium (Th) levels exceeding typical requirements of <500ppm.

Secondary zircon product is of typical special/chemical grade quality containing <1.0% TiO_2 and <1,000ppm U+Th.

Potential HiTi products were only produced for Glenaladale Main as insufficient sample was available for further testing of Mossiface material, with chemical analyses of Glenaladale Main produced products, HiTi 70 and HiTi 80 indicating products to contain elevated levels of SiO_2.

Primary ilmenite products produced contain different levels of TiO_2, but similar levels of ilmenite as identified optically, thereby suggesting varying ilmenite species with varying titanium levels. Confirmation of this would require further detailed mineralogical analyses.

Further to the above the primary ilmenite product produced, contain elevated levels of Cr_2O_3 calculated at 0.8% for Glenaladale Main and 0.6% for Mossiface. Given the TiO_2 levels and fine size range, material would be best suited as titanium smelter feed material and/or direct titanium dioxide pigment manufacture. For this to occur Cr_2O_3 levels are required to be <0.1%.

3.2.2 Ilmenite Product Test Work

A representative sample produced from the Glenaladale Main potential ilmenite was submitted for sulphuric acid solubility test work with CSIRO, detailed QEMSCAN analyses with Amdel – Bureau Veritas and an undisclosed titanium smelter operator to determine Cr_2O_3 solubility, free chromite and potential titanium slag quality respectively.

Cr_2O_3 Solubility

Sulphuric acid solubility test work completed under standard CSIRO conditions indicated that the produced Glenaladale Main ilmenite had a TiO_2 solubility of 89.4%, with soluble Cr_2O_3 content of 0.20 wt%. For material to be suitable as a feedstock for sulphuric acid titanium dioxide production soluble Cr_2O_3 levels are required to be <0.1%, with data suggesting overall Cr_2O_3 levels will need to be reduced to <0.4%, so as to meet this specification.

Chromite Deportment

In order to ascertain the deportment of the chromite within the produced ilmenite product from Glenaladale Main, a sample was submitted for QEMSCAN analyses with Bureau Veritas – Amdel. Mineral abundance data indicate the ilmenite product to contain 1.93% chromite of which 69.93% was 100 % liberated. Making use of this data the associated liberated Cr_2O_3 level is calculated to be 0.55% and assuming 100% removal, associated Cr_2O_3 is calculated at 0.25%.

Potential Titanium Slag Quality

Preliminary titanium slag test work completed on the produced Glenaladale Main ilmenite product indicate that a potential titanium slag containing 84.6% TiO_2 could be produced but that it contained elevated levels of Cr_2O_3 and MgO calculated at 1.38% and 3.04% respectively.

3.2.3 Ilmenite Product Upgrade Test Work

Given the fact that 69.93% of the chromite contained within the ilmenite is liberated applying proven physical separation methodologies such as roasting could reduce the overall Cr_2O_3 levels to within the theoretical calculated liberated levels of 0.25%. In order to test this, additional material was prepared and submitted to Austpac Resources for testing of its low temperature roasting technology and magnetic fractionation.

Low temperature roasting "LTR" methodology and process as developed by Austpac Resources enhances the magnetic separation of iron bearing mineral sands, by continuous fluid bed roasting with reducing gases at <650°C, which is below the temperature where significant rutilisation occurs. Unlike high temperature roasting the ilmenite product from LTR is amenable to the manufacture of sulfate pigment or smelter feed stock.

Data from this test work indicated that ilmenite material to be amenable to low temperature roasting and fractionation, producing a final ilmenite product containing 53.7% TiO_2 and 0.19% Cr_2O_3. Full chemical analyses are included as per Table 3.4.

Table 3.4: Low Temperature Roast Produced Product

	Conductor Fraction	LTR Product
TiO2	49.69	54.06
Fe2O3	43.25	44.72
SiO2	1.67	0.67
Al2O3	1.33	0.48
Cr2O3	1.18	0.19
MgO	1.88	1.92
MnO	0.93	1.05
ZrO2	0.31	0.14
P2O5	0.11	0.03
U3O8	11.27	0.00
ThO2	80.94	19.32
V2O5	0.22	0.22
Nb2O5	0.09	0.09
CaO	0.05	0.03
SO3	0.00	0.00

3.2.4 General – HiTi 90 Production, Ti Mineral Recovery Increase, Zircon Production

Further to the production of ilmenite product for further ilmenite upgrade test work from the above mentioned test program Robmet completed metallurgical test work to ascertain the potential of producing a HiTi 90 (>90% TiO_2) product within the non-magnetic mineral separation process and evaluate the impact increasing the overall

TiO_2 recovery within the wet concentration process and concentrate upgrade process would have on final production grades for the HiTi products and final zircon.

Preliminary metallurgical test work indicates that it is possible to increase the overall TiO_2 recovery within the wet concentration and concentrate upgrade circuits by 15-20%. Increased recoveries are believed to be associated with the increase of leucoxene and altered ilmenite recoveries as is evident by the production of a secondary ilmenite product containing 65.2% TiO_2 within the HiTi processing circuit. It is important to note and acknowledge that the recovery increase has been achieved utilizing wet shaking tables and would require detailed metallurgical test work to ascertain the levels of recovery increase achievable utilizing spiral separators.

Processing of a conductor concentrate through a revised HiTi processing methodology successfully produced a HiTi 90, HiTi 80, HiTi 70 and secondary ilmenite product as per Table 3.5.

Table 3.5: Potential HiTi Products (HiTi 70, HiTi 80, HiTi 90)

	Assay							
	TiO2	Fe2O3	SiO2	Al2O3	Cr2O3	ZrO2+HfO2	U XRF	Th XRF
	%	%	%	%	%	%	ppm	ppm
Secondary Ilmenite - 648	65.2	24.0	3.7	2.1	1.7	0.2	12	89
HiTi 70 - 648	75.5	7.8	10.1	2.3	0.4	0.7	42	129
HiTi 80 - 648	84.4	3.9	6.9	1.8	0.1	0.3	0.1	0.3
HiTi 90 - 648	90.7	0.5	6.2	0.9	0.1	0.2	0.0	0.3

HiTi 70 and HiTi 80 products are in line with that produced during the bulk test program. Given the low yield of the HiTi 90 calculated at 4.2% with respect to primary electrostatic circuit feed, within a continuous processing environment it is likely that only two products would be produced, HiTi 70, HiTi 80 by combining streams and fractions or limiting processing.

Zircon products produced from the abbreviated test program although containing higher levels of TiO_2 is comparable to those produced during the bulk test program as per Table 3.6.

Table 3.6: Potential Zircon Products

	Assay					
	TiO2	Fe2O3	Al2O3	ZrO2+HfO2	U XRF	Th XRF
	%	%	%	%	ppm	ppm
Primary Zircon - 486	0.14	0.05	0.1	65.5	391	222
Primary Zircon - 648	0.24	0.07	0.1	65.4	405	265
Secondary Zircon - 486	0.8	0.1	0.1	62.5	448	279
Secondary Zircon - 648	1.2	0.1	0.1	65.0	468	310

Overall metallurgical balance data based on XRF analyses indicate an overall ZrO_2 recovery to zircon product and TiO_2 recovery to titanium products of 68.5% and 46.3% respectively for the abbreviated process compared to 52.2% and 37.15% respectively for the bulk process. This increased recovery is associated with improved mineral recoveries and inclusion of semi-processed streams within the wet concentration process due to the utilization of wet shaking tables. Further metallurgical test work is required to confirm the recovery increase as appropriate when utilizing an optimized multi-stage spiral separator circuit.

3.2.5 Mineral Recoveries

Mineral recoveries for the bulk test program, predicted mineral recoveries and model recoveries are summarized as Table 3.7. Predicted/Model mineral recoveries are based on data gleaned from bulk test program data, test program to increase TiO_2

recoveries and incorporates mathematical model data, recirculation loads and semi-processed streams.

Table 3.7: Mineral Recoveries

	Test Work	Predicted	Model	Notes
WCP - Heavy Mineral Concentrate				
Ilmenite Recovery	68.1	75.0	85.0	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Leucoxene Recovery	19.1	25.0	55.0	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Rutile Recovery	91.9	95.0	95.0	
Zircon Recovery	88.4	95.0	95.0	
CUP - Magnetic Concentrate				
Ilmenite Recovery	87.8	90.0	90.0	
Leucoxene Recovery	3.1	5.0	5.0	
Rutile Recovery	4.3	4.0	4.0	
Zircon Recovery	-	-	-	
CUP - Non-Magnetic Concentrate				
Ilmenite Recovery	7.1	7.0	5.0	
Leucoxene Recovery	86.1	85.0	85.0	
Rutile Recovery	71.1	75.0	85.0	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Zircon Recovery	92.6	95.0	95.0	
MSP - Magnetic Concentrate (Ilmenite Product)				
Ilmenite Recovery	90.0	90.0	90.0	
Leucoxene Recovery	-	-	-	
Rutile Recovery	-	-	-	
Zircon Recovery	-	-	-	
MSP - Non-Magnetic Concentrate (HiTi 70)				
Ilmenite Recovery	19.4	19.5	19.5	
Leucoxene Recovery	4.0	5.5	8.5	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Rutile Recovery	25.0	27	27	
Zircon Recovery	-	-	-	
MSP - Non-Magnetic Concentrate (HiTi 80)				
Ilmenite Recovery	44.9	45.5	45.5	
Leucoxene Recovery	52.2	51.0	76.5	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Rutile Recovery	60.3	63.0	63.0	
Zircon Recovery	-		-	
MSP - Non-Magnetic Concentrate (Zircon)				
Ilmenite Recovery	-	-	-	
Leucoxene Recovery	-	-	-	
Rutile Recovery	-	-	-	
Zircon Recovery	69.8	81.2	81	Model assumes improved recoveries are achieved through Circuit Optimization and incorporation of re-circulating loads
Overall				
Ilmenite to Ilmenite Product	53.8	60.8	68.9	
Ilmenite to HiTi 70	0.9	1.0	0.8	
Ilmenite to HiTi 80	2.2	2.4	1.9	
Leucoxene to Ilmenite Product	-	-	-	
Leucoxene to HiTi 70	0.7	1.2	4.0	
Leucoxene to HiTi 80	8.6	10.8	35.8	
Rutile to Ilmenite Product	-	-	-	
Rutile to HiTi 70	16.3	19.2	21.8	
Rutile to HiTi 80	39.4	44.9	50.9	
Zircon to Zircon Product	57.2	73.3	73.1	

3.3 Process Selection

Metallurgical scoping test work completed, utilizing typical mineral sands processing methodologies and standard mineral sands processing equipment confirmed that potential products of acceptable quality, with acceptable mineral recoveries could be produced from Glenaladale Main ore.

Selected process would incorporate typical mineral sands processing stages to produce a potential primary zircon product, secondary zircon product, HiTi 70/HiTi 80 products and primary/secondary ilmenite products. Selected process would consist of several processes to achieve this and will include but not limited to a feed preparation process, concentrate upgrade process and mineral separation process. Final process selection with respect incorporation of additional stages to produce a HiTi 90 product and ilmenite low temperature roast product would be subject to further evaluation.

4 MINING

AMC Consultants Pty Ltd (AMC) were engaged by Oresome to prepare a resource block model and Mineral Resource estimate, suitable for reporting in accordance with the JORC Code, for the Glenaladale Deposit.

Following is a summary of the works carried out. The complete report and supporting data are included at Appendix 2.

4.1 Mineral Resource Estimate

AMC considers a 1% HM cut-off grade is a reasonable value based on current market trends with increasing prices for zircon, rutile and other titanium minerals and developments in mineral processing costs.

The Mineral Resource above a cut-off of 1% HM is shown in Table 4.1.

Table 4.1: Mineral Resource above a Cut-Off of 1% HM

Resource Area	Tonnes (M)	HM (%)	Slimes (%)	Contained HM (Mt)
Inferred VHM assemblages Mineral Resource	360	2.7	24.7	9.7
Inferred Mineral Resource: No VHM assemblages estimate	1,350	2.1	24.3	29
Total	1,170	2.2	24.4	38

Note: The total may not equal the sum of the individual vales due to rounding.

A portion of the Inferred Resource has been further qualified by an estimation of the grades of mineral assemblage data for valuable heavy minerals (VHM) comprising zircon, rutile, altered ilmenite, leucoxene and monazite. The ilmenite, altered ilmenite and leucoxene have been combined into a variable called “other titanium minerals” by summing their percentages within the HM fraction.

Due to the lack of VHM drill hole data, block values for these minerals were obtained from the mean statistical value for each domain. The inferred VHM assemblage Mineral Resource is shown in Table 4.2. The zircon, rutile, other titanium minerals and monazite grades are shown as a percentage of the HM.

Table 4.2: Inferred VHM Assemblage Mineral Resource Above a Cut-Off of 1% HM

Category	Tonnes (Mt)	HM (%)	Zircon (%)	Rutile (%)	Other Titanium (%)	Monazite (%)
Inferred	360	2.7	15	4	50	0.6

Note: Other titanium minerals are the sum percentage of ilmenite, altered ilmenite and leucoxene.

Rio Tinto Exploration carried out drilling in the Gippsland Basin from 2002. They drilled 180 RC holes in the area, with 3,776 samples being assayed for HM (%) and slimes (%). Of these samples, 460 were assayed for assemblage minerals including but not restricted to, rutile, leucoxene, ilmenite, altered ilmenite, low Ti ilmenite, zircon and monazite. OSA drilled an additional eighteen holes in 2011.

The Mineral Resource, reported in the Resource Estimate for the Glenaladale Mineral Sands Deposit (AMC 111117 : April 2012) document included at Appendix 2, was estimated using ordinary Kriging and block modelling.

4.2 Mining Method

For this conceptual study AMC adopted a method of mining used in similar style deposits. The material to be mined is classified as soil, overburden and ore.

The ongoing mining process will return the area to a similar landform, only leaving a void in the final mining block and the initial overburden stockpile.

4.2.1 Topsoil and Subsoil

Mining will require the removal of vegetation and sufficient soil to progress the mine. Topsoil and subsoil are to be stripped from the mine path, stockpiled separately, adjacent to the mining area to be returned to the same location upon completion of mining. Topsoil under the subsoil stockpiles will also be stripped and stockpiled.

Soils will be stripped and replaced using pull scrapers or similar.

4.2.2 Overburden

Overburden will be mined in advance of the ore with conventional trucks and excavators. Overburden will be directly placed onto consolidated tails if sufficient void is available. Initially, overburden will be stockpiled adjacent to the mining void.

4.2.3 Ore

Ore will be directly fed into the Mining Unit Plant (MUP) using a dozer trap system, similar to the methods used in similar mineral sands mining operations. Oversize screened by the MUP trommel will be returned to the excavation. The remainder of the ore, as a slurry, will be pumped to the Wet Concentrator Plant (WCP).

4.2.4 Tails

Tails will be returned to the mining void in cells defined by overburden bund walls. When tails have consolidated sufficiently, overburden and soil will be placed on top.

Initially a surface Tailings Storage Facility (TSF) will be required. The initial TSF will contain the tailings from the WCP and Mineral Separation Plant (MSP).

4.3 Mining Schedule

Whittle shells were generated, then divided into areas (mining blocks) to provide a logical progression of mining and to enable higher value areas to be mined early in the schedule.

Table 4.3 summarises the contents of the mining blocks used in the schedule.

In order to optimise the schedule, shells smaller than the highest cash surplus shell were chosen for each mining block. This decision improved the initial cash flow and the discounted value by increasing the grade of each block. The blocks are listed in the proposed mining sequence.

Table 4.3: Mineral Resource Above a Cut-Off of 1% HM

Item	Unit	Mining Block									
		2	3	4	1	8	6	5	9	7	Total
Whittle	Shell	65	65	65	70	65	65	65	65	65	
Total	Mt	53.1	24.2	10.5	22.6	38.4	22.2	147.6	41.1	94.2	**453.9**
Ore	Mt	20.5	13.7	4.9	11.6	8.3	16.1	104.0	14.9	69.3	**263.4**
Slimes	%	21.8	20.4	25.0	22.1	20.8	24.5	27.0	22.6	24.8	**24.8**
HM	%	4.5	3.2	3.6	3.1	4.0	2.2	2.5	2.8	2.2	**2.7**
Zircon	% of HM	21.8	19.4	20.3	18.7	21.3	15.9	13.0	19.3	13.2	**16.0**
Rutile	% of HM	6.3	5.8	5.9	5.5	6.2	4.9	3.7	5.6	3.7	**4.6**
Leucoxene	% of HM	11.5	12.9	12.2	13.1	11.9	14.6	15.5	13.0	14.5	**14.0**
Ilmenite	% of HM	37.4	36.2	36.5	35.5	37.2	34.1	31.5	35.9	31.9	**33.6**
HMCon.	kt	675	326	130	263	248	262	1,923	302	1,109	**5,237**
Zircon	kt	146.2	63.1	26.2	49.0	52.5	41.5	249.3	58.2	146.1	**832.1**
Ilmenite	kt	184.3	86.1	34.5	68.1	67.2	65.0	442.4	79.2	257.8	**1,284.6**
HyTi70	kt	19.7	9.2	3.7	7.2	7.2	6.9	43.9	8.4	25.0	**131.1**
HyTi80	kt	74.1	36.7	14.2	29.2	27.4	29.8	209.8	33.7	116.1	**571.0**

A summary of the mining schedule is shown in Table 4.4.

Table 4.4: Mining Schedule

Year	Total Mt	Ore Mt	Slimes %	HM %	Zircon % of HM	Rutile % of HM	Leucoxene % of HM	Ilmenite % of HM	HM Con. kt	Zircon kt	Ilmenite kt	HyTi70 kt	HyTi80 kt
1	20.0	7.7	21.8	4.5	21.76	6.33	11.50	37.44	254	55.0	69.3	7.4	27.9
2	20.0	7.7	21.8	4.5	21.76	6.33	11.50	37.44	254	55.0	69.3	7.4	27.9
3	24.3	11.4	21.0	3.8	20.67	6.08	12.17	36.86	317	65.2	85.2	9.1	35.2
4	21.5	11.4	22.0	3.4	19.76	5.83	12.65	36.31	280	55.2	74.3	7.9	31.3
5	29.8	13.7	22.2	3.2	19.13	5.59	12.88	35.78	321	61.2	83.9	8.9	35.7
6	42.1	13.7	22.6	3.2	19.51	5.76	12.77	36.14	319	62.0	84.2	9.0	35.7
7	19.0	13.7	25.2	2.3	14.97	4.48	14.88	33.24	231	34.5	56.1	5.8	26.0
8	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
9	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
10	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
11	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
12	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
13	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
14	19.4	13.7	27.0	2.5	13.01	3.66	15.49	31.53	253	32.8	58.2	5.8	27.6
15	32.2	13.7	23.9	2.7	17.50	5.05	13.69	34.63	270	47.1	68.3	7.1	30.0
16	26.2	13.7	23.9	2.4	15.99	4.59	13.78	33.69	242	38.6	59.5	6.0	26.1
17	18.6	13.7	24.8	2.2	13.23	3.73	14.46	31.88	219	28.8	50.9	4.9	22.9
18	18.6	13.7	24.8	2.2	13.23	3.73	14.46	31.88	219	28.8	50.9	4.9	22.9
19	18.6	13.7	24.8	2.2	13.23	3.73	14.46	31.88	219	28.8	50.9	4.9	22.9
20	18.6	13.7	24.8	2.2	13.23	3.73	14.46	31.88	219	28.8	50.9	4.9	22.9
21	8.6	6.3	24.8	2.2	13.23	3.73	14.46	31.88	101	13.3	23.5	2.3	10.6

5 CONCEPTUAL DESIGN

5.1 Process Design Criteria

The process criteria used in the design of the plant are summarised below:

Throughput: 11.1 Mtpa of ROM ore or 1500 tph of ROM ore.

WCP: process 1485 tph ROM ore

CUP: process 47 tph HMC

MSP: process 14.9 tph mags and 21.2 tph non-mags

Plant availability: 85% per annum or 7400 hours per annum

Beneficiation plant battery limits: Feed starts from ROM feed to the MUP; co-disposed discharge of slimes, tails and rejects into the mining void; bagged products - Primary and Secondary Zircon and HiTi; bulk products - primary and secondary Ilmenite.

Solids SG's: Zircon (4.7), Ilmenite (4.7), Rutile (4.2 – 4.3)

Water: assumed bore water with a Total Dissolved Solids <1200 ppm

CUP / MSP Feed Moisture: 8%

5.2 Process Flow Diagram

An Engineered Block Process Flow Diagram (PFD) 581-G-PF-0000-0001 Rev B, is included at Appendix 3 and has been developed based on metallurgical flowsheets provided by Robbins Metallurgical. These flowsheets form the basis of this study.

5.3 Material Balances

Material balances are listed in table 5.1.

Table 5.1: Material Balance

Material	TPH
ROM	1500
MUP Screened Oversize	15
Slimes	369.4
WCP Screened Oversize	7.4
Tails	1083.8
Zircon Primary	5.6
Zircon Secondary	2.2
Ilmenite Primary	9.7
Ilmenite Secondary	4.2
HiTi	2.6

5.4 Development Approach

Conceptual design was based on the key processing facilities:-

- Two mobile Mining Unit Plants (MUP's);
- Wet Concentrator Plant (WCP);
- Concentrate Upgrade Plant (CUP); and
- Mineral Separation Plant (MSP).

The MUP's will be designed to handle a nominal 750tph of run of mine (ROM).

The WCP will be designed to process the material from the MUP and produce a heavy mineral concentrate (HMC).

The CUP will be designed to process HMC received from the WCP to produce a magnetic and non magnetic product.

The MSP will be designed to process the magnetic and non-magnetic products from the CUP to produce the final products.

5.5 Process Description

5.5.1 Mining Unit Plants

Two (2) MUP's have been included in the scoping study. Each skid mounted MUP will be mobile, independently operated and capable of handling 50% of the total design ROM.

The MUPs will receive, screen, wash and pulp the ROM before pumping the pulp to the WCP trommel for further wet processing.

Each MUP will comprise of the following:-

- Skid mounted dry feed module which will:-
    - Be fed ROM by front end loaders or similar dry mining equipment;
    - Coarsely screen and receive ROM into an apron feeder;
    - Feed the ROM onto an inclined conveyor; and,
    - Deliver the ROM to the pumping module.
- Skid mounted pulping module which will:-
    - Wash, with high pressure water sprays, and further screen the ROM received from the dry feed module;
    - Pulp the screened undersize in a process bin;
    - Pump the pulped material to the WCP trommel; and,
    - Discharge the screened oversize onto a trash conveyor for disposal.

5.5.2 Wet Concentrator Plant

The WCP will process the pulp received from the MUPs to produce a HMC product. Waste from the WCP is comprised of slimes and tails.

The WCP will further screen and wash the pulp received from the MUPs before diluting the pulp prior to desliming.

Desliming will be carried out by hydrocycloning. Overflows (slimes) from the hydrocyclones will report to a thickener and underflows (mineral sands) will be pumped to a gravity spiral concentration circuit.

The thickener will be dosed with flocculant to assist settlement of the slimes. The thickener overflow will be returned to a settlement dam for recycling and underflow (slimes) will be co-disposed with the sand tails from the gravity concentration stage.

The gravity concentration stage will produce dewatered HMC and tails. HMC will be transferred to the CUP using Front End Loaders (FEL). Tails will be dewatered by hydrocycloning prior to co-disposal with the thickener underflow and rejects from other processes. The co-disposal stream will also be dosed with flocculant prior to being returned to one of the mining voids. Overflows from the tails dewatering hydrocyclone clusters will be returned to a settlement dam for recycling.

The WCP will, where practical, comprise two (2) identical process streams. Each stream will receive pulp from only one (1) MUP. The WCP will therefore be capable of operating if only one (1) MUP is in operation (eg whilst one MUP is relocated to operate in another section of the mine lease).

The WCP will be in a permanent location and strategically situated such that it is central to the Glenaladale main ore body to be mined. The maximum distance from either MUP to the WCP shall be 2,000 m.

The main items which comprise the WCP are as follows:-

- Trommel to screen and wash the pulp received from the MUPs;
- Trommel oversize trash conveyor;
- Hydrocyclone clusters for pulp desliming;
- Hydrocyclone clusters for dewatering sand tails prior to co-disposal;
- Thickener;
- Flocculant plants;
- In line mixer for mixing flocculant with the co-disposal stream;
- Gravity spirals to concentrate mineral sands;
- Hydrocyclones to dewater HMC;
- Process bins and slurry pumps; and,
- Water tanks and water pumps.
- HMC Stockpiles

5.5.3 Concentrate Upgrade Plant

The CUP will be permanently located near the WCP, however will be capable of operating independently to the WCP.

The CUP will process HMC delivered by FEL from the WCP HMC stockpiles to produce a non-magnetic and magnetic concentrate. Waste from the CUP will comprise of tails.

HMC delivered to the CUP will be screened and pulped prior to further processing. The pulp will then be pumped through a Low Intensity Magnetic Separator (LIMS), Wet High Intensity Magnetic Separator (WHIMS), a gravity concentration stage and dewatering stage.

Highly susceptible magnetic material from the LIMS will be pumped to the WCP for co-disposal with tails/slimes.

Weakly magnetic material from the LIMS will be pumped to the WHIMS.

The magnetic material from the WHIMS will be dewatered by hydrocycloning. The dewatered magnetic concentrate will be delivered by FEL to the ilmenite circuit in the MSP.

Non magnetic material from the WHIMS will be pumped through the gravity concentration stage.

The gravity concentration stage will produce a dewatered non-magnetic concentrate and tails. The non-magnetic concentrate will be delivered by FEL to the rougher HTR circuit in the MSP. Tails will be pumped to the WCP for co-disposal with tails/slimes.

Overflows from hydrocyclones will be recycled as process water within the CUP.

The main items which comprise the CUP are as follows:-

- Feed Hopper;
- Inclined conveyor to receive HMC;
- Vibrating screen to screen and wash the HMC prior to pulping in a process bin;
- Vibrating screen oversize trash conveyor;
- LIMS;
- WHIMS;
- Gravity spirals to concentrate weakly magnetic material;
- Hydrocyclones to dewater magnetic concentrate and non-magnetic concentrate;
- Process bins and slurry pumps;
- Magnetic and Non-Magnetic stockpiles
- Solids trap; and,
- Water tanks and water pumps.

5.5.4 Mineral Separation Plant

Rougher HTR Circuit

The rougher HTR circuit is located in the dry MSP which is in a permanent (location near the WCP) central to the lease.

The rougher HTR circuit will process the non-magnetic concentrate received from the CUP to produce a non-conductive concentrate and a conductive concentrate. Waste from the rougher HTR circuit will report to rejects.

Non-magnetic concentrate will be dried and then fed through a series of high tension roll separators to produce a conductive concentrate and non-conductive concentrate.

The conductive concentrate will be conveyed to the HiTi circuit for further dry processing.

The non-conductive concentrate will be processed through a series of rare earth roll magnetic separators to produce zircon enriched concentrate and reject streams.

The zircon concentrate will be fed to the wet zircon circuit for further wet processing.

The rejects will be conveyed to a reject bin for ultimate co-disposal with the WCP tails/slimes.

A dust scrubber system will collect dust from dry material transfer points within the MSP.

The main items which comprise the rougher HTR circuit are as follows:-

- Feed Hopper
- Inclined conveyor;
- Fluid bed dryer;
- Rotary screen to remove oversize after drying;
- Reheaters;
- High tension roll separators;

- Rare earth roll magnetic separators;
- Dry bulk bins;
- Belt conveyors;
- Bucket elevators;
- Rotary table feeders;
- Vibrating feeder;
- MSP dust scrubber and associated exhaust fan, exhaust stack, process bin, slurry pump, spray water pump and sump pump.

HiTi Circuit

The HiTi circuit is also located in the dry MSP, and will process the conductive concentrate received from the rougher HTR circuit to produce a HiTi product. Waste from the HiTi circuit will comprise strategic rejects and rejects.

Conductive HiTi concentrate will be reheated and then fed through a series of high tension roll separators to produce a conductive stream and a non-conductive stream (strategic rejects).

The conductive stream will be processed through an induced roll magnetic separator to produce a non-magnetic HiTi product and a magnetic concentrate (rejects).

The HiTi product will be bagged for transport and sale.

The HiTi circuit strategic rejects and rejects along with the strategic rejects and rejects from other circuits will be pulped and then pumped to the WCP for co-disposal with tails/slimes.

The main items which comprise the HiTi circuit are as follows:-

- Reheater;
- High tension roll separators;
- Induced roll magnetic separator;
- Dry bulk bin;
- Product bagging station;
- Belt conveyors;
- Bucket elevators;
- Process bins and slurry pumps; and,
- Sump pump.

Wet Zircon Circuit

The wet zircon circuit will further upgrade the non-conductive concentrate received from the rougher HTR circuit.

The gravity concentration stage will produce a dewatered zircon concentrate and tails.

Tails will be pumped to the WCP for co-disposal with tails/slimes.

Overflows from hydrocyclones will be recycled as process water within the wet zircon circuit.

The main items which comprise the wet zircon circuit are as follows:-

- Gravity spirals;
- Hydrocyclones for dewatering;
- Shaking tables;
- Belt filter for dewatering;
- Process bins and slurry pumps;
- Solids trap for solids recovery;
- Water tanks and water pumps; and,
- Sump pump.

Dry Zircon Circuit

The dry zircon circuit, located in the dry MSP, will process the zircon concentrate stream from the wet zircon circuit to produce primary and secondary zircon products. Waste from the dry zircon circuit will comprise of strategic rejects and rejects.

Zircon concentrate will be dried and then fed through various stages of high tension roll separators and induced roll magnetic separators to produce primary and secondary zircon product.

The zircon products will be bulk bagged for transport and sale.

The dry zircon circuit rejects will be co-disposed with the WCP tails/slimes.

The main items which comprise the dry zircon circuit are as follows:-

- Feed Hopper
- Inclined conveyor to receive the zircon concentrate stream from the wet zircon circuit;
- Fluid bed dryer;
- Rotary screen to remove foreign material after drying;
- Reheaters;
- High tension roll separators (HR's);
- Induced roll magnetic separators;
- Dry bulk bins;
- Product bagging stations;
- Belt conveyors;
- Bucket elevators; and,
- Rotary table feeder.

Ilmenite Circuit

The ilmenite circuit, located in the dry MSP, will process the magnetic concentrate received from the CUP to produce primary and secondary ilmenite products.

Magnetic concentrate will be dried and then fed through a series of high tension roll separators and rare earth roll magnetic separators to produce primary and secondary ilmenite.

The non-conductive concentrate will constitute rejects.

Primary and secondary ilmenite will be transported in bulk containers for sale.

The ilmenite circuit rejects will be pulped and then pumped to the WCP for co-disposal with tails/slimes.

The main items which comprise the ilmenite circuit are as follows:-

- Feed Hopper
- Inclined conveyor to receive magnetic concentrate from the CUP;
- Fluid bed dryer;
- Rotary screen to remove foreign material after drying;
- High tension roll separators;
- Rare earth roll magnetic separators;
- Dry bulk bins;
- Belt conveyors;
- Bucket elevators;
- Rotary table feeder;
- Process bin and slurry pump; and,
- Sump pump.

5.5.5 Process Water

Process water will be pumped from the process water dam to the WCP water tank and to the MUP's.

Process water for the WCP and CUP will be pumped from the WCP water tank.

Process water for the dust scrubber, strategic pulping bin and other rejects pulping bins will be sourced from the CUP.

Co-disposed slimes/tails will be pumped to one of the mining voids from which water will overflow into an adjacent dam. The overflow will then be pumped to a settlement dam in the vicinity of the WCP.

Overflows from the WCP thickener and from the WCP tails dewatering hydrocyclone clusters will also report to the settlement dam.

The settlement dam will overflow to the process water dam.

5.6 Auxiliary Plant, Utilities and Localised Infrastructure

On site auxiliary plant and utilities will service the plant and include:-

- Electrical infrastructure;
- Access roads;
- Security hut, fencing and access gate;
- Mine vehicle wash down bay and general tyre wash;
- Workshop and store;
- Office complex complete with workstations, toilets, lunch room, first aid and a small laboratory;

- LPG gas storage bullet and reticulation;
- Packaged sewage treatment plant and reticulation;
- Field amenities units for MUP;
- Fire and emergency services.

5.7 Optional Low Temperature Roasting Plant

Data from metallurgical testwork as per Section 3.2.3 of this report indicated the ilmenite material to be amenable to low temperature roasting and fractionation.

Should this optional processing of the Ilmenite be required the Low Temperature Roasting (LTR) plant would be located adjacent to the dry MSP, whereby the conductive streams from the HR's would be conveyed to the LTR plant.

The AUSTPAC LTR plant will essentially comprise of two structures, one will contain the pre-heater and LTR fluid bed vessels installed in an offset vertical arrangement including the wet scrubbing units. The second, mechanically isolated structure will contain the magnetic separation equipment to prevent interference from the fluid bed equipment due to low frequency vibrations.

This process would produce a primary ilmenite product.

The rejected streams can be returned to the WCP for co-disposal with tails/slimes.

5.8 Proposed Site Location and Layout

The proposed site location drawing 581-G-SL-0000-0051 and site layout drawing 581-G-SL-0000-0052 are included at Appendix 4.

6 PRELIMINARY SCHEDULE AND CONSTRUCTION

6.1 Preliminary Schedule

Preliminary Schedule 581-PM-SCH-0000-8005 is attached at Appendix 5.

It is estimated the Engineering, Procurement, Construction and Commissioning phase of the project is 118 weeks.

The schedule is indicative only and will change dependant lead times of services and equipment at the time of tender / procurement.

6.2 Human Resources

Human resources for the initial construction phase would be sourced both locally and interstate. Staffing of the ongoing operation would see a large proportion of the workforce preferably being sourced from the local Gippsland surrounding area to facilitate a commuter style workforce rather than fly in fly out or site based camp.

This approach mitigates the potential for industrial relations issues, bolsters community support for the project and ensures employment in the local shire and surrounding areas.

7 INFRASTRUCTURE

7.1 High Voltage Power Supply

SP Ausnet manages the electricity network for the Gippsland region. An application was submitted to SP Ausnet for the provision of 11.3MW per hour, to be provided to the assumed plant location on the west side of the Fernbank-Glenaladale Road and Bairnsdale - Dargo Road intersection.

Points of note with regards to HVPS supply:

- Power lines can be installed in T or Loop circuits.
- T Circuit = Single circuit which equates to cheaper installation cost, however; power outages will impact the plant.
- Loop Circuit = Double circuit costing 1.5 to 2 times more than the T circuit, however; power outages will not impact the plant.
- Zone Substation is required, and on site is preferred. SP Ausnet recommends two transformers to provide redundancy and therefore greater reliability.

For the purpose of this study budget pricing for T circuit, single substation has been included, however, further investigation and risk mitigation of interruptions to supply need to be addressed prior to determining final power supply requirements.

SP Ausnet, Networks Strategy and Development Division advised that there is a suitable location approximately 5 kilometres from site where a T junction can be tapped into existing 66kV line. This will require the following upgrades and additions to existing infrastructure:

1. Switching Station – 1 x 66kV CB and associated isolators, protection and control. Infrastructure e.g. civil, structural, AC & DC supplies, buildings.
2. Zone Substation – 1 x 66kV CB, 66/22kV Tx and 4 x 22kV CB and associated protection and control. Infrastructure e.g. civil, structure, AC & DC supplies, buildings.
3. 5km of new 66kV lines built over existing SWER line.

Budget pricing provided for these works is AUD14.5 Million.

The following assumption applies to the budget quotation provided:

- The Zone Substation is to be within the site boundary.

The following exclusions apply to the budget quotation provided above:

- Purchase or negotiations for land to build the Switching Station and Zone substation;
- High Voltage reticulation within the site;
- Negotiations and compensation associated with the new 66KV registered easement required over the public property;
- Costs associated with vegetation clearing or approvals;
- Costs associated with Cultural, Heritage & Vegetation reports/approvals.
- Costs to upgrade any of the existing MFA-BDSS No1 66kV line;
- Costs associated with increased BPS generation requirements;
- Ground conditions have not been assessed and the pricing does not reflect possible wet ground and access issues;

- No system study has been carried out and thus the option described may change significantly.
- No easement allocations have been incorporated in the pricing and will be the responsibility of the customer to obtain.

In light of the above exclusions a PC SUM of AUD2 Million has been included in the CAPEX to cover Environmental, Cultural Heritage and access fees based on historical project costs for similar works.

7.2 Water

4.6 Gl which equates to 172 litres per second (l/s) is required as make up water. The local agricultural industry use the Mitchell River and shallow aquifer as their water supply, therefore the preferred option is to access the deeper non allocated aquifer in the Lindenow region.

A pilot bore is currently under construction and results will not be available prior to submission of this scoping study.

Capital costs for a borefield based on conservative 12.5 l/s bores have been included.

Should the aquifer not be productive an alternative option may be to construct a 5 - 10 Gigalitre holding dam using seasonal melt run off from the Mitchell River. Should the need to progress with building the dam become apparent, liaison with the Victorian State Government and Water Authority would be required.

The construction of this dam would become a state government, in conjunction with the local water authority, project. Costs associated with the construction of this dam are unable to be estimated as the regulatory requirements are unknown at this time.

A further alternative would be to negotiate with local producers for excess water allocations. However, the perception at this point in time is that there would be strong community resistance and cost control on the purchase of the excess allocations would be uncertain.

At this time the proposed borefield water supply quality is assumed to have low salinity and total dissolved solids (TDS) below 1200ppm which is suitable for product wash water. If it is evident that the TDS exceeds 1200ppm a Reverse Osmosis plant will be required to produce fresh process water for final product wash purposes. This is normally introduced into the final concentrate bin at the WCP plant.

7.3 Gas

Gas is required for the Fluid Bed Dryers located in the Mineral Separation Plant. Both Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG) options have been investigated for the purpose of this study.

LPG – There are no capital costs associated with LPG, however there is an annual facility fee of approximately $16,000.00. Cost of LPG fluctuates monthly based on changes in the Saudi CP and USD AUD exchange rates. Supply & demand will also impact the cost of LPG, thereby making it difficult to estimate annual operating costs associated with LP gas supply.

LNG - Supply of LNG is more complex and needs to be tailored to individual operational requirements. There are capital costs associated with LNG however operating costs are lower and as a rule increase along with CPI annually, making it easier to forecast annual operating expenditure. Due to the higher capital cost versus lower operational cost, LNG only becomes a viable option when there is continual usage for a period in excess of 5 years to recoup the additional capital expenditure.

It should be noted that during extended plant shutdown periods, in excess of a week, there will be LNG losses through vaporisation that are not experienced when using LPG.

Indicative capital costs for LNG installation is $125,000 with a lead time of 12 months including design.

LPG costings have been used at this early study stage. However, LNG options should be investigated during the next study phase to firm up capital / operating costs enabling a more accurate comparison to the LPG.

7.4 Fuel

Diesel will be required for mining, processing and mine support mobile equipment. Costs for a fuel farm and bowser have been included in the capital estimate.

7.5 Freight & Logistics

For the purpose of this report, the following assumptions have been made regarding freight and logistics:

- Haulage will be from Glenaladale site to Pt Anthony.
- Zircon and Hi Ti products will be transported in 2 tonne bulka bags loaded into 20 tonne net, six meter ISO shipping containers.
- Ilmenite will be transported as dry, free flowing bulk (bulk density 2400 - 2700 kg/m3) in B-Double trucks.

Figure 7.1 depicts the proposed site location with respect to Port Anthony, Port Hastings, Port Melbourne and the Port of Geelong.

Between the Plant Location "pin" and Fernbank-Glenaladale Turn Off "pin" is the Fernbank-Glenaladale Road. The Princes Highway then runs from the Fernbank-Glenaladale Road turn off to Sale and continues towards Melbourne. The route to Port Anthony will utilise the South Gippsland Highway, see Figure 7.6 for more detail.

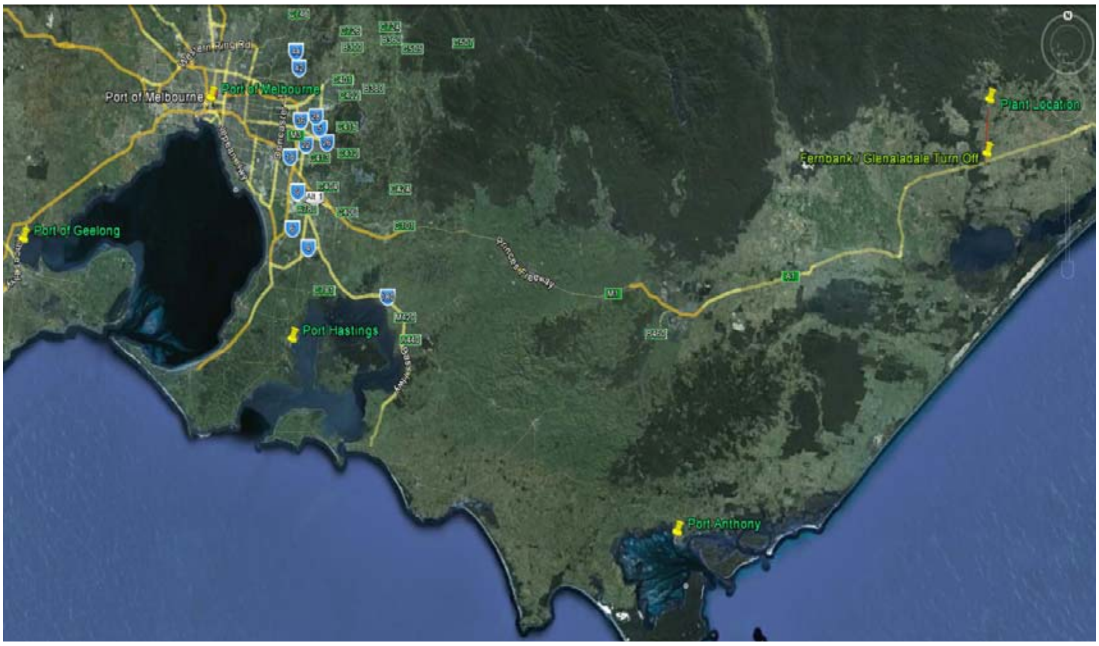


Figure 7.1 Glenaladale Site in relation to Port locations

7.5.1 Roads

The Department of VicRoads Eastern Region was contacted to source information regarding haulage routes, regulations, financial obligations (ie. govt fees payable / road/infrastructure upgrade responsibility) that need to be complied with.

Roads in Victoria are managed by either the state government or local council. Roads listed within the "Declared Arterial Road Network", accessible on the VicRoads website, are managed by the state government. All other roads are managed by the local councils. Planning permits will need to be submitted to local councils for all road upgrades required within their jurisdiction.

The developer is required to commission a Traffic Impact Assessment (TIA) on the proposed haulage route, inclusive of both state government and local roads. This assessment investigates the impact to road safety and traffic controls, for example, use and adequacy of turning lanes, roundabouts, traffic lights etc. This report is then submitted to VicRoads for review, comment and conditions that may be imposed upon the developer.

There are various companies within the local area that can carry out a TIA, and the cost associated with the report is approximately $5000.00. This cost has been included in the Capital Estimate.

VicRoads will also conduct an investigation into whether there will be additional maintenance costs on the state managed roads as a result of the increased volume of traffic. Should an increase in maintenance costs be identified this will be passed on to the developer. Vicroads cannot supply indicative costs for this until a TIA and investigation into the proposed route are carried out.

Any proposed route between site and Port Anthony will require the use of both local and state government roads. Preliminary discussions with VicRoads have indicated the main areas of concern may be the intersection at Fernbank-Glenaladale Road / Princes Highway and passage through the town of Yarram due to local community resistance to recently increased levels of traffic. The TIA will address the road issues and early community engagement should be considered to decrease local community resistance.

For the purposes of this study a capital sum of AUD 6 Million has been included for a TIA, the construction of 3 kilometres of turning lanes for site access, entry onto the Princes Highway, entry to Pt Anthony, upgrade of the Fernbank-Glenaladale Road / Bairnsdale-Dargo Road intersection and upgrade of the Fernbank/Glenaladale road.

7.5.2 Rail

There are no existing rail facilities that service Port Anthony, the assumed port for export of product, and no future rail developments planned for that area, therefore rail investigations in relation to this study have been limited.

Department of Transport Victoria has provided high level information with regards to existing and proposed rail infrastructure within the Bairnsdale / Melbourne regions. They advised that Port of Hastings, situated between Port Anthony and Melbourne, is still at the planning stage for being upgraded, but has the potential for direct rails links for bulk & containers in the longer term.

Rail at this stage is not a feasible method of transport, however further investigation over the life of mine may be warranted should the project proceed to pre feasibility stage.

7.5.3 Ports

There are multiple ports from which the final products can be exported. These ports are listed below with brief description of their available facilities and capabilities. Figure 7.1 shows the port locations with respect to the proposed plant site.

Port Anthony: Located approximately 166 km's from site and privately owned, Port Anthony will be the most cost effective port solution. Government funding of 2 million dollars to further develop the Port Anthony facility was provided under the Gateway to Growth scheme.

It is anticipated that Stage 1 civil works, supporting facilities and infrastructure to handle export capacity of 1 million tonnes per annum will be completed by 1Q 2013. Port Anthony will operate as a bulk shipment port, with brown coal being anticipated as the major export from the port.

Once stage 1 dredging is complete it is anticipated that Multi-Purpose Vessels (MPV) able to load containers, bags and bulk, will call directly to the berth. See Figures 7.2 and 7.3 for typical (MPV's). These ships will be able to load cargo to 10,000 tonnes.

Figure 7.2 Multi-Purpose Vessel with containers

Figure 7.3 Bulk Loading

Larger product shipments in excess of 10,000 tonnes will require transhipment of approximately Eight (8) nautical miles by barge into the open waters where transfer to a larger vessel will take place. The costs associated with transhipment have been advised by Port Anthony at less than $8 per tonne.

Proposed stage 2 works will increase port capacity and related infrastructure (i.e. roads) to handle export capacity between 20 – 50 million tonnes per annum. An environmental effects statement will be required prior to these works and approvals may be hindered by protected "seagrasses" located within the vicinity of the port.

At this stage the MPV should be suitable to export the ilmenite in bulk and zircon, HiTi products in bulka bags. See figures 7.4 and 7.5 for bulka bag transport and loading.

Figure 7.4 Bulka Bags in Containers

Figure 7.5 Bulka Bags in the ships hold

Port Anthony have advised that any required infrastructure to store the proponent's bulk product at the port will be provided, owned and operated by the stevedoring company or port owner, but funded as a capital investment loan by the proponent. The loan will then be repaid by the stevedoring company at a discount per tonne across the wharf.

Costs are dependent on volumes of throughput, and if throughput is lower then costs may change slightly.

Storage of containers as required on site will be on existing hardstand area which is currently available. If in the future this hardstand area storage is not available, any additional storage area required to be constructed for the containers will be at the proponent's expense.

Pricing summary for all products FOB Port Anthony is as follows:

Bulk Products - $31.50 per tonne.

Container Products (packaged in Bulka Bags) - $54.00 per tonne.

Prices for container road transport include return of empty containers to Glenaladale.

Port Hastings: Located between Port Anthony and Melbourne, Port Hastings is a government owned asset used for bulk fuel and steel products. Currently earmarked for further development, Port Hastings does have limited options for on site storage at this stage however storage cannot be guaranteed in 3 – 5 years. Port Hastings should be investigated further as an alternate option should Port Anthony not be developed as planned.

Port of Geelong: Victoria's major dry bulk product. The Port of Geelong does not have on site product storage. Indicative costs for the storage, transport from store to port and loading bulk product are $26.00 per tonne. Itemised costs as provided by the port are as follows:

- Storage approximately 20 minutes from port (receipt, store & unload trucks) - $13.50 per tonne.
- Transport from store to wharf - $4.00 per tonne,

- Load cargo from wharf to ship using shore cranes - $8.50 per tonne

Indicative costs from AG-Spread Haulage Company are $40.00 per tonne of bulk product from Glenaladale site to Geelong

FOB costs for Port of Geelong are $66 per tonne of bulk product.

The current market price of Ilmenite may preclude the Port of Geelong from being a viable option for bulk export at this stage.

Port of Melbourne: Victoria's major container port which is accessible by rail and road. The Port of Melbourne does not have on site product storage. Indicative costs provided by Patrick's for the transport from store to port and loading containers is $6.60 per tonne. Storage per container is $15.00 per container per day (after two free days) equating to 0.75cents per tonne per day. Fuel levy, currently at 12.2%, is adjusted accordingly every month.

Indicative costs from Scott Corporation Ltd haulage company are $48.50 per tonne of product from Glenaladale site to Port of Melbourne.

FOB costs for Port of Melbourne are $55.10 per tonne exclusive of storage.

7.5.4 Road Haulage

Following is a breakdown of the products that will be transported from Glenaladale site. The quantity of product will differ per annum dependant on the production schedule:

20 tonne net of dry, bagged Zircon and HiTi 80, free flowing sand transported in six meter ISO shipping containers as follows (Full Container Units – FCU's):-

Primary Zircon	1,100 - 2,300 FCUs p/a	22,000 - 46,000 TPA
Secondary Zircon	475 – 1,000 FCUs p/a	9,500 - 20,000 TPA
HiTi	1,650 – 2,250 FCUs p/a	33,000 – 45,000 TPA
Total	**3,225 – 5,550 FCUs**	64,500 – 111,000 TPA

Note: *These products will be packaged in 2 tonne bulka bags which may be transported by truck to Port Anthony without containers. In order to maintain a conservative approach to this study, we have included the containers to cover the event that these products may need to be transported to the Port of Melbourne.*

Dry, bulk, free flowing ilmenite sand (bulk density 2400 - 2700 kg/m3) transported in B-Double 40 tonne loads, as follows:-

Ilmenite	1,850 – 2,750 loads p/a	74,000 – 110,000 TPA

Access to the proposed site will be from the Bairnsdale – Dargo Road which is an arterial road rated for B-Double trucks.

The above loads equate to 14 - 22 B-Double Truck movements per day, based on a 5 day week for 50 weeks of the year, or

12 - 19 B-Double Truck movements per day, based on a 6 day week for 50 weeks of the year.

The most direct route to Port Anthony is approximately 166 kilometres, refer Figure 7.6, but may not prove to be the most practical dependant on the costs associated with upgrading local roads.

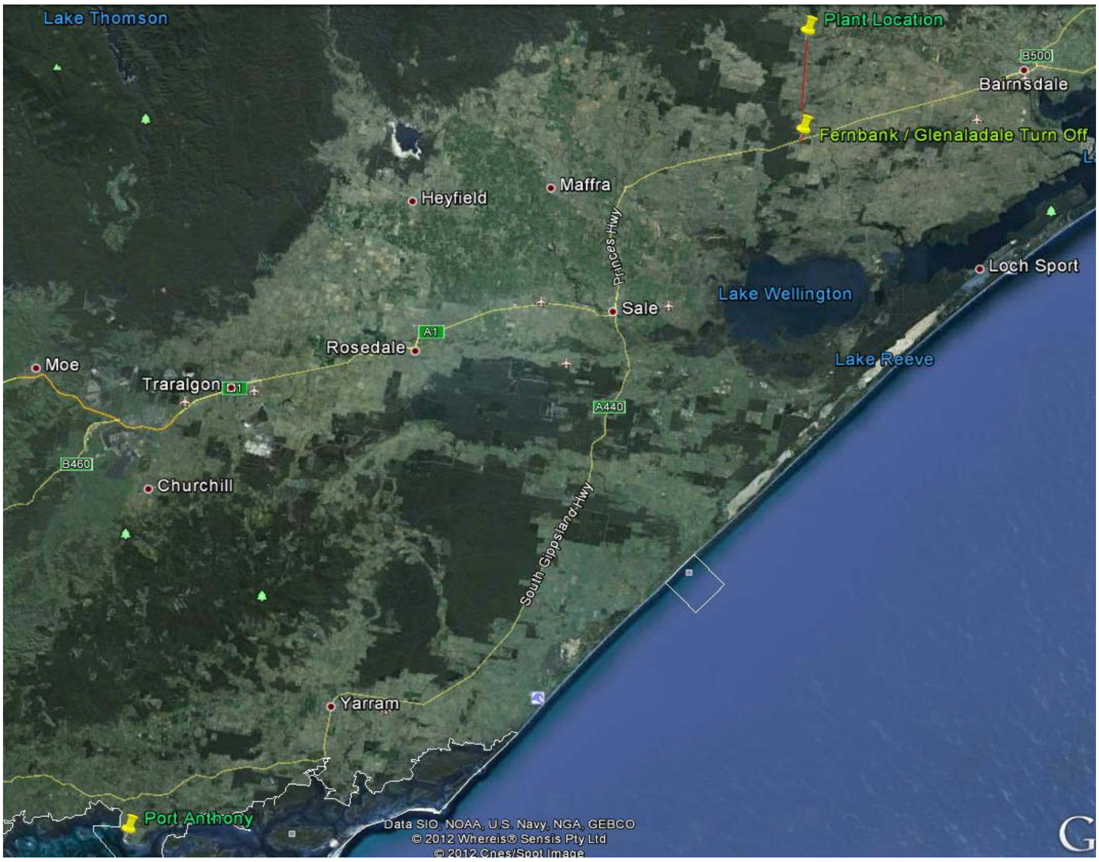


Figure 7.6 Route from Glenaladale Site to Port Anthony

The Bairnsdale-Dargo road meets the Fernbank-Glenaladale road, a local council managed road approximately 14 kilometres long that may require upgrading.

The Fernbank-Glenaladale Road / Bairnsdale-Dargo Road intersection may also require upgrading. Refer Figure 7.7.

Figure 7.7 Fernbank-Glenaladale Road / Bairnsdale-Dargo Road Intersection

The intersection between Fernbank-Glenaladale Road and the Princes Highway will need to be upgraded should this become the preferred route.

(Indicative costs have been included in the Capital Estimate these three possible road upgrades).

The Princes Highway and South Gippsland Highway are both main arterial roads rated for B-Double trucks.

All roads, with the exception of Fernbank-Glenaladale Road, to the Port of Melbourne and the Port of Geelong are main arterial roads managed by VicRoads.

8 ENVIRONMENTAL

8.1 Overview

AECOM were commissioned by Oresome to undertake a preliminary constraints, opportunities and process assessment for the Gippsland HMS Project. The full report has been included at Appendix 6.

The report provides the outcomes of a preliminary risk workshop held at AECOM's Melbourne office and aimed at identifying planning and environmental risks which may make the project unviable or cause decision making authorities to refuse statutory planning and/or environmental applications. It also discusses the approvals process to which the project is likely to be subject.

8.2 Regulatory Requirements

There are five key acts relevant to the project. These include the:

Mineral Resources (Sustainable Development) Act 1990 (Vic) (MRSD Act)

Environmental Effects Act 1978 (Vic) (EE Act)

Planning and Environment Act 1987 (Vic) (P&E Act)

Aboriginal Heritage Act 2006 (Vic) (AH Act)

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act).

It is considered likely that this project would require assessment via the production of an Environment Effects Statement under the EE Act. It would require approvals under the MRSD Act (mining licence and Work Authority) and the AH Act (approval of Cultural Heritage Management Plan). It could require approvals under the P&E Act and EPBC Act dependent on the final configuration of the project and the nature of impacts.

A range of secondary approvals would also be required including under the *Water Act* 1989.

8.3 Preliminary Risk Assessment

The preliminary risk assessment involved a workshop to identify key planning and environmental risks related to the project with a particular focus on those which may impact on the feasibility of the project (if any). Technical advice was sought in the following areas, identified in the proposal as potentially involving project critical risks:

- land use planning
- transport and traffic
- surface water and groundwater
- terrestrial flora and fauna
- noise and vibration
- Aboriginal cultural heritage.

As risks in each technical area were identified, they were categorised into one of the following four categories:

Category F: risk areas that may have no viable solution, considered to represent a potential fatal flaw in the project as described.

Category A: risk areas requiring detailed investigation and assessment, and complex or detailed management as part of the approvals process.

Category B: risk areas requiring moderate levels of investigation, targeted assessment and standard management measures as part of the approvals process.

Category C: risk areas requiring minimal attention as part of the approvals process and subject to standard management measures.

The Category F and A risks that were identified are shown in the table below.

Table 8.1: Identified Risks - Environmental

Risk	Category / risk level
Land use planning	
EGSC or State Govt may not support mining in the local/area.	A / very unlikely but impact severe
Planning permit and appeals through VCAT or PSA process (if not EES) may cause significant delay in project schedule, cost and negative community perception and at worst permit/amendment not granted.	A / more uncertain than EES process
Approval conditions potentially unreasonable and cause significant limitations on mine footprint, design or staging which adversely impacts the project schedule, design, budget and economic viability.	A
Potentially significant community complaints in relation to trucks, noise, dust, light and visual impacts.	A
Surface water, groundwater & hydrology	
Potential inability to identify a reliable water source(s) and/or secure water at an acceptable economic price to meet water demand (up to 6.2GL).	F
Potential significant impact (real or perceived) on water level in local (unconfined) aquifers and economic and environmental beneficial uses.	A
Terrestrial ecology	
Removal of Nationally listed (EPBC) vegetation communities, potential delays in approvals, alterations to mine foot print (to avoid) and/or significant offset costs. Need to demonstrate 'avoidance'.	A/B
Removal of habitat and/or fauna species of State and National significance, potential delays in approvals, alterations to mine foot print (to avoid) and/or significant offset costs. Need to demonstrate 'avoidance'.	A/B
Noise & vibration	
Non-compliance with operational noise criteria at night.	A

8.4 Preliminary Risk Assessment Outcomes

The capacity to obtain an economical and reliable water supply will be critical to determining project feasibility. Further investigations are currently underway regarding groundwater resources under the site and the capacity for groundwater to supply water for the project. Discussion should be held regarding further assessment of water supply options for the project in parallel with these investigations.

Opposition to mining projects is common and can potentially result in significant delays, increased costs and reputational damage to the proponent. Community concerns can relate to inadequate communication, lack of opportunity for community input or concerns over specific project impacts. The combined risk of community opposition as a result of these concerns is considered to be an additional A/B risk to the project.

The development of a community and agency stakeholder engagement plan will be an important next step for the project. This type of plan gives structure to the wide ranging consultation which needs to occur for projects of this nature and assists in managing risks associated with a potential lack of support for the project and community opposition.

The timing and prioritisation of the next phase of activities for ecology, noise and vibration, cultural heritage, traffic and land use planning should be the subject of further discussion as it will be necessary to determine where they fit in the broader program of works (and the consultation program).

8.5 Approvals Process

The next steps in the approvals process would be discussion with the Department of Primary Industries (DPI) and the Department of Planning and Community Development (DPCD), as DPI administer the MRSD Act and DPCD administer the EE Act. These discussions would clarify the requirements for obtaining a mining licence and undertaking assessment under the MRSD Act (likely via an EES) and the necessary timing of associated applications and referrals.

9 COST ESTIMATES

9.1 Capital Cost Estimate

9.1.1 General (Infrastructure)

For the purposes of this scoping study, the following Request for Quotation (RFQ's) were fielded for infrastructure items.

- HV power supply – SP Ausnet
- Freight & Logistics - Port Anthony
- LPG and LNG supply options - Elgas

9.1.2 General (Processing Plant)

For the purposes of this scoping study, the capital cost estimate for the processing plant has been produced using a combination of in-house cost database and historical data of like projects.

Costs for typical process equipment that is used in the mineral sands industry have been applied. The costs are derived from recent vendor quotations (< 12 months) which have been fielded during Robbins recent bankable feasibility studies.

Costs for fabricated items (structural steelwork) have been derived from similar wet and dry processing plants and scaled accordingly by applying $/square meter rates.

Costs for civil and concrete have been derived from similar wet and dry processing plants and scaled accordingly by applying $/square meter rates.

Formal pricing enquiries were not used in formulating the capital estimate.

The only item for which an external RFQ was fielded was the thickener unit.

9.1.3 Accuracy of Estimate (Definition)

"Estimate accuracy range is an indication of the degree to which the final cost outcome for a given project will vary from the estimated cost. Accuracy is traditionally expressed as a +/- percentage range around the point estimate after application of contingency, with a stated level of confidence that the actual cost outcome would fall within this range (+/- measures are a useful simplification, given that actual cost outcomes have different frequency distributions for different types of projects).

As the level of project definition increases, the expected accuracy of the estimate tends to improve, as indicated by a tighter +/- range." From *AACE International Recommended Practice No. 17R-97 COST ESTIMATE CLASSIFICATION SYSTEM – Cost Estimating and Budgeting*

Given the above inputs mentioned at sections 10.1.1 and 10.2.2, the expected accuracy range for this estimate is Class 4 (+35/-10%), refer to table 10.1 below for an understanding of estimate class and characteristics.

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical +/- range relative to best index of 1 [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Screening or Feasibility	Stochastic or Judgment	4 to 20	1
Class 4	1% to 15%	Concept Study or Feasibility	Primarily Stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Mixed, but Primarily Stochastic	2 to 6	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Primarily Deterministic	1 to 3	5 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Deterministic	1	10 to 100

Notes: [a] If the range index value of "1" represents +10/-5%, then an index value of 10 represents +100/-50%.
[b] If the cost index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%.

Figure 9.1 Generic Cost Estimate Classification Matrix

From; AACE International Recommended Practice No. 17R-97 COST ESTIMATE CLASSIFICATION SYSTEM – Cost Estimating and Budgeting

9.1.4 Cost factors

The following typical cost factors have been applied to the cost estimate;

- Freight Costs factored at 3% of extended equipment costs
- Fabrication detailing at 6% of extended equipment costs
- Installation costs at 15% of extended equipment costs
- EPCM Fees at 16% of direct costs
- EPCM Home and Site Office expenses at 3.5 % of the EPCM fee
- Project Insurances at 0.4% of direct and indirect costs
- Commissioning Spares at 0.5% of direct and indirect costs
- Operational Start-up spares at 1.5% of direct and indirect costs
- Owners costs at 2.0% of direct and indirect costs

9.1.5 Contingency

An overall project contingency has been applied at 15% of direct and indirect costs.

9.1.6 Capital Cost Summary

The full Capital Cost Estimate has been included at Appendix 7.

PROJECT: Oresome_Gippsland Resource - 11.1 MTPA Scoping Study

J581 SUMMARY

Area	Area Description	Description	Details	UNIT COST $	Extended Cost $	Installation UNIT COST FACTOR	Installation Extended Cost $	Fabrication Detailing	Freight	LINE TOTAL $	
	Mining				28,125,000					Nothing in this area above the line.	
1000	MUP				24,439,510		4,515,485	1,211,700	673,241		
2000/3000	WCP/CUP				54,485,496		7,283,576	472,653	1,542,147		
4000	Mineral Separation Plant				29,641,703		4,760,517	1,219,619	795,105		
	This sheet automatically sums from the Area Subtotal sheets										
T1	Total Direct Material and Labour			T1 (M)	136,691,710	T1 (L)	16,559,578			153,251,288	T1
T2	Total Freight								3,010,493	3,010,493	T2
T3	Total Fabrication Detailing							2,903,972		2,903,972	T3
T4	SUB-TOTAL DIRECT FIELD COSTS (= T1 (M&L) +T2+T3)									159,165,752	T4
T5	Labour indirects (%of T1 (L)) if required										T5
T6	EPCM Fees (16 % of T4+T5)	16.0%								25,466,520	T6
T7	EPCM Home and Site Office expenses (3.5% of EPCM fee)	3.5%								891,328	T7
T8	SUB-TOTAL INDIRECT COSTS (=T5+T6+T7)									26,357,849	T8
T9	PROJECT SUB TOTAL (DIRECT+INDIRECT COSTS =T4+T8)									185,523,601	T9
T10	Project Insurances (% of T9)	0.4%	Indicative only							742,094	T10
T11	Commissioning Spares (% of T9)	0.5%	Indicative only							927,618	T11
T12	Operational Start Up Spares (% of T9)	1.5%	Indicative only							2,782,854	T12
T13	Owners costs (% of T9)	2.0%	(Staff, travel, accomm, Shire DP and BP fees etc.)							3,710,472	T13
T14	Infrastructure									27,324,600	T14
T15	Project Contingency (% of T9)	15.0%	Covers unforeseen items; bad weather, rock excavation, labour disputes, minor oversights etc.							34,342,230	T15
T16	Non Capital Expenses									16,100,000	T16
T15	TOTAL = SUM T9-T16 (Excluding Escalation)									$271,453,489	T17

This Estimate is exclusive of GST, Taxes, Duties and Interest during construction.
This Estimate is an opinion of probable project costs. R.J. Robbins & Associates cannot be held liable should the actual costs fail to match the Estimate for reasons beyond our reasonable control.

Figure 9.2 Capital Estimate Summary

9.2 Operating Cost Estimate

9.2.1 General

Investigations have been carried out for the following operating costs;

- HV Power Supply – per KWh rate has been escalated to compensate for the introduction of the carbon tax.
- Process Water Supply – indicative usage rate of $3.75 per Ml provided by Oresome
- Freight and Logistics (basis FOB port Costs)
- Gas supply for material drying purposes
- Flocculant plant reagents
- Salaries for labour rates are based upon the Hays Resources and Mining, Salary guides 2011 / 2012.

The following data has been provided by Oresome or third party sub-contractors for inclusion into the operating costs;

- Mining costs
- Royalties
- Owners costs (Corporate office and overhead)
- Marketing Costs

9.2.2 Exclusions

The following item has been excluded from the operating cost estimate.

- Shipping Costs (by end user)
- Taxes and duties

9.2.3 Operating Cost Summary

The full Operating Cost Estimate has been included at Appendix 8.

Total				
Area Description	MUP	WCP / CUP	MSP & Product Storage	Total Cost per Annum
Labour	$ -	$ 10,535,476	$ 3,017,582	$ 13,553,058
Reagents	$ -	$ 2,405,519	$ -	$ 2,405,519
Diesel Fuel	$ 35,058	$ 687,809	$ 412,143	$ 1,135,011
Electrical Power	$ 2,887,776	$ 6,591,002	$ 1,281,384	$ 10,760,162
Gas	$ -	$ -	$ 3,347,332	$ 3,347,332
Water	$ -	$ -	$ -	$ 15,870
Maintenance	$ 699,804	$ 1,239,962	$ 763,917	$ 2,703,683
Spare Parts	$ 349,102	$ 596,571	$ 371,429	$ 1,317,102
Haulage / FOB Port Costs				$ 7,396,560
Mining				$ 36,326,235
Owners Costs (provided by OAPL Navigator Model)				$ 1,380,000
Total Operating Cost	$ 3,971,740	$ 22,056,339	$ 9,193,787	$ 80,340,532

Exclusions
Applicable Taxes/Duties

Figure 9.3 Operating Cost Estimate

9.3 Economic Analysis

9.3.1 General

A preliminary financial model was developed to ascertain a high level Net Present Value (NPV) and Internal Rate of Return (IRR). The complete model is attached at Appendix 9.

The following costs are excluded from the NPV / IRR calculations:

- Royalties (currently 2.75% of Net Market Value in Victoria)
- Duties and Taxes
- Depreciation
- Funding
- OPEX escalation

9.3.2 NPV and IRR

Points of note:

- Project delivers good returns until year 8 upon where the HMC grade decreases by 1%, zircon % decreases from nominally 20% to 13%, and there is a projected price drop for all products at this point.
- Capital expenditure includes AUD 28.125M for a start up pit and tailings storage facility. These works must be carried out during the construction phase of the project and therefore must be included in initial funding and cash flow. Accordingly, the capital associated with these works has been subtracted from year one operating costs.
- NPV calculated at between AUD 170 – 190 Million
- IRR calculated at between 25 – 30%

9.3.3 Optimising the NPV and IRR

In reviewing the model it is apparent that the reaction to the fall in HMC grade has been to increase the ROM throughput to ensure consistent HMC output, as per normal operating procedure within the industry.

However, from year 8 the increased overburden strip ratio coupled with the grade deterioration and product price decreases is resulting in a substantial reduction to surplus funds. To address this situation, further detailed mine study, inclusive of raising the cut off grade and revisiting the mine plan, should be carried out during the definitive study stage of this project.

10 MARKETING

TZ Minerals International Pty Ltd (TZMI) was engaged by Oresome to conduct a product quality assessment of the planned products from the Gippsland HMS Project. The purpose of the report is to assess the quality of the Ilmenite, HiTi and zircon products and review potential end-use market opportunities. The full report, inclusive of the summary of product pricing and a memo with updated comments in relation to the revised Ilmenite specification after LTR processing have been included at Appendix 10.

10.1 Product Quality Considerations

10.1.1 Primary Ilmenite

The TiO_2 content of just under 49% indicates that the Gippsland primary ilmenite can be classified as a sulfate grade product. As such, the normal target markets for the product would be for sulfate pigment manufacture or as a feed for titanium slag manufacture. However, the elevated chrome levels at 0.5% would preclude the sale of the product for sulfate pigment manufacture, certainly not as a standalone product.

It is possible that the product could be blended with other ilmenite feedstocks to allow limited use, but the extent to which this would be possible would need to be clarified with customers.

In terms of targeting the primary ilmenite as a feed for titanium slag manufacture, two product specification issues are apparent. The MgO level at 1.7% is above the 1% upper threshold for chloride feedstocks and so the ilmenite is not a direct feed for chloride slag manufacture. And while the MgO levels are acceptable for sulfate slag manufacture, the elevated Cr_2O_3 levels are not. So the Gippsland primary ilmenite is not suitable as a direct feed for slag manufacture. Again, there could be some application as a blend feedstock at discounted prices.

So, given the above, it may be possible for the Gippsland primary ilmenite to find some limited application in the Chinese sulfate pigment industry, but this would only be achieved if the product was heavily discounted on price, most likely in excess of 30% from prevailing prices. It is also not clear to TZMI what annual sales tonnage could be achieved, even at discounted prices, and this would need to be the subject of further direct discussions with customers, who would most certainly ask for trial parcels for testing.

Notwithstanding the recent Cr solubility test results for the primary ilmenite product, which indicates 1 Cr solubility of <0.1%, TZMI is of the view that this will have limited impact on the product pricing and significant price discounts will still apply.

10.1.2 Secondary Ilmenite

With a TiO_2 content of 57%, the Gippsland secondary ilmenite is at the boundary of the traditional sulfate – chloride grade classification. Typically, any ilmenite at 58% TiO_2 or above is recognized as a chloride route product.

In terms of product quality, the secondary ilmenite is not ideal for either process route, but is more likely to be seen as a sulfate grade product. One possible use is as a feed for chloride titanium slag production, with such slag targeted at the molten salt chlorination process for the production of titanium sponge, specifically in China.

Product testing as a feedstock for this application would be required to confirm the suitability of the secondary ilmenite in this end-use, most likely as a blend feed. The

SnO_2 specification of the ilmenite would also need to be below (0.05%), for use in titanium sponge applications. The SnO_2 content was not available at the time of writing.

As far as pricing is concerned, TZMI estimates that a 10% discount on its base case price for sulfate ilmenite may be applicable, with the elevated Cr and Mn contents offsetting the high TiO_2 content.

10.1.3 HiTi 80 and HiTi 70

For use a feedstock for chloride pigment manufacture, pigment producers will not be able to use this product given the fine particle size. Nevertheless, while the fine particle size is an issue for chlorination, it is a benefit for use in welding electrodes, particularly for flux cored wires. With planned output of the HiTi 80 product at only 3,000-5,000 tpa, this annual tonnage is best targeted as a bagged product into the welding electrode sector.

From a pricing perspective, TZMI estimates that the Gippsland HiTi 80 should achieve a price of around US$800 per tonne FOB (long term average in real 2011 terms) while the HiTi 70 product is more like US$500 per tonne FOB, both as bagged products.

10.1.4 Zircon

In terms of product specification, the primary zircon product appears acceptable for ceramic application, having a low Fe content and acceptable levels of TiO_2 and Al_2O_3. The ceramics sector would therefore be the preferred target market for the Gippsland primary zircon product. However, the product suffers from elevated levels of U+Th, beyond the general industry upper limit of 500 ppm and this would impact of the desirability of the product in a number of regions and for many potential customers, based on import regulations regarding radionuclide levels.

However, given that both China and India currently import zircon products with elevated U+Th levels, the saleability of this product will not be an issue. For valuation purposes, TZMI recommends using TZMI's base case reference price for zircon for the primary zircon product. It should be recognized though, that some customers will attempt to use the elevated U+Th levels to achieve a discounted price, and that will depend on the market environment at the time.

In terms of the secondary zircon product, a price discount of 20% off TZMI's base case reference price for premium zircon should be applied to allow for the lower ZrO_2 content and elevated TiO_2 and U+Th levels. Possible markets may include the zircon chemicals industry, or the zircon concentrate processors, most of which are located in China. A further possibility is to examine whether a better zircon product can be produced at lower recoveries (lower tonnage, but higher price).

10.1.5 Primary Ilmenite after LTR processing

After successfully carrying out LTR processing test work to reduce the Cr_2O_3 levels in the Ilmenite product, TZMI were requested to provide comments on the revised product specification in terms of product quality and the corresponding impact on pricing.

The reduced TiO_2 content of 54.1% indicates that the Gippsland primary ilmenite can be classified as a sulfate grade product. As such, the normal target markets for the product would be for sulfate pigment manufacture or as a feed for titanium slag manufacture.

For sulphate pigment use, the main quality issue is the elevated Cr_2O_3 levels in the Ilmenite product. Similar to the CRL's ilmenite product (with Cr_2O_3 of 0.3%), TZMI expects China to be the main market for this ilmenite product. This ilmenite can be blended with domestic Chinese ilmenite and consumed in the sulphate pigment sector. Therefore, it may be possible to target the Gippsland planned ilmenite product at Chinese pigment producers or concentrate processors, but at a price discount.

In terms of targeting the ilmenite product as a feed for titanium slag manufacture, the MgO levels at 1.9 % is well above the industry upper threshold of 1% for chloride feedstocks and would preclude the sale of the product for chloride slag manufacture. However, this product should not pose an issue for sulphate slag manufacture other than the elevated Cr_2O_3 levels.

As far as pricing is concerned, TZMI estimates that a price discount in the range of 15 – 20% off the base case prices for sulfate ilmenite should be applied to allow for the elevated Cr_2O_3 levels.

10.1.6 Summary of planned product prices

Table 10.1: Summary of planned product prices from Gippsland Project

Real – US$/t FOB	2011	2012f			2013f			2014f			2015f			2016f		
		Low	Base	High	Low	Base	High	Low	Base	High	Low	Base	High	Low	Base	High
Primary Ilmenite	154	188	219	246	167	207	240	124	179	221	89	127	165	84	108	142
Secondary Ilmenite	198	241	281	316	214	266	308	159	230	284	114	163	212	107	139	183
HiTi 80	696	1,873	1,951	2,107	2,056	2,360	2,627	1,709	2,303	2,674	1,160	1,957	2,500	884	1,273	1,909
HiTi 70*	650	850	1,000	1,100	1,045	1,200	1,335	890	1,200	1,393	533	900	1,150	406	585	877
Primary Zircon	1,900	2,244	2,537	2,732	2,284	2,665	3,046	1,857	2,693	3,157	1,540	2,446	2,990	1,352	2,210	2,828
Secondary Zircon	1,520	1,795	2,029	2,185	1,827	2,132	2,437	1,486	2,154	2,526	1,232	1,957	2,392	1,082	1,768	2,263

Real – US$/t FOB	2017f			2018f			2019f			2020f		
	Low	Base	High	Low	Base	High	Low	Base	High	Low	Base	High
Primary Ilmenite	83	104	130	83	104	125	82	105	124	82	105	123
Secondary Ilmenite	107	133	167	106	134	161	106	134	159	105	135	159
HiTi 80	759	966	1,380	690	875	1,195	657	821	1,083	641	798	1,025
HiTi 70*	430	545	747	414	525	717	410	513	677	400	500	641
Primary Zircon	1,293	1,940	2,587	1,279	1,809	2,356	1,260	1,728	2,216	1,249	1,726	2,162
Secondary Zircon	1,035	1,552	2,070	1,023	1,447	1,884	1,008	1,382	1,773	999	1,380	1,730

Note: Prices shown above are derived from TZMI's price forecasts (real 2011 terms), taking into consideration any price premiums/discounts that may be applicable for each project.

** There is no readily available reference pricing for HiTi 70 in the market. TZMI has benchmarked Gippsland's HiTi 70 product against Chinese sulfate slag (76% TiO_2), although the Chinese slag product is predominantly targeted at pigment Manufacture.*

11 RISK ASSESSMENT

Robbins carried out an internal preliminary risk assessment addressing the areas listed in the table below. As risks were identified, they were categorised into one of the following categories:

Category F: risk areas that may have no viable solution, considered to represent a potential fatal flaw in the project as described.

Category A: risk areas requiring detailed investigation and assessment, and complex or detailed management as part of the approvals process.

Category B: risk areas requiring moderate levels of investigation, targeted assessment and standard management measures as part of the approvals process.

Category C: risk areas requiring minimal attention as part of the approvals process and subject to standard management measures.

Table 11.1: Identified Risks – Non-Environmental

Risk	Category / risk level
Process Plant	
Clay removal – handling and disposal	A
WCP - spiral performance / recoveries	B
WCP - spiral configuration	B
Concentrate Upgrading Plant (CUP) – plant performance / recoveries	B
Mineral Separation Plant (MSP) – plant performance / recoveries	B
Water Management / Reclamation	A
Infrastructure – Freight & Logistics	
Port Anthony – availability	B
Port of Geelong scenario - costs	B
Water Supply	F
Marketing	
Products saleability	B

Risk	Category / risk level
Mining	
Availability of MUP's	B
Poor mine planning resulting in increased operational costs	B
Industrial Relations	
Trade Union activity – during construction phase	A
Trade Union activity – interruption to ongoing operation	B

11.1 Clay removal – slimes management

The average slimes content of the ROM feed has been measured during the preliminary test work at 24%. Although regarded as high within the mineral sands industry the settling rates viewed during the preliminary test work are typically within range. Therefore, it is not perceived that solids removal from the process water will be problematic.

Given the location of the deposit and likely mining technique to be employed, co-disposal of the slime with the solid tail is the preferred method of tailings deposition.

The advantages of co-disposal systems are well documented in the mineral sands industry and is now accepted as best practice for high slimes ore bodies.

Another advantage of co-disposal is the water reclamation from the tails void which has typically run at 70% at another Australian mineral sands operations. The recycle efficiency for the Glenaladale operation is conservatively set at 50% for the purposes of this study.

The only operating cost offset for incorporating co-disposal in the plant design is the inclusion of a rheology modifier introduced prior to the open discharge of the co-disposed tails to the mining void.

Provided logical tailings management methods are adopted there is no reason that the operation would not be viable due to the slimes content.

11.2 Water Supply

Water supply is the most critical area identified during this risk assessment by AECOM and Robbins.

Drilltec are in the process of drilling an investigation bore to explore the deeper aquifer in the Lindenow region. The extent of this drilling is based on discovery and initial flow rate.

It is important to note that discovery is only the first stage in confirming the availability of an adequate supply to sustain the operation. In order to proceed with a degree of confidence typically yield tests are conducted over a period of some one to three weeks. This involves either the off take of bore water or the excavation of earthen dams of 30 – 50 mega litres capacity to prove up continuity of supply. This would identify issues relating to average yield, sustainability of water supply and nature of the aquifer.

Given that these activities have not been carried out this is identified as an unquantifiable risk at this time.

11.3 Water Management – Infiltration / Reclamation

As mentioned in 12.1 the operation will win water from the tailings void and a conservative 50% reclaim rate has been nominated during the conceptual design of the processing plant.

One of the risks associated with co-disposing of slimes is that there can be a sealing of the tailings dam which slows the rate at which water can seep back to the aquifer. If badly managed the operation can "make water" resulting in the excavation of off path infiltration pits. This is largely dependant on the type of clay fines present in the ore body and management strategies.

However, this risk can be and is being mitigated by major producers within the mineral sands industry.

As the operation will employ a typical open cut mining pit, proven dewatering techniques will need to be utilised during significant rain events to ensure the in pit MUP can meet the required 85% operational availability.

Once again, dewatering activities, such as in-pit dewatering, are common place amongst existing operations and issues can be largely mitigated using proven techniques.

11.4 Trade Union Activity during construction

It is strongly recommended that membership with a body such as the Australian Metals and Mining Association (AMMA) be taken prior to commencement of a Bankable Feasibility Study for advice and guidance on the latest industrial relations legislation. AMMA are also one of the few organisations that represent employers at a federal level.

12 CONCLUSIONS

Based on the work carried out for this scoping study, Robbins concludes the following:

- Given the degree of metallurgical test work carried out to date, Oresome can proceed with a level of confidence in the knowledge that the metallurgical results are sound.
- The mining method adopted by AMC has been used in similar style deposits. Overburden will be mined in advance of the ore, and fed directly into the Mining Unit Plant (MUP) using a dozer trap system. This is typical of the methods used in similar mineral sands mining operations.

  The mining schedule has been optimized to improve the initial cash flow and discounted value by increasing the grade of each block.
- Methodologies associated with the process and processing plant are unremarkable and the separation equipment and techniques are common place within the mineral sands industry. Therefore from an operations perspective there is manageable risk associated with the processing plants.
- A preliminary schedule indicates project duration of 118 weeks from project go-ahead (commencement of engineering) to practical completion (finish of ore commissioning). The schedule will be dependant on lead times associated with services and equipment at the time of tender.
- From an infrastructure perspective enough investigation has been carried out by Robbins relating to HVPS, gas and roads to confirm that these services can be delivered should the project proceed.
- Water supply is the most critical area identified during this study process. At the present time, works in progress to find a water resource is unlikely to be completed prior to the deadline date for taking over the leases. As a safety measure we have opted to include conservative pricing of a borefield and pumping system to provide the 4.6Gl per year. The alternative, should the borefield venture be unsuccessful, is to lodge an application to secure an allocation of water from the state government. Further investigation on the allocation and operating costs will be required.
- Freight and logistics was investigated based on the assumption that export of product will be from Port Anthony. To cover the eventuality that Port Anthony is not developed as planned further investigation into the use of Port Melbourne, Port of Geelong and Port Hastings was carried out. Ultimately transport of product will not be a problem however the options available will result in an increase to operational costs.
- The environmental assessment uncovered a number of issues, see table 9.1, which will require further investigation should the project progress to the next stage.

  It is expected that this project would require assessment through preparation of an Environmental Effects Statement under the Environmental Effects Act.

- Capital Estimate carries a confidence factor of -10/+35% and has been calculated as follows:
  - $221,011,239 Direct costs.
  - $16,100,000 Indirect costs.
  - $34,342,230 Contingency of 15%
- Operating Estimate has been calculated at $80,340,532 per annum and is based on mining 11.1Mtpa of ROM ore at 3.5 grade.
- NPV/IRR calculations, exclusive of all royalties, duties and taxes, are:

  NPV calculated at between AUD 170 – 190 Million

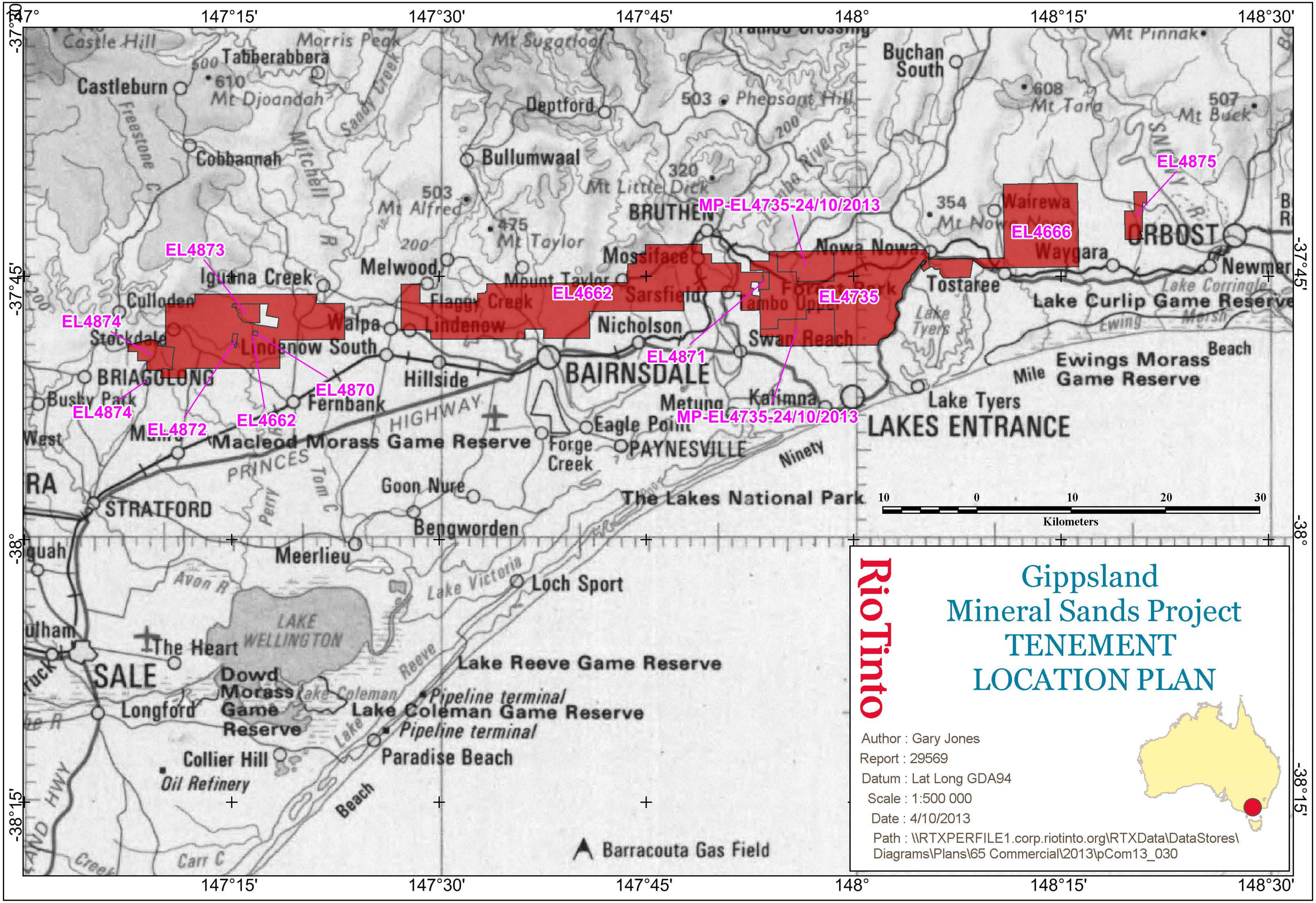
  IRR calculated at between 25 – 30%
- The product quality assessment of the Glenaladale resource products, namely, Ilmenite, HiTi and zircon have all been identified as having end-use market opportunities.

In conclusion, investigations, risks workshops and third party reporting has identified that this potential operation is viable dependant on mitigation of the risks associated with securing a suitable water supply.

REFERENCES

Robbins report is based upon:

- Discussions with employees and consultants of Oresome gained throughout the duration of the study;
- Discussions with local authorities within the Gippsland Region – East Gippsland Shire Council, VicRoads, SP Ausnet (HVPS).
- RIO Tinto Exploration Report No. RD_2007_07
- Independent sources of cost estimation data



Gippsland
Mineral Sands Project
TENEMENT
LOCATION PLAN
RioTinto
Author : Gary Jones
Report : 29569
Datum : Lat Long GDA94
Scale : 1:500 000
Date : 4/10/2013
Path : \\RTXPERFILE1.corp.riotinto.org\RTXData\DataStores\Diagrams\Plans\65 Commercial\2013\pCom13_030
EL4875
EL4666
MP-EL4735-24/10/2013
EL4873
EL4662
EL4735
EL4874
EL4871
EL4870
EL4872
10 0 10 20 30
Kilometers
147°15'
147°30'
147°45'
148°
148°15'
148°30'
-37°45'
-38°
-38°15'
BAIRNSDALE
LAKES ENTRANCE
SALE
STRATFORD
PAYNESVILLE
BRUTHEN
Lake Wellington
The Lakes National Park
Lake Reeve Game Reserve
Macleod Morass Game Reserve
Ewings Morass Game Reserve
Lake Curlip Game Reserve
Barracouta Gas Field