

OLYMPIA
RESOURCES LIMITED

Harts Range Garnet Project

Feasibility Study

September 2003

DISCLAIMER

HBH Consultants prepared this report on behalf of Olympia Resources Ltd. The authors were Rob Crawford, BE, MBA, Peter Hopwood, BE, PhD, Michael Ingram, BSc, and Simon Logie, BE, BSc.

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The conclusions and recommendations contained in this document reflect the professional opinion of HBH, using the data and information supplied. HBH has used reasonable care and professional judgement in interpretation of the data. In relying on HBH's conclusions and recommendations Olympia Resources Ltd should review and consider the agreed scope of work for the study, and the methodology used to carry out the work, both of which are stated in this document.

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1.

SUMMARY

Olympia Resources Ltd plans to develop its garnetiferous mineral sands deposits located near Harts Range in the Northern Territory of Australia. The 36 Mt of proven reserve ore Olympia Resources has identified represent 30 years of production at a mining rate of 1.2Mt/a. Olympia Resources controls an additional probable ore reserve totalling 35 Mt, implying a further 29 years of production, or a lesser period at a higher production rate, should the market justify an expansion.

Total ore resources in areas controlled by Olympia Resources are estimated at 65 Mt. Olympia Resources is confident that there are additional deposits within an economic distance from the site of the proposed plant. Olympia considers that these proven and probable reserves are sufficient for the project to be economic. The proven and probable reserves are shown in detail in the following table:

Ore Type	Ore	Garnet In Sand	Garnet Recovered
Proven			
Dune	25,000,000	1,600,000	720,000
Floodplain	3,400,000	220,000	120,000
Paleochannel	6,000,000	390,000	230,000
Swale	1,600,000	98,000	52,000
Total Proven	36,000,000	2,300,000	1,100,000
Probable			
Creek Channel	440,000	49,000	30,000
Floodplain And Paleo-channel	16,000,000	1,200,000	680,000
Dune	18,000,000	1,000,000	480,000
Total Probable	35,000,000	2,300,000	1,200,000

Olympia Resources plans to complete engineering design and construction of the plant at Harts Range before the end of calendar year 2004. The plant will be commissioned progressively and will achieve full production at the beginning of 2005. Olympia Resources will complete its marketing campaign before production commences.

Olympia Resources will bring to the market new products: high-grade garnet with large particle sizes (>710 microns), suited to water filtration and other, similar applications; blends of medium particle size

(>260 microns, < 710 microns) garnet and AMH ¹, primarily aimed at the surface treatment market; and a smaller particle size (>180 microns, < 260 microns) blend of garnet and AMH suited to water jet cutting applications. Olympia Resources is confident these products will be accepted in the marketplace, based on discussions and in-principle agreements with potential purchasers.

The project is located 180km north-east of Alice Springs, in central Australia. The project area straddles the Plenty Highway, facilitating transport to and from the site.

The project has no significant environmental or social impacts. Olympia Resources will rehabilitate mined areas progressively, in accordance with industry best practice. Neither Olympia Resources nor the Northern Territory Government believes that the project represents a significant risk to the environment. Olympia Resources has submitted its Notice of Intent (NOI) to proceed to the Northern Territory Government, and expects environmental approval by the end of calendar 2003.

This study estimated the capital cost for the planned development to be \$24.4M, which includes a contingency of 10%, and is accurate to $\pm 15\%$. At the planned production rate of 178.5 kt/a, annual operating costs are estimated to be \$20 M, again with an accuracy of $\pm 15\%$.

At a discount rate of 10%, and based on the above-quoted capital and operating cost estimates as well as a number of other realistic parameters, this study shows that the Harts Range project has a net present value of \$34.9 M. The baseline project delivers an internal rate of return of 26.4%. Initial capital investment can be recovered in approximately 5 years, before interest. Olympia Resources believes that these financial indicators can be improved upon through active intervention and risk management.

There are no perceived technical risks inherent in the project beyond those which normally apply, viz:

- Water is not available in the forecast quantities; and
- The mineral suite does not behave in practice as testwork completed to date has demonstrated.

Olympia Resources is confident that these risks are not likely to threaten the success of the project, based on expert advice the company has received. The company will conduct further testwork and a water drilling programme to minimise or remove these risks.

¹ Alumino – magnesio – hornblende, a mineral with inert chemistry, SG of 3.2, and a Mohr hardness in the range of 5 - 6.



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As Harts Range will produce a range of industrial minerals, Olympia Resources must manage the risks normally associated with such a project:

- Part of the total range of products remains unsold, or its sale is deferred;
- Price discounting by competitors; and
- Replacement of garnet and garnetblende in the market by cheaper alternative materials.

Olympia Resources considers that these risks are manageable, and has developed appropriate mitigation strategies for all of the market-related risks to project success. The company has recently despatched over 300kg of market samples to potential customers world-wide, and will follow these with a further 700kg of samples in the very near future. After customer testwork has been completed, Olympia will visit each potential customer and negotiate supply contracts.

The Harts Range deposit contains significant reserves of garnet and AMH, sufficient to support mining at the planned rate for 20 years. This study shows that the project can be exploited profitably. Further work is under way to confirm market acceptance of the mineral products, and to confirm the proposed processing flowsheet. On the basis of this study, and other work, Olympia Resources therefore believes that the Harts Range project is an exciting opportunity and a sound project, set to take its place as a producer of a valued range of industrial minerals in demand both internationally and within Australia.

2. INTRODUCTION TO THE PROJECT

2.1. Project Concept

Olympia Resources Limited acquired exploration leases in the Harts Range region of the Northern Territory of Australia. These leases contained known deposits of garnet and associated minerals. Olympia Resources proceeded to explore these deposits further, and in so doing found additional quantities of ore. As it became apparent that these deposits could potentially be developed as a profitable project, a concept for the future exploitation of the Harts Range garnet sands emerged.

In broad terms, Olympia Resources intends producing the sands at Harts Range by

- Constructing a production facility adjacent to the ore and close to the Plenty Highway, which traverses the mineral leases;
- Transporting the sand products in bulk by road to Alice Springs;
- Contracting with a logistics company for bulk storage and product packaging at Alice Springs;
- Exporting the products in bulk or in packed form to international customers through the port of Darwin, or by rail or road to domestic customers in southern states of Australia.

This document describes this concept in detail, and examines its technical and financial feasibility.

2.2. History of the Region

The Harts Range region has a long history of exploration and mining with gold discovered at Artunga in 1887, scheelite in 1909 and copper in the Jervois Range in 1929. In more recent times exploration has been carried out for a wide range of commodities including base metals, diamonds, rare earths, industrial minerals and uranium.

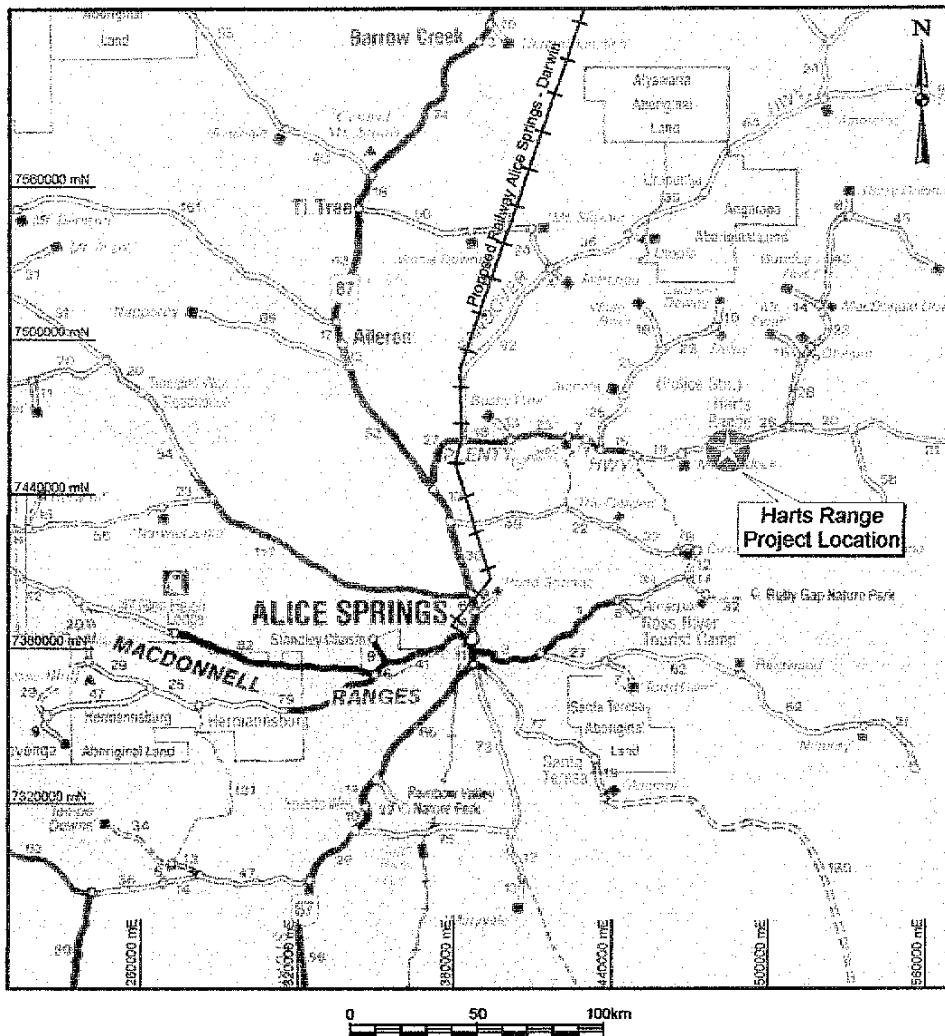
The area is included within the Harts Range – Plenty River Mica Field that at one time was the most important mica field in Australia. In addition to mica, industrial mineral exploration has included vermiculite, corundum and garnet. Exploration for gem quality garnet and corundum was undertaken over parts of the Ongeva and Hale rivers during the early 1980's with a shift towards industrial grade garnets during the 1990's. Although garnet mineralisation is widespread throughout the region, only a few deposits have been located to date.

2.3. Location, Topography and Climate

2.3.1. Location

The project area is located some 150 km northeast of the provincial centre of Alice Springs. Vehicle access is via the sealed Stuart Highway then the partly sealed Plenty Highway. The Plenty Highway is sealed as far as Ongeva Creek, after which it becomes a well-formed graded road. The Plenty Highway passes through the project area, and transects several of the project leases before continuing eastward to connect to the Donohue Highway in Queensland.

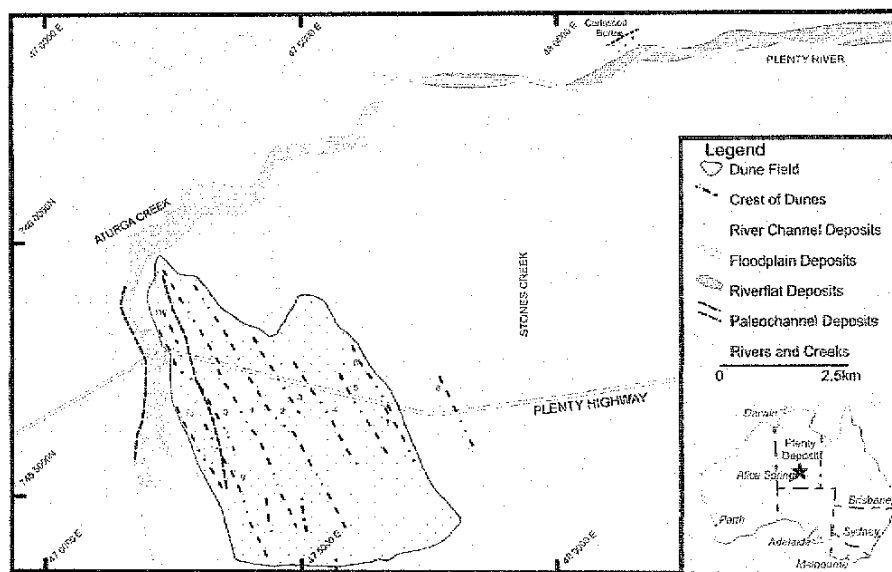
A journey to the project site from Alice Springs would consist of 68 km up the sealed Stuart Highway to the Plenty Highway intersection, followed by 126 km east along the Plenty Highway. Of the 126 km Plenty



Highway travel, the 98km east to Ongeva Creek is sealed, and the final 28 km is unsealed. The proposed processing plant site is located just off the Plenty Highway, on the north side of the Harts Range.

2.3.2. *Topography*

The site is basically flat, overlain with dune structures which rise as much as 40m above the surroundings. Elevation of the site is about 580m (AHD). Creeks in the area are seasonal and intermittent. Process water will therefore be obtained from underground aquifers.



2.3.3. *Climate*

Harts Range lies in a dry and hot environment. Data from the Commonwealth Bureau of Meteorology are available for Jervois, located about 140km east of Olympia's garnet resources; conditions at Harts Range will be similar to those experienced at Jervois.

Conditions at the dry plant in Alice Springs will be similar to those recorded at the Bureau's Alice Springs weather stations (one at the Post Office, and another at the airport).

Key information from these locations as set out below:

Element	Jervois	Alice Springs PO ²
Data acquired over years	1966-2001	1873-1989
Mean daily maximum temperature, deg C	30.5	28.3
Mean no days where Max Temp > 40 C	38.3	14.1 *
Mean no days where Max Temp > 35 C	119.5	86.9 *
Highest daily Max Temp, deg C	47.5	45.2 *
Lowest daily Min Temp, deg C	-5	-7.5 *
Mean 9am wind speed, km/h	11.6	10.3 *
Annual rainfall, mm	305	279
Mean no of rain days	38.8	30.6
Highest monthly rainfall, mm	288.2	362.9
Lowest monthly rainfall, mm	0	0
Highest recorded daily rainfall, mm	139.2	166.4
Mean daily evaporation, mm	7.9	8.4 *

Data from the Bureau of Meteorology are provided in the Appendices, Section 15.13.

2.4. Ownership and Royalties

Olympia Resources has negotiated royalties with various stakeholders in the Harts Range garnet deposits. The first of these is with the vendor of the leases to Olympia Resources; the agreed basis is that the vendor will receive a royalty per tonne of garnet produced. The second agreement is with the local indigenous community, to which Olympia Resources will also pay a royalty per tonne of garnet produced. The third agreement, which has yet to be finalised, is with the Northern Territory Government. Olympia Resources expects to pay the Government a percentage of the net profit on garnet produced, with a royalty holiday yet to be determined.

² Figures marked with * were obtained from data for Alice Springs Airport, where data acquisition continues



3. GEOLOGY, RESOURCES AND RESERVES

3.1. Summary

The following information has supplied to Olympia Resources by Continental Resource Management Pty Ltd.³

During 2002 Olympia Resources Ltd undertook an extensive air-core exploration programme in the Harts Range district. Large resources of garnetiferous sand were identified in deposits either side of the Plenty Highway.

Estimations of the resources have been made based on geological logging of the holes, and analysis of the heavy mineral content using tetro-bromo-ethane separation. Garnet content has been determined on composite samples by various techniques including methyl iodide, rare earth magnet and Wilfley table separations.

Drill density varies over the project, requiring the resource classification to be spread between measured, indicated and inferred. A further factor in classification of the resource has been the relative confidence in the garnet contents of the various resource units.

3.2. Tenements

Olympia has assembled a portfolio of 14 tenements in the Harts Range region of the Northern Territory, as set out in the following table:

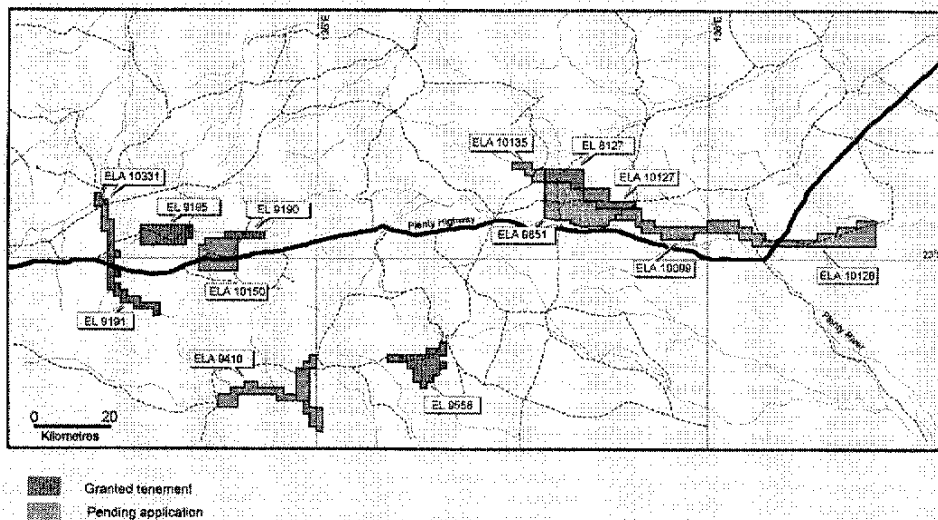
Tenement	Status	Holder/s	Area	AAPA Certificate
MLS171	Application 22-02-96	John W Bengert atf Olympia Resources Ltd	100ha	
EL8127	Granted 29-01-96 Expires 28-01-04	Olympia Resources Ltd	14 blocks	
EL9190	Granted 15-08-95 Expires 14-08-05	Olympia Resources Ltd	18.9 km ²	C2000/094
EL9191	Granted 15-08-95 Expires 14-08-05	Olympia Resources Ltd	50.55 km ²	
ELA9410	Application 30-10-95	John W Bengert atf Olympia Resources Ltd	41 blocks	

³ Continental Resource Management Pty Ltd, "Harts Range Garnet Project Resource Report, Olympia Resources Limited", Report No WA03/005, March 2003.

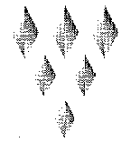


Tenement	Status	Holder/s	Area	AAPA Certificate
ML 23868	Application 24-04-03	Olympia Resources Ltd	2543 Ha	
ELA9851	Granted 24-01-02 Expires 23-01-08	Olympia Resources Ltd	67 blocks	
ELA10150	Granted 23-01-02 Expires 22-01-08	Olympia Resources Ltd	93 km ²	C2000/094
ELA10331	Granted 24-01-02 Expires 23-01-08	Olympia Resources Ltd	48.3 km ²	
ELA10372	Granted 23-01-02 Expires 22-01-08	Olympia Resources Ltd	39.0 km ²	
ELA23087	Application 5-3-01	A Lockett atf Olympia Resources Ltd	25 blocks	
ELA23088	Application 5-3-01	A Lockett atf Olympia Resources Ltd	14 blocks	
ELA23089	Application 5-3-01	A Lockett atf Olympia Resources Ltd	53 blocks	
ELA23090	Application 5-3-01	A Lockett atf Olympia Resources Ltd	8 blocks	

Tenements not held directly by Olympia are subject to agreements to purchase with the registered tenement holders.



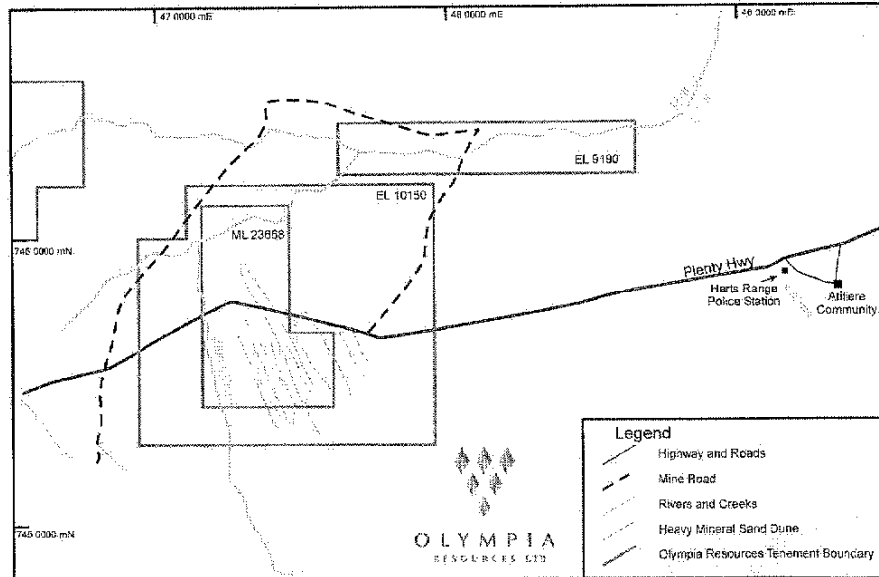
All of the leases are subject to Native Title as they are located on pastoral leases. An The Central Land Council and Olympia Resources have reached an Indigenous Land Use Agreement; this is further discussed in



Section 9.3.

Olympia Resources has based its reserves estimate on ore identified in two leases close to the Plenty Highway. These leases are shown in the following, more detailed map:

Olympia Resources Ltd



Tenement Location Diagram

Figure *

3.3. Geological Setting

Erosion of the eastern exposures of the Arunta Block has created from Alcoota Station eastwards to Indiana and Jervois Stations, almandine-rich alluvial garnet deposits potentially suitable for abrasive applications. These alluvial garnet deposits have been largely derived from the erosion of hard rock garnetiferous Proterozoic Irindina Gneiss and Riddock Amphibolite formations belonging to the Harts Range Group.

With decomposition, the garnet bearing source rocks disintegrate to detrital sands containing garnet and other heavy minerals such as magnetite and hornblende, which enter the numerous seasonal channelways that drain the areas of high relief. The feeder channels coalesce to form generally one main channel, and as these drain out of the areas of moderate relief they slow and broaden, often to widths of up to 100 to 200 metres. Significant volumes of alluvium accumulate as the channels widen, and access becomes easier as the surrounding relief becomes lower.



An exception to the river-bed alluvial garnet deposits are the Riddock Dunes. These are a series of north-westerly trending fixed dunes in otherwise low relief terrain covered by Quaternary alluvial sands and drained by south bank tributaries to the Plenty River. They are believed to have formed from overbank deposits of the Plenty River, and are similarly rich in heavy minerals and garnet.

3.4. Geology

The geological units of the Olympia deposits in the Harts Range area are:

- River Wash: Sands and gravels of the active channels of Aturga Creek and the Plenty River.
- Floodplain Deposits: Consolidated, but unaltered and unlithified, mostly from 1.5 to 4.5m thick.
- Dunes: Fixed sand-dunes, up to 20m thick. They contain carbonate alteration and some lithification, especially towards their base.
- Swales: Between the dunes. They are finer-grained than the dunes and more strongly lithified.
- Paleochannels: Older floodplain and river channel deposits unconformably beneath the floodplain, dune, and swale units. They are lithified and subject to carbonate alteration in part.

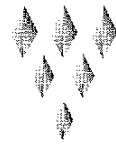
Tertiary Clay: Tertiary clay unconformably underlies the above units. It is known from water bores in the area to be in excess of 100m thick in places. It is cream or green in colour, and contains minor sand grains.

The river channels, the floodplains, the paleochannels and the dunes all contain significant quantities of heavy minerals, including garnet. These units average over 7 % garnet and 40 % total heavy minerals in their sand fraction, which comprises between 75 and 80% of each of the units. The swales also contain heavy minerals and garnet.

3.5. Drilling Program

Continental Resource Management Pty Ltd supervised an air-core drilling program on E10150 and E9190 in the Harts Range, in the Northern Territory in late 2002 on behalf of Olympia Resources Ltd. The drilling was successful in locating substantial resources of garnet in four geological environments. The environments are:

- Desert dunes
- Floodplains of modern creeks and rivers
- Modern river channels



- Palaeochannels, possible Tertiary in age.

The dunes contain a large amount of heavy mineral, with grades between 30 and 54% and averaging 43% in their sand fraction, which constitutes approximately 78% of the dune material. The heavy mineral fraction averages about 18% garnet. The garnet is similar in grain size distribution to that produced by GMA Garnet at Port Gregory in Western Australia, but is significantly more angular. In 2001 Olympia drilled the dunes to a depth of 2m with a hand auger and estimated a resource of 13.4Mt of sand containing 1.3Mt garnet to a depth of about 2.5m.

The modern river channels in the Harts Range area have been the subject of extensive prospecting since the 1960s. Olympia has previously identified resources of garnet in the Hale River, Ongeva Creek and the Plenty River. The garnet in the riverbeds is suitable for abrasive applications.

Drilling in 2002 extended the resource known from the dunes and modern river channels by testing the full depth of the dune sands and confirming the results of the hand auger drilling conducted on the Plenty River in 2001. The drilling program also led to the discovery of garnetiferous sand in the floodplain and palaeochannel deposits beside Aturga Creek and the Plenty River.

3.6. Mineral Resource Estimate

The tenements held by Olympia Resources which have been included in resource estimates are listed below.

Summary of Olympia Resources Tenements in the Resource Statement

Tenement	Status	Holder/s	Area	AAPA Certificate
EL9190	Granted 15-08-95 Expires 14-08-05	Olympia Resources Ltd	18.9 km ²	C2000/09 4
EL9191	Granted 15-08-95 Expires 14-08-05	Olympia Resources Ltd	50.55 km ²	C1998/01 2
ELA10150	Granted 23-01-02 Expires 22-01-08	Olympia Resources Ltd	93 km ²	C2000/09 4
ELA10331	Granted 24-01-02 Expires 23-01-08	Olympia Resources Ltd	48.3 km ²	
ELA9410	Application 30-10-95	John W Benger atf Olympia Resources Ltd	41 blocks	

The resource estimate is set out in detail in the Continental Resource



Management report. ⁴ The resource estimate is summarised below.

	Bulk Density	Tonnes Sand	Garnet	Tonnes Garnet
<u>Measured</u>				
Floodplain	1.73	2,800,000	6.5%	180,000
Palaeochannel	1.73	3,900,000	9.3%	360,000
Dune 1	1.85	12,000,000	7.7%	920,000
Total Measured		18,800,000	7.8%	1,500,000
<u>Indicated</u>				
Floodplain	1.73	11,200,000	9.1%	1,000,000
Dunes	1.85	19,800,000	7.6%	1,500,000
Ongeva South	1.7	2,000,000	5.7%	120,000
Total Indicated		33,000,000	7.9%	2,620,000
<u>Inferred</u>				
Aturga Floodplain	1.73	3,300,000	10.8%	360,000
Aturga Creek Channel	1.7	540,000	13.6%	70,000
Plenty River Floodplain	1.73	3,400,000	6.0%	200,000
Plenty River Channel	1.7	1,000,000	16.0%	170,000
Dunes	1.85	7,000,000	8.1%	570,000
Ongeva Creek North	1.7	3,400,000	3.1%	110,000
Hale River	1.7	11,700,000	5.5%	640,000
Total Inferred		30,340,000	7.0%	2,120,000
Grand Total		82,140,000	7.6%	6,240,000

Note: Some numbers are rounded appropriately

3.7. Reserves

Continental Resource Management Pty Ltd have applied recovery factors to a portion of the resources identified in Section 3.6 and conclude the total estimated reserves of garnet (2.3Mt) and AMH (6.1Mt) are sufficient to support production of 100,000t of garnet and 300,000t of AMH per year for 20 years.

These reserves are summarised as follows:

⁴ Continental Resource Management Report WA03/005, *ibid*.



Reserve Summary - Harts Range Garnet - AMH Project
(all numbers are metric tonnes)

Ore Type	Ore	Garnet In Sand	Garnet Recovered	AMH In Sand	AMH Recovered
Proven					
Dune	25,000,000	1,600,000	720,000	6,900,000	2,100,000
Floodplain	3,400,000	220,000	120,000	965,000	340,000
Paleochannel	6,000,000	390,000	230,000	1,400,000	570,000
Swale	1,600,000	98,000	52,000	370,000	120,000
Total Proven	36,000,000	2,300,000	1,100,000	9,600,000	3,100,000
Probable					
Creek Channel	440,000	49,000	30,000	110,000	43,000
Floodplain And Paleochannel	16,000,000	1,200,000	680,000	4,200,000	1,600,000
Dune	18,000,000	1,000,000	480,000	4,800,000	1,400,000
Total Probable	35,000,000	2,300,000	1,200,000	9,100,000	3,100,000

In estimating the reserves Continental Resource Management assumed that all of the resource within the area of the reserves is recoverable. In practice, however, Continental Resource Management expects that a small proportion of the resource will not be recovered, for the following reasons:

- Up to 2% of the reserve may be lost to protect mature trees, as directed by the environmental consultants
- The topsoil layer will not be processed. This may be as thick as 10cm. The floodplain averages about 2.3m in thickness. A 10cm layer of it thus comprises about 4% of its total. The dunes are thicker and thus a lower proportion of them will be affected, and the paleochannel ore, being everywhere buried, will not be affected.
- There will be no losses in the palaeochannel
- The plant is sited within the area of the reserves, probably on dune material over paleochannel. The plant is expected to cover a 100m square site, the north-western corner of which is at 7,457,000N 472,400E. The volume of dune sand beneath this site is 20,000m³, and of paleochannel, 18,000m³.

In the reserve estimate the following recoveries have been used for garnet >250µm, as a percentage of the total garnet:

Floodplain:	56%
Dune:	46%



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Palaeochannel:	56%
Swale:	53%

These figures have been used to estimate the reserves of garnet. The recent testwork indicates that 40% of the AMH will be recovered into product (Section 15.4).

Subsequent to Continental Resource Management's issue of the reserves report, test work using a Rare Earth Roll was completed at Lakefield Oretest. With the addition of a triple-stage Rare Earth Roll on the +710 dry plant tails stream, recovery of garnet >250µm as a percentage of the total garnet are as follows:

Floodplain:	60%
Dune:	46%
Palaeochannel:	60%
Swale:	53%

Production rates, and capital and operating cost estimates have been prepared using the revised recovery figures.

4. MINING

4.1. Mining Method

4.1.1. *Parameters*

The mine plan is based upon delivering 1.2Mt/a of ore to the processing plant. The in situ bulk density is approximately 1.8 t/m³, while the loose bulk density is approximately 1.5 t/m³. The angle of repose of the dry loose sand is approximately 33°.

The orebody can best be described as unconsolidated fluvial sands, with an interburden layer of weakly consolidated fluvial sands within a carbonate matrix.

The total pit depth will average 6.5m, consisting of:

- 0.1m topsoil
- 3.0m Floodplain ore
- 0.5m calcrete interburden (not always present)
- 3.3m Palaeochannel ore

The haul distance from the pit to the processing plant is not excessive. Mining operations are planned for a rate of 150 t/h, and with a haul distance of up to 800m this can be carried out with one (1) 40t⁵ capacity articulated dump truck (ADT) and loader. Should mining activity take place beyond this distance, either additional earthmoving equipment can be employed, or the wet concentrator plant can be re-located.

4.1.2. *Geotechnical engineering*

As the depth of the pit is not likely to exceed 7m, there are no major geotechnical problems at Harts Range.

4.1.3. *Hydrology*

Aturga Creek runs through the mining area from south to north. Diversion works (trench and bunds) will be required to divert intermittent flow around the mining pit. A contracted bulldozer will construct these pit protection measures.

Water from tails will seep into pit from backfill areas. Olympia will employ a diesel-driven pump to return water from a collection sump into

⁵ Vehicle capacities are normally quoted in short tons, so capacity of ADT in metric tonnes is 36.

the cyclone overflow return pump hopper. There will be minimal in-pit storage volume available.

Rainfall events will partially flood the pit in the wet season, as it is estimated that the pit will not drain naturally in the time required to prevent flooding altogether. The open area of pit will be approximately 40,000 m². Some water will be absorbed into sandy ground surrounding the pit, but it will be slow to release, leading to some water accumulation within the pit.

4.1.4.

Equipment List

The following equipment is proposed for the mining operation:

Equipment	No	Proposed Type/Model	Utilisation (h/a)	Strategy
Front End Loader	1	Volvo L220E or equivalent	8000	Contractor
Front End Loader	1	Volvo L180E or equivalent	8000	Contractor
Articulated Dump Truck	1	Bell B40C or equivalent	8000	Contractor
Water Truck	1		1000	Purchase
Grader	1		1000	Purchase
Dozer	1		1000	Hire
Lights	2		3650	Purchase

The equipment listed above will be sufficient when mining within 800m of the wet plant. At larger distances, one or more additional Articulated Dump Trucks will be required.

Other equipment located at the mine site will include a slimes stacker and water return pump. This equipment is included in the process plant equipment list.

The fuel farm to supply diesel and lubricants for the mining equipment is included in the capital cost for the Wet Plant.

4.1.5.

Consumables list

Consumables used at the mine site include:

Equipment	Annual Consumption	Annual Cost
Diesel	800,000 litres	\$360,000
Tyres	various	\$50,000
Spare Parts	Included in repairs and maintenance cost	\$415,000

4.1.6. *Personnel list*

For a continuous mining operation within 800 m of the wet plant with a 4-shift roster, operation of the equipment listed in section 4.1.4 will require the following personnel:

Description	Number
FEL Operator	8
ADT Operator	4
Water Truck / Grader	1
Leave / Relief	1
Total Manning	14

4.2. *Mine Planning*

4.2.1. *Grade control*

Olympia Resources expects that there will be very little deliberate grade control. Some work will be needed to determine the edges of the mining sections of Palaeochannel, although this will be visible when mining, as there is a calcrete cement in the Palaeochannel on the margins and it will be very obvious to the operator. The Floodplain mining plan is incomplete, but its primary purpose is to minimise the loss of reserves due to removal of the topsoil layer. The dunes require no further work with respect to grade control.

4.2.2. *Pit design⁶*

The basic mining approach involves a constantly advancing mining face moving approximately 80m laterally (crest to toe of ore faces), and approx 160m in width.

A simultaneous backfilling operation will follow the pit path, returning the ground to approximately the original topography.

4.2.3. *Pre-stripping and initial earthworks*

The general sequence of events is expected to be as follows:

1. Diverting Aturga Creek and construction of bund walls around the initial mining area.
2. Clearing of vegetation and stripping and stockpiling of topsoil from initial pit area.
3. Clearing of vegetation and stripping and stockpiling of topsoil from initial tailings dump area.

⁶ See typical section drawing in the Appendices, Section 15.11.

4. The first four months of tailings will require dumping above natural grade to enable the creation of the mine pit void space. This material will be placed in the form of an elongated low (+10m) hill, not dissimilar to the existing dunes located to the east of the initial mining area. When sufficient void space has been created in the mine pit, tailings will then begin to be used as backfill in the pit void. The above-grade tails dump created will be rehabilitated, with contouring, topsoil replacement, and revegetation taking place.

4.2.4. *Mining Sequence*

Mining will proceed as follows:

5. Contract dozer to clear vegetation to windrows either side of mine path.
6. Contract dozer to push topsoil (100mm) to windrows either side of mine path.
7. FEL 1 to mine Floodplain ore and dump over Palaeochannel ore face below.
8. FEL 1 to windrow calcrete interburden between Floodplain and Palaeochannel ore whilst ADT is delivering ore to plant. Load calcrete interburden in ADT for haul across pit when time is available.
9. FEL 1 to load now blended Palaeochannel and Flood-plain ore from lower level of pit into ADT for haul to feed stockpile and hopper.
10. FEL 2 to stockpile heavy mineral concentrate for drainage prior to dry processing.
11. FEL 2 to load stockpiled heavy mineral concentrate into dry plant feed hopper.
12. FEL 2 to load fine concentrate into ADT for haulage to long term fine heavy mineral stockpile.
13. FEL 2 to load oversize from Grizzly and Screen into ADT for return to backfill area of pit.
14. FEL 2 to load Dry Plant tails into ADT for return to backfill area of pit.
15. FEL 2 to move tails stacker and re-shape stacked tails.
16. FEL 2 to maintain slimes pond bunds, pit safety bunds, and dewatering pits and sumps.
17. Contract dozer to complete backfill re-shaping, topsoil spreading, and broken vegetation spreading.

18. Grader and water truck to maintain haul and entrance roads, in-pit roads and drainage, assist with rehab operations.

4.3. Mining Rate

The general understanding is that ore grades are very consistent laterally across the Floodplain and Palaeochannel ore. Due to the physical layout of the orebodies, mining is expected to progress along several north – south lines or axes.

The ore-body has been modelled using Micromine software.

In the first five years of mining it is possible that no dune sand will need to be mined if the rate of mining of about 1.2Mt/a is sustained. Olympia Resources suspects this will not happen, because in later years the company expects that the market will start to drive production.

The mining operation excavates 1.2 Mt/a of ore consisting of 60% Palaeochannel material and 40% Floodplain material. This ore blend consists of 45% heavy mineral and contains the following:

- Slimes and Oversize – 319 kt/a
- Total Sand – 881 kt/a
- Heavy Mineral – 397 kt/a (proportion of total sand)
- Garnet – 73.5 kt/a (proportion of heavy mineral)

The wet plant design is based on the feed above produces the following streams:

- Oversize – 137 kt/a
- Slimes – 182 kt/a
- Coarse HM Concentrate – 290 kt/a
- Fine (<250 micron) HM Concentrate – 143 kt/a
- Tailings – 448 kt/a

Coarse heavy mineral concentrate will be stockpiled for about a month to allow the concentrate to dry naturally. The stockpile will then be reclaimed to the feed hopper of the dry separation plant.

The dry plant will produce 178.5 kt/a of saleable products with the remaining 111 kt/a waste being returned to the mining pit by off-road mining truck for disposal with wet plant tailings. The market for fine (< 250 micron) heavy mineral concentrate is currently uncertain and as a result this material will be stockpiled for potential future use. The oversize stream, containing very little water, will be disposed of by back-loading dump trucks from the pit. The wet plant tailings and slimes streams are to be pumped to the mine location for in-pit dis-

posal.

4.4. Mining Capital and Operating Cost Estimates

It is currently envisaged that the mining operation will be by a contractor, so no capital cost will be incurred by Olympia Resources for mining plant and equipment other than the water truck, grader, and lights. The capital cost of these items has been included in the Appendices, Section 15.12. The total cost, using some second-hand equipment, is estimated to be \$0.4M.

HBH estimated costs incurred if the strategy described in Section 4.1.4 is pursued. It was assumed that the Front End Loaders and Articulated Dump Trucks would be leased, as they will operate continuously and have a life of approximately 10,000 hours (15 months). The water truck and grader would be purchased outright second-hand, but are expected to operate (on average) 20 hours per week or 1000 hours per year. Two light stands would be purchased and would operate 10 hours per day or 3650 hours per year.

The dozer is expected to operate between 500 and 1000 hours per year, clearing vegetation, stripping and replacing topsoil, and performing rehabilitation activities. An allowance was made to hire the dozer with operator.

A detailed mining cost estimate is included in Section 15.12. This estimate concludes with a direct cost of \$2.31/t of ore mined, or \$2.57/t if the mining operation is implemented by a contractor with a profit margin of 10%.

Olympia have received budget pricing of \$2.37/t for mining within 1200m of the wet plant ⁷. The quote is subject to confirmation after a site visit and excludes camp and meal facilities ⁸. The inclusion of other minor costs is to be confirmed, but this quotation suggests a very streamlined mining operation. The \$2.57/t figure has been used in the operating cost estimate in this study, as the volume of dry plant tails has increased since the quote was obtained.

⁷ Contractor is Kwikcon, local to Alice Springs

⁸ The budget price also referred to a mobilisation cost of \$42,000 which amounts to \$0.005/tonne of product when amortised over 5 years.



5. PROCESSING

5.1. Ore Sampling and Test work

Olympia Resources sampled the orebody in 2003, including obtaining bulk samples. Flowsheet alternatives were trialled at laboratories in Perth. Reports of the various tests are available, and form the basis of process design ⁹.

The flowsheet has been developed from first principles and testwork conducted on samples of feed from Harts Range in the Northern Territory. The plant has been designed to produce garnet and garnetblende products for sand blasting and water filtration applications.

5.2. Mineral Separation Plant (MSP) ("Wet Plant")

The Harts Range MSP is planned to be a conventional heavy mineral sand concentration plant operating in a remote location. The facility will include all infrastructure required to support the process plant operation.

The flowsheet for this facility is relatively simple. Its operation should be robust and reliable. The assumed operating year of 8000 hours leaves over 4 weeks for unplanned downtime and planned shutdowns for maintenance; this is considered conservative for such a plant.

The MSP will be a transportable conventional spiral separation plant with a feed rate of 1.2 Mt/a (150 t/h) at an average feed grade of 45% heavy mineral. The plant will produce 27 t/h of coarse HMC and 15 t/h of fine (-250 micron) HMC. The design will allow for relocation after mining out an area to minimise haulage costs.

The MSP will produce a plus 250µm coarse HMC as feed for the dry plant at Harts Range.

A conceptual plant layout is included in the Appendices, Section 15.11.

The main elements of the Harts Range MSP are described below.

5.2.1. *Vibrating Screen & Cyclone Desliming*

The front end loader will feed a hopper with a belt feeder discharging onto a polyurethane deck vibrating screen fitted with water sprays.

⁹ See Appendices, Section 15.4.



The 1.7 mm aperture screen breaks up the sand feed and with the aid of water sprays forms slurry, which reports to the constant density feed tank and a clean oversize waste for disposal.

The slurry is pumped from the constant density tank into the de-sliming cyclones. Coarse heavy minerals are discharged through the apex, and fine (<90 micron) slimes minerals are exited through the vortex finder located at the top middle of the cyclone. The cyclone underflow gravity flows to the primary hydrosizer with the fine slimes fraction reporting to the slimes thickener. This slime fraction would have a negative impact on the subsequent gravity separation if not removed at this stage.

5.2.2.

Hydrosizer

The primary hydrosizer uses a rising current of water to separate the fine and coarse sand. Hydrosizers (up-current classifiers) act on the differences in size and density of mineral particles. Water is injected through perforated spray pipes, providing a rising up-current of water. Mineral feed entering the top of the classifier meets the rising current.

The interaction of the rising current and the settling solids creates a fluidised bed of particles that causes fine or low density mineral grains to rise over the overflow weir together with the process water. Coarser or higher density grains pass through the fluidised bed to the underflow discharge.

Hydrosizers are commonly used in this application in the mineral sands industry. The fluid bed density and rising current velocity can be used as operating parameters to change the size separation being achieved.

5.2.3.

Beneficiation Plant

To increase the separation efficiency of the spirals, the beneficiation plant is split into a fine and a coarse stream. The coarse and fine streams are fed from the hydrosizer underflow and overflow respectively. Each of these streams consists of a rougher, scavenger and cleaner spiral circuit to make a clean Heavy Mineral Concentrate (HMC).

Spiral concentrators use differences in mineral specific gravity and the effects of fluid drag to separate light and heavy minerals. A spiral concentrator consists of a curved trough formed into a spiral around a vertical axis. Feed pulp enters the top of the spiral column and flows down. The particles sort themselves according to size, shape and density with the lighter, coarser and rounder particles carried by the flowing water to the outside of the trough. Heavier, finer and flatter particles stay close to the inside of the spiral.

The heavy mineral concentrate is progressively removed from the trough by splitters located along the length and at the base of the spi-



ral. The garnet (specific gravity 4.03) and amphibole (3.29) are both high-density minerals with respect to quartz, which has a specific gravity of 2.65. The final product from the spirals is a heavy mineral concentrate that is suitable for dry mill processing.

5.2.4. *Concentrate Handling*

Fine beneficiated HMC is screened to recover the plus 250µm HMC for incorporation into the coarse HMC product. The minus 250µm HMC is stockpiled using a stacker and dewatering cyclone for future use.

The coarse (plus 250µm) concentrate will be pumped to the concentrate vacuum belt filter where a filter cake and a filtrate are produced. The use of demineralised water sprays on this vacuum filter belt is to remove salt from the HMC concentrate.

5.2.5. *Services*

Fine and coarse tailings slurries from the beneficiation circuits are pumped to dewatering cyclones within the mining pit. Cyclone stacking of this slurry takes place with cyclone overflow, containing very low solids, being pumped back to the process water pond. The deposition of tails back into the pit is also further controlled to leave a shallow depression to be used for solar drying of the Slimes Thickener underflow. Once solar drying of the fines ponds is complete, rehabilitation starting with the reinstatement of the topsoil may commence.

Water will be supplied from a bore field and pumped to a process water tank at the plant site.

Power will be supplied from a contract supply diesel fired power station. A laboratory, workshops, stores and administration will be provided on site.

An accommodation camp will be provided on site plus a reverse osmosis plant for potable water supply.

5.3. *Dry Separation Plant ("DSP") ("Dry Plant")*

The Harts Range DSP facility is planned to convert the coarse concentrate from the MSP into four product streams. The dry plant flowsheet is relatively simple. While amphibole and garnet are physically quite similar, it is possible for streams of high concentrations of either to be created using conventional screening and magnetic separation. Energy demand in the plant is largely due to the concentrate drier, which will use LPG as fuel.

A conceptual plant layout is included in the Appendices, Section 15.11.



The process is described in greater detail below.

5.3.1. Concentrate Drying & Screening

The HMC will be reclaimed from a stockpile after some time elapses for maximum natural drying. The concentrate will be dried using a system consisting of a fluid bed drier, fluid bed cooler, de-dusting cyclone and baghouse.

5.3.2. Electrostatic Separation

The concentrate will pass through an electrostatic corona discharge separator to remove the ilmenite in the concentrate. This will simplify future processing and magnetic separation if removed at this stage. A DC wire electrode running parallel to the roll generates a corona charged electrostatic field between itself and the earthed roll. Mineral is fed onto the rotating roll and is carried into the zone of influence of the ionising wire. All grains passing through this zone receive an electrical surface charge.

Conductor particles quickly lose their charge to the earthed roll and because of inertia leave the roll and are collected. Non-conductor particles acquire an opposite charge to the roll surface and are thus attracted to the surface until brushes dislodge them. A wiper electrode supplied with high voltage AC is set below the roll to help remove the non-conductor minerals by neutralising the induced charge.

High-tension roll separators are commonly found in all dry mill circuits for the separation of conductive rutile and non-conductive zircon. In this instance they will be used to remove ilmenite.

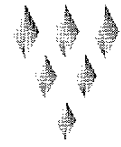
The ilmenite will be a waste stream.

5.3.3. Dry Screening

The concentrate will be screened at 710, 450 and 250µm using a triple deck vibrating screen into three product streams namely plus 710µm, minus 710+450µm, minus 450+250µm and an undersize waste stream.

5.3.4. LIMS Magnetic Separation

These LIMS (Low Intensity Magnetic Separation) devices are low strength magnets, which are used to remove the highly magnetic magnetite. Each stream will have a low intensity magnetic separator to remove the magnetite that will initially go to waste. The feed to the LIMS will be by variable speed conveyor feeder.



5.3.5. *RED Separation*

The RED (Rare Earth Drum) separation will separate quartz, AMH and garnet. The quartz will go to waste and the middlings will be separated further using secondary RED drums.

The mineral is fed in a thin falling layer over a large diameter (600mm) rotating stainless steel drum, inside of which is a permanent rare earth magnet. Magnetic minerals fall in an arc close to the drum surface, whilst progressively less magnetic minerals fall further from the drum. A series of knife-edge splitters separate the minerals now classified by magnetic susceptibility.

Rare earth magnetic drum separators are applied to a wide range of separation duties that include improving the ceramic quality of zircon by rejecting weakly magnetic contaminants, to production of ilmenite products. For this project they will be effective in separating quartz garnet and amphibole particularly at the coarse sizes.

5.3.6. *RER Separation*

A single triple-stage RER (Rare Earth Roll) unit will be used to scavenge garnet and AMH from the +710 RED tails stream. The magnetics product (combined garnet and AMH) will be combined with the Coarse Garnetblende product from the +710 RED stage, whilst the non-magnetic minerals will go to tails.

A Rare Earth Roll unit consists of one or more stages of magnetic separation devices. Each device comprises a feed chute (with roll feeder on the first stage) discharging feed onto a thin conveyor, which passes around a high strength magnetic head roller. The head roller is constructed of alternating slices of rare earth magnet and steel poles, and serves to hold paramagnetic and magnetic minerals to the belt as it passes around the head roller. The movement of the belt flings non-magnetic minerals outwards, whereas the magnetic minerals only fall from the belt once past the magnetic roller.

Rare Earth Roll separators are commonly used in mineral sand and industrial mineral applications for separation of magnetic minerals.

5.3.7. *Product Loadout*

The dry products will be loaded into road trains for transport in bulk to the Alice Springs facility, where it will either be transferred into containers for export via Darwin (as bulk material within the containers), or be packed into 2 tonne bulka-bags and 25kg bags, for both domestic and export markets. The products will depart Alice Springs by rail or road.



5.3.8. *Services*

All services will be locally produced, in common with those for the MSP.

5.4. **Product Packing and Despatch**

There will be four dry plant products, which can be packed in 25kg bags, 2 tonne bulka bags or shipped in bulk

- +710µm Garnet - 25kg bags, 2 tonne bulka bags
- +710µm Garnetblende - 25kg bags, 2 tonne bulka bags
- 710+250µm Garnet - 25kg bags, 2 tonne bulka bags
- 710+250µm Garnetblende – bulk only

Olympia Resources will contract with Perkins Shipping Group for product packing and shipping. Perkins will establish a packing plant and bulk storage facility in Alice Springs, with rail access. The facility will receive bulk products from Harts Range into store. Sales in bulk will be by container (until the Port of Darwin has a bulk loading system), and Perkins will load containers in Alice Springs for the international market. These containers will be transferred to Darwin via the new railway.

Product packed in bags will be shipped by road or rail from Alice Springs to the customer, either north or south of Alice Springs.

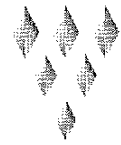
5.5. **Future Expansion**

Olympia Resources has two expansion paths: market the <250µm material stockpiled at Harts Range; or increase the capacity of the total operation to produce the coarse fractions of garnet and amphibole. The resource estimates for Harts Range show that an increased production rate is sustainable. Clearly, both expansion paths depend on market success in the first phase of the project.

Both the wet plant at Harts Range and the dry plant in Alice Springs will be designed to permit future expansion with minimal impact on ongoing operations. The level of pre-investment will be minor, but the concepts for future expansion have been worked through, and allowances made where appropriate.

5.6. **Production Workforce**

In addition to the personnel required at site for mining, Olympia Resources will employ a team to operate and maintain the process plants. The structure and numbers of the site organization is estimated as follows:



Title	Number Required
Mine Manager	1
Technical Manager	1
Shift Supervisors	4
Wet Plant Operators	4
Dry Plant Operators	4
Mechanical / Diesel Trades	2
Electrical Tradesman	1
Laboratory Staff	2
Leave Relief	2
TOTAL	21

The cost of these people has been included in the Operating Cost Estimate (Section 15.12).

A high degree of multi-skilling will be required in the workforce, as there are no additional staff available to cover for operators on meal or ablution breaks. The above staff will also interchange with the mining contractor operators, which do not have sufficient numbers to cover for meal and ablution breaks. Two leave relief operators have been included to account for staff absent on annual or sick leave.

Further staff are required for transport, packaging, and distribution duties at the Alice Springs packaging plant, and at Darwin Port. The numbers and cost of these people are detailed in the Transport and Logistics Report by Perkins (Section 15.7), and have been accounted for in the Operating Cost Estimate as a cost per tonne of product.

6. INFRASTRUCTURE AND ADMINISTRATION

6.1. Harts Range

The major facilities required at Harts Range are listed in the following:

6.1.1. *Accommodation*

Single person's quarters (SPQ) with 20 rooms, mess, wet mess, recreational facilities, water treatment plant, waste water treatment plant, landscaped outdoor area, suitable for occupancy by shift workers. Includes first aid facility. It is assumed that staff and contractors rostered off will return to Alice Springs, and that 38% of the workforce (contractor and staff) is sourced from the Harts Range community and reside locally.

6.1.2. *Administration office / gatehouse*

Transportable offices for site administration and gate supervision, containing the site communications hub.

6.1.3. *Borefield*

Eleven bores each capable of continuous delivery of 3-4 l/s. Production rates of up to 25 l/s will be required; this will be drawn from bores on a rotation basis, with the remaining units on standby or under maintenance. Bore pumps will deliver to a storage tank with independent transfer pump delivering water by pipeline to the process water tank at the plant.

6.1.4. *Power generation*

Diesel-fuelled package power station owned and operated by power provider contracted to deliver power to Olympia Resources.

6.1.5. *Mining equipment*

Owned and operated by contractor(s) to Olympia Resources.

6.1.6. *Diesel and oil storage*

Bunded and protected fuel storage tank(s) with all fixtures and fittings required by code for filling, emptying, delivery to vehicle refuelling point

6.1.7. *Workshop / warehouse*

Limited capability workshop, able to effect simple repairs on plant equipment and vehicles. Warehouse to comprise lockable undercover

and open area to store spare parts, consumables, etc.

A site plan is provided in the Appendices, Section 15.11.

6.2. Communications

Olympia Resources will have operations personnel based at the Harts Range site, and an administration team at the company's headquarters in Perth. The company will maintain high-speed data connections between all of its operations.

6.3. Company administration

For the purposes of this study an administration team comprised of the following positions has been assumed:

Position	Annual Cost
General Manager	\$150,000
Secretary	\$50,000
Accountant	\$75,000
Marketing Executive	\$125,000

Administration incurs additional costs, such as travel, office accommodation, communications and the like. These costs have been assumed to be:

Item	Annual Cost
Office accommodation	\$75,000
Travel	\$100,000
Other – allow	\$250,000

Summing the above, the total administration cost has been assumed to be \$0.83M per annum, before escalation.



7. TRANSPORT AND LOGISTICS

7.1. Products

The MSP at Harts Range will produce two streams of concentrate. A fine stream ($<250\mu\text{m}$) will be stockpiled on site in the first years of operation, while the coarse stream ($>250\mu\text{m}$) will pass as feed to the Harts Range dry plant. Olympia Resources will investigate potential markets for the fine stream; if buyers of some or all of this material can be found, it will also be loaded on to trucks for transport to Alice Springs.

The new Alice Springs – Darwin railway will be commissioned in time for Olympia Resources to use it for the long-distance product transport north to Darwin for export. Product will be in both bulk and packed form. In Darwin the wagons will be unloaded to a stockpile or container park prior to being loaded to ships in the Port of Darwin.

Olympia Resources will also have the option of selling to customers in the southern states of Australia. Products for these markets will be transported by road or rail south from Alice Springs.

Olympia Resources commissioned Perkins Shipping of Darwin to prepare a separate feasibility study into the methods and costs of product packing and transport. This study resulted in a report, which is provided in the Appendices, Section 15.7. This study developed transportation costs, which have been used in determining overall operating costs for the project (see Section 11.2).

7.2. Consumables

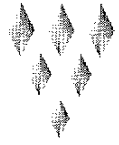
The processes at Harts Range require few consumables apart from diesel fuel for mobile equipment and for power generation, and LPG for the drier.

Fuel will be trucked to the site by road from Alice Springs.

Camp consumables will also be brought to site by road from Alice Springs. The ordering, storage and transport of all such materials will be managed by the camp contractor.

7.3. Personnel

Personnel working at Harts Range will live in the Single Person's Quarters near the plant, regardless of whether they are plant operators, mining contractor's personnel, power supply contractor's personnel, or camp support personnel (cook, cleaners, etc.). Olympia Resources as-



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sumes that these people will be drawn from the workforce generally available in Alice Springs, except perhaps for qualified technical personnel, who may need to be recruited from further afield. Olympia Resources also expects that these personnel will travel to site in their own vehicles at the start of a roster, and drive back to Alice Springs for R & R at the end of the roster period. Some personnel may be able to travel in company vehicles moving between the site and Alice Springs on a regular basis (supply trucks, etc.)

Under the terms of the proposed ILUA Olympia Resources and its contractors will engage day workers from the nearby aboriginal communities. Transport to and from site for these workers will be by bus, with the community most probably providing the bus and driver. Olympia Resources will operate the bus, and the project capital cost includes a 20-seat bus for this purpose as well as for other movements of personnel.

8. MARKETING

8.1. The Blasting Media Market

Vital to successfully preparing surfaces for surface coating by abrasive blasting is the choice of blasting media. There are many alternatives, but the choice will be dictated by cost, the quality of the result, and local environmental or occupational health regulations. In particular, high silica content in a blasting medium may mean that its use is banned.

Some of the more common non-metallic blasting media ¹⁰ are:

- *Silica sand* – rounded shape, low cost, 5 Mohr hardness ¹¹, high dusting, not suitable for recycling
- *Mineral sand (Ilmenite)*. Rounded Shape, 5-7 Mohr hardness, medium dusting, recyclable
- *Garnet*. Angular shape 7-8 Mohr hardness, medium dusting, recyclable.
- *Zircon*. Cubic shape, 7.5 Mohr hardness, low dusting, recyclable.
- *Slag (Copper)*. Angular shape, 8 Mohr hardness, low dusting, recyclable.
- *Silicon carbide*. Angular shape, 9 Mohr hardness, low dusting, recyclable.
- *Aluminium oxide*. Blocky shape, 8 Mohr hardness, low dusting, recyclable.
- *Aluminium oxide*. Blocky shape, 8 Mohr hardness, low dusting, recyclable.

Metallic abrasives are used for high productivity blasting of steel, particularly in blast chambers where the media can be efficiently recycled because of its relatively high cost.

Surface profile is a very important component of coating performance, and media specification and blasting technique will determine the end result. The table below indicates the effect of media specifications on

¹⁰ Robinson, J.: "What Lies Beneath – Surface Preparation, the Key to Coating Performance", Corrosion Management, v12no1, May 2003

¹¹ Mohr hardness ranges from 1 for talcum to 10 for diamonds, and applies to non-metallic materials. Hardness of metallic grit is measured in Rockwell C units (R_c)

surface profile on steel ¹².

Technology now available allows surface preparation to be closely tailored to the end use. For example, for painting over galvanised surfaces, a fine abrasive such as ilmenite is required to be used at low nozzle pressure to remove the surface oxide film from the zinc without damaging the galvanized coating. Steel shot has too much energy for this application and will inevitably produce poor results ¹³.

Abrasive	Profile Height - Microns				
	25µm	37µm	50µm	63µm	75-100µm
Silica sand	30/60 Mesh	16/35 Mesh	16/35 Mesh	8/35 Mesh	8/20 Mesh
Steel Grit	G80	G50	G40	G40	G25
Steel Shot	S110	S170	S280	S280	S330
Garnet	80 Mesh	36 Mesh	36 Mesh	16 Mesh	16 Mesh
Al. Oxide	100/50 Grit	36 Grit	24 Grit	24 Grit	16 Grit

8.2. Olympia Resources' Product Testing

Olympia Resources completed preliminary testing of representative samples of its garnet and amphibole products as blasting media ¹⁴. (This report is included in the Appendices, Section 15.6.) These tests were conducted in accordance with relevant Australian Standards. The conclusions of the testing were as follows:

- Each of the samples was found to be capable of producing a surface cleanliness of Class Sa3 as assessed by AS1627.4-1989, or ISO 8501-1.
- Abrasive blast cleaning with all but one of the samples produced a surface with residual dust contamination that would pass as a Grade 1 visual residual dust contamination test in

¹² Robinson, J; *ibid*.

¹³ Robinson, J; *ibid*.

¹⁴ Robert J de Graaf, Corrosion Management and Advisory Services report CMAS 309Ra, June 2003



accordance with AS 3894.6 Method C. (From best to worst, this is rated as less than Grade 1 to worse than Grade 5.) The sample which did not achieve grade 1 residual dust contamination achieved Grade 2.

- Small particulate contamination by embedment and adherence was detected by qualitative image analyses on micrographs. The research scientist recommended further investigation of this, as part of planned larger-scale trials.
- Adhesion tests were inconclusive. Adhesion values obtained were only 30 to 60% of what might be required for a high quality epoxy coating to adhere to the abrasive blast-cleaned steel. However, the scientist also noted that these results were poorly correlated with other test outcomes (profile, and residual dust). Further examination on larger trials is required to establish the suitability of Olympia Resources' products for use with coatings requiring high adhesion values.

It was clear from the preliminary testing that products of this project will perform as abrasive blast media. Further testing was indicated, with larger samples, to develop product performance specifications and to establish production quality control criteria.

Olympia Resources subsequently commissioned testing with 25kg samples of Harts Range garnet and garnet-AMH blend (50:50), with particle sizes > 425 microns. These materials were tested under Australian and international standards, and were compared with samples of both copper slag and a competitor's garnet product. The testing laboratory's report on these trials is also included in the Appendices, Section 15.6.¹⁵

Once again, the trials found that the two products could achieve surface cleanliness of Class Sa3, albeit with profiles too small for high-build heavy duty coating systems. There were some operator concerns with respect to high levels of dust; this issue warrants further investigation. Although there was surface contamination with the garnetblende sample, it was not significantly different to that obtained with the competitor's product. There were several indications that the Harts Range products are superior to copper slag.

The two reports on the performance of Harts Range products are considered to be preliminary by the testing laboratory. Nevertheless, Olympia's products will perform as blasting media, and acceptable results are achievable with normal methods of application. Tests by potential customers will occur in the near future, at which time a better

¹⁵ Robert J de Graaf, Corrosion Management and Advisory Services report CMAS 322Ra, September 2003

appreciation of product performance will become available to Olympia Resources.

8.3. Olympia Resources' Products

The Harts Range Project has been designed to produce four products.

Apart from the filtration grade product, Olympia Resources plans to market three blasting media, with varying proportions of garnet and amphibole. None of these products is exactly the same as any now sold by Olympia Resources' future competitors. Olympia Resources has a marketing strategy involving product substitution (for example, replacing the use of copper slag as a medium in Singapore, where the environmental hazards of its continued use are significant); and direct competition, albeit with an alternative material.

Much of the garnet sold internationally is in sizes less than the range nominated by Olympia Resources for its Harts Range products. Smaller particle sizes are not as effective in the blasting process. With the more coarse fractions available through this project, the Harts Range products are expected to be a superior product at the respective price points suggested by Olympia Resources.

8.3.1. *Filtration grade garnet, >710µm*

This is the premium product of the project. The large grain size available in the Harts Range Paleochannel deposits allows Olympia Resources to produce a material suited to water filtration and similar applications, with only low levels of impurity. The product will be not less than 93% garnet, with the impurities largely being represented by AMH. Olympia Resources will call this product "Coarse Garnet".

8.3.2. *>710µm Garnetblende*

This predominantly AMH blend will be sold as a blasting medium. This blend will be black in appearance. Olympia Resources will call this product "Coarse Garnetblende".

8.3.3. *Garnet, - 710µm + 250µm*

This predominantly garnet product will be Olympia Resources' premium blasting medium. Its name in the marketplace will be "Medium Garnet".

8.3.4. *AMH, - 710µm + 250µm*

This balanced blend of predominantly amphibole is also a blasting medium. It will be sold as "Medium Garnetblende".

8.3.5. HMC Material <250µm

While there may be some potential users of this finer material, Olympia Resources has determined that in the first phase of the Harts Range project it will not be processed into a saleable product. To minimise cost a blend of amphibole and garnet in this size range will be separated from the coarser material in the Harts Range wet plant, and then stockpiled on site. If it is never sold it can be readily returned to the mining area prior to completing rehabilitation.

8.4. Market Analysis

Olympia Resources has identified several potential markets, both in Australia and world-wide.

In the blast market around the world, metal slag, and in particular copper slag, is widely used. Due to the toxic nature of copper slag and therefore its destructive impact on the environment, its use is in decline and Olympia Resources believes that its garnetblende (garnet and AMH mix) is an ideal replacement product. It is environmentally friendly, as it is inert, while also being competitively priced relative to copper slag.

Australia

There is a large blast market across various industrial applications in Australia, especially in Victoria and South Australia. Until recently, much of the media used was various metal slags, and in particular copper slag, but garnet's share of this market is expected to increase due to environmental concerns and a reduction in the availability of domestically produced copper slag.

South-East Asia

In Singapore, a considerable demand for blast media exists in industries such as ship-building and offshore oil & gas fabrication. This demand has included the use of copper slag, and if a replacement, such as Olympia Resources' garnetblende were available at a competitive cost in Singapore, the users advise that the use of copper slag will be phased out, with support from the Government.

Other potential markets have been identified in South-East Asian countries such as Malaysia and Thailand.

Europe

The European garnet market has grown significantly over the past several years, but this growth is expected to be more moderate in future. Much of this recent growth was driven by the water jet market, but this has now levelled off. In addition, there does appear to be a trend for

heavy industry to be moving out of Europe where costs and environmental regulations are higher than in other areas around the world. Germany is the largest market in Europe, accounting for roughly one-third of European garnet consumption. There is also growth in the water filtration market, but this is starting from a small existing base.

In Europe, Olympia Resources is in discussions to distribute the Harts Range products through with a number of industry participants. The products would be shipped to Northern European ports, warehoused and then distributed by road and rail throughout Europe. Products could be shipped in bulk to the distributor, with the distributor being responsible for any required packing into smaller volumes.

North America

North America is the largest consumer of industrial garnet in the world, but local production is only able to satisfy roughly 40% of the annual market requirements, resulting in a substantial quantity of garnet being imported. Looking at the larger abrasives market, it is dominated by the use of silica sand, with garnet only accounting for about 2% of the market by volume. As such, there is potential for Olympia Resources' products in the North American market and Olympia Resources is currently in discussions with potential distributors there.

Overall, Olympia Resources believes that the Australian and South-East Asian markets will be capable of consuming all of the Harts Range output, at least in its first phase. However, some product will also be sold into the European and North American markets, as there has been considerable interest from users in these locations.

8.5. Marketing Status

Representatives of Olympia Resources have attended industrial mineral conferences, and have visited potential customers in Europe and North America, as well as South-East Asia. Preliminary product samples from testwork in early 2003 were well received by those seeing them. Olympia Resources more recently completed bulk testwork designed to create samples of a size sufficient for potential customers to trial the material. Olympia Resources will shortly despatch around 1 t of such samples to interested parties world-wide.

8.6. Pricing

Olympia Resources has acquired data on current selling prices for garnet products both within Australia and internationally. The Harts Range Project will produce some comparable products, but will also create new products for surface treatment, blends of garnet and AMH. The selling prices of these products have been assumed, based on reason-



able assessments of the likely worth of these products to the customers.

The products assumed for the base case, and their respective selling prices, are:

Product	Selling Price, A\$
Coarse Garnet, >710µm	300.00
Coarse Garnetblende, >710µm	300.00
Medium Garnet, - 710µm + 250µm	190.00
Medium Garnetblende, - 710µm + 250µm	96.50
Incremental cost, delivered in 2 t bulka bag	20.00
Incremental cost, delivered in 25kg bags on pallets	25.00

These prices are FOB Darwin. Olympia Resources may market its products FOT in the overseas market; if so, it will adjust its selling prices to include the additional transport and import duty costs.

8.7.

Revenue

Using the design basis throughput of the project, the product streams will generate revenue at the selling prices noted in Section 8.6 above. The base revenue from each product is shown in the following table, assuming all is sold in bulk:

Product	KT/A	A\$/t	A\$M
Coarse Garnet	13.05	300.00	3.92
Coarse Garnetblende	30.79	300.00	9.24
Medium Garnet	11.58	190.00	2.20
Medium Garnetblende	123.15	96.50	11.88
TOTAL			27.24

9. ENVIRONMENTAL IMPACT

9.1. Government approvals processes

The Northern Territory Government ¹⁶ requires project proponents such as Olympia Resources to submit a "Notice of Intent" (NOI) to initiate the process of environmental assessment and approval. The Harts Range NOI was prepared and submitted to the NT Government at the end of August 2003 (a copy of the NOI is included in the Appendices, Section 15.2). The Government will take about 4 weeks to process the NOI, during which time it will determine whether the project will require a "Project Environmental Report" (PER) or an "Environmental Impact Statement" (EIS). Olympia Resources expects that it will be required to meet the less stringent PER requirements.

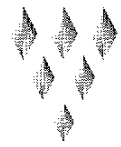
The PER process requires the proponent to submit a document which details the environmental and social impacts of the proposed project. The Government reviews this document for completeness, and releases it for public comment. Comments are received and assessed by the Government. Based upon these comments and its assessment more generally of the project, the Government decides whether to accept or reject the application.

The more stringent process for gaining environmental approval is the EIS. Under this process the proponent must respond to public comments, usually by issuing a supplement to the initial impact statement document. The Government then assesses the original impact statement, the public comments and the supplemental material before announcing its decision.

The PER process can take between 4 and 6 months to complete; the EIS process is longer, between 6 and 12 months.

The project is presently considered to have low environmental impact, given its size and the absence of toxic chemicals in the production process. Therefore, Olympia Resources expects that its NOI will result in the Government requiring a PER, and the schedule reflects this. The company will need approvals from the local indigenous people before the project can proceed. (See Section 9.3, where the status of agreements with local people is discussed.)

¹⁶ This discussion is based on a conversation with Mr Steve Tatzenko, Manager Environment & Policy, Minerals & Energy, Dept of Business, Industry & Resource Development, Northern Territory Government, and a brief review of guidelines posted to the Internet by Mr. Tatzenko's department.



9.2. Environmental impacts

One primary impact of the project upon the environment will arise from the mining operation. Olympia Resources has undertaken to preserve topsoil removed prior to mining beginning, and to rehabilitate the mined areas progressively as the ore depletes¹⁷. The processes at Harts Range will return tailings and rejected silica sand to the excavated areas, avoiding the need for long-term waste dumps or slimes dams.

The project requires a borefield to support operations at Harts Range. This borefield will be designed in accordance with best practice, and withdrawal rates will not exceed long-term sustainable rates from any bore. Water conservation is a feature of the production process design, to minimise the need to extract water from what is a very dry environment.

Road transport from Harts Range to Alice Springs is required. The project involves moving about 180,000 tonnes per annum of products from Harts Range to Alice Springs. As the project will operate for 8,000 hours per year, this implies a concentrate transport rate of 22.5 t/h for every hour of operation. In any 24-hour day, therefore, 540 t of concentrate will be trucked to Alice Springs. Olympia Resources expects that its transport contractor, Perkins, will move this material in side-tipping triple road trains with a capacity of up to 150 t per train. Therefore, 4 to 6 such road trains will be needed each working day, equally spaced throughout the 24 hours.

In Alice Springs, the packaging plant will operate 24 hours a day, 7 days a week, except for maintenance periods. The plant will generate light and some noise; Olympia Resources expects Perkins to minimise the impact of these by careful design, as well as by locating the plant away from residential areas of the town. The truck route to and from the site will avoid quiet areas of Alice Springs. A site to the north of the town, adjacent to the railway, is envisaged.

Products at Alice Springs will be stored on site in a manner designed to eliminate dust emissions to the surroundings.

When the products go to market, they will be loaded on to trucks, either in containers or pallets, and to rail, for transport either north to Darwin and export markets, or south to domestic markets. Again,

¹⁷ Olympia Resources will initiate environmental work such as a plant nursery and field planting, seed collection activities, mulching, and environmental sort monitoring. The final plan of these activities will be developed during the environmental approvals process. Olympia Resources hopes to involve the local communities in this work.



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routes for such transport will be organised to avoid impact on residential parts of Alice Springs.

The project has no other significant environmental impacts.

9.3. Native Title and related issues

Olympia Resources' Exploration Leases are all located within pastoral leases. Northern Territory legislation therefore requires the company to negotiate agreements with the local peoples before the leases can be converted to Mining Leases.

Olympia Resources negotiated an Indigenous Land Use Agreement ("ILUA") with the Central Land Council representing the indigenous peoples of the Harts Range region. The ILUA was executed by the parties in March 2003. The ILUA was notified in the print media, at the end of July 2003; objectors to the Agreement have until 30th October this year to do so. The Native Title Registrar will then assess the ILUA, and if it is found to comply with the Native Title Act, it will be registered and become effective. The salient points of the Indigenous Land Use Agreement are summarised in a letter from Olympia Resources' solicitors, in the Appendices, Section 15.5.

Olympia Resources expects to pay a royalty to the local communities. Additionally, the company will employ local people in the Harts Range workforce.

10. EXECUTION PLAN

10.1. Summary ¹⁸

Olympia Resources has initiated the environmental approvals processes with the Northern Territory Government, by submitting its Notice of Intent to proceed (NOI). Olympia has appointed HBH Consultants as its engineer and project manager. Design will commence by October 2003, and will advance to the point that long-lead equipment will be able to be ordered (committed) upon receipt of environmental approval from the Government.

Olympia Resources will contract with one construction company for fabrication and erection of both the MSP and the dry plant at Harts Range. This will produce economies of scale and resource sharing.

After initial mining has produced sufficient ore at the ROM pad, the Harts Range MSP operation will be commissioned, producing sufficient concentrate for commissioning of the dry plant. Bulk products will then be transferred by the company's contractor, Perkins, to Perkins' Alice Springs facility for load-out to customers, and for commissioning of the packing plant.

10.2. Schedule ¹⁹

The schedule milestones are shown in the following table. The implied activity durations are based on advice from the Northern Territory Government, and HBH's experience with similar projects elsewhere in Australia. The critical path lies through environmental approvals (to month 7), then through long-lead equipment delivery, completion of construction, and commissioning.

Activity	Month
Submit NOI to Northern Territory Government	0
Commission environmental consultants	1
Submit PER document	3
Government review complete	5
PER Public comment period complete	5

¹⁸ A more detailed Draft Project Execution Plan is included in the Appendices, Section 15.9.

¹⁹ A project high-level bar chart is provided in the Appendices, Section 15.10.



Activity	Month
Government review of PER complete	6
Environmental approval process completed	7
Environmental approval	7
Award engineering and project management	1
Order long-lead equipment	7
Complete engineering	8
Tender construction	6
Award construction	7
Mobilise to site	8
Commence overburden removal	9
Commence mining	9
Commence plant construction	8
Harts Range construction complete	15
Harts Range commissioning complete	16
Alice Springs construction complete	15
Alice Springs commissioning complete	17
First product	17
Consistent production	18

11. CAPITAL AND OPERATING COST ESTIMATES

11.1. Capital Cost Estimate

The Harts Range Project is estimated to require the expenditure of \$19.5M in direct costs with a further \$4.9M in indirect costs to establish the operation. This estimate comprises:

- Direct Costs - \$19.5M
 - Wet Concentrator - \$6.5M
 - Dry Separator - \$8.65M
 - In Pit - \$0.6M
 - Borefield - \$1.9M
 - Mining - \$0.4M
 - Camp - \$0.9M
 - Miscellaneous - \$0.55M
- Indirect Costs - \$4.9M
 - EPCM - \$2.65M
 - Client Costs - \$0.3M
 - Contingency - \$1.95M

11.1.1. *Wet Concentrator*

The \$6.5M expended in the construction of the Wet Concentrator includes the capital cost of the following mechanical equipment:

- Separation Spirals \$0.5M
- Pumps \$0.4M
- Vacuum Belt Filter \$0.55M
- Slimes Thickener \$0.45M

The Spirals and pumps are required to carry out the separation process and form the core of the Wet Concentrator. The Vacuum belt filter de-waters the concentrate prior to stockpiling. It is essential to reduce the

product moisture before drying, to reduce LPG consumption. The slimes thickener processes the slimes waste stream to recover as large a proportion of water as possible for return to the process. Although expensive it is cheaper than the alternatives of increased water supply, filters or a tailings dam.

11.1.2.

Dry Plant

Of the \$8.65M expended in the construction of the dry plant, capital is required for the purchase and installation of process equipment, as follows:

- Fluid Bed Dryer and Cooler \$1.2M
- Rare Earth Drums and Rolls \$1.25M
- Electrostatic Separators \$0.5M
- Screens \$0.3M
- Material Handling Equipment \$0.7M
- Material Storage \$0.4M

All of the above items are critical for carrying out the dry separation process.

The detailed Capital Cost Estimate is provided in the Appendices, Section 15.12.

11.1.3.

Cash Flow

For economic modelling purposes, a simple cash flow has been assumed, as follows:

Financial year	Proportion of total
2003-04	60%
2004-05	40%

This profile assumes that the schedule (see Section 10.2) is achieved.

11.2. Operating Cost Estimate

A direct operating cost of \$20M/Year, or \$115/Tonne of saleable product, is comprised of the following proportions:

- Mining Cost - \$3.2M/year (\$18/Tonne of product)
- Wet Plant Processing - \$3.2M/year (\$18/Tonne of product)
- Dry Plant Processing - \$4.1M/year (\$23/Tonne of product)
- Packaging and Transport - \$9.4M/year (\$56/Tonne of product)

The mining cost, although small per tonne of ore mined, equates to significant expense in light of the quantities of ore moved. Wet Plant operating expenditure comprises primarily of operating personnel, with further contributions from consumables, spares and power consumption. The Dry Plant operational expenditure is slightly higher than the wet plant expenditure, primarily due to the cost of LPG to provide heat for the drying process. The largest proportion of the operating cost is from packaging and transport. This cost is unavoidable due to the remote location of the site from the nearest port. The transport cost currently allows for road transport to Alice Springs and rail transport to the Port of Darwin.

To reduce the project capital expenditure many of the project costs are part of service contracts. These service contracts include the following:

- A mining contractor is employed to carry out all mining duties, reimbursed as a cost per tonne of ore feed.
- Logistics contractor packages and transports products from Storage Silos at the Harts Range Dry Plant to the Port of Darwin.
- A power contractor provides the diesel generation sets and associated infrastructure to provide 1600kW of power required for the project. The contractor's costs are reimbursed per kW/hr.

Olympia Resources may undertake the work within these service contract activities, hence reducing the operating cost at the expense of increased capital. However, from previous experience this is unlikely to result in large savings or an improved financial position for the project. Olympia Resources will re-evaluate the approach used in this study before deciding if change is warranted.

The detailed Operating Cost Estimate is provided in the Appendices, Section 15.12.

12. ECONOMICS

12.1. Principal economic parameters

The key parameters for this project are

- Product selling prices
- Capital cost
- Operating cost (particularly energy and transportation)
- Capacity expansion schedule

Other factors such as royalties affect project economics, but the impact of these is second-order.

Prices are FOB Darwin. Olympia Resources may market its products FOT in the overseas market; if so, it will adjust its selling prices to include the additional transport and import duty costs.

All results from the project economic model included in this study are before debt and before tax, so interest payments, depreciation and tax payments are not included. The impact of these factors on Olympia Resources is beyond the scope of this study.

12.2. Royalties and taxes

Olympia Resources has royalty obligations to the Northern Territory government, the local indigenous community, and the original owner of the Harts Range mining lease. The extent of the company's obligations is subject to further negotiation. For the purposes of this study, the royalties have been assumed as follows:

Royalty	Royalty structure
Vendor	\$2.00 per tonne of garnet sold
Local aboriginal communities	\$4.00 per tonne of garnet sold
Northern Territory Government	3% of net profit on all products sold, with a 5-year royalty holiday

It should be noted that the first two royalties are specifically calculated for each of Olympia Resources' products. Thus a tonne of material containing 25% garnet would attract a royalty of \$0.50, in the case of the vendor's royalty, because this tonne of material would contain 0.25t of

garnet. There is no royalty on amphibole sold in the case of the vendor and aboriginal community royalties.

12.3. Other parameters

The model examines the effects of inflation of both costs and revenues. Each can be varied independently of the other, allowing the user to see the effects of a difference in these rates (such as might arise if the market becomes more competitive, constraining selling price increases).

12.4. Base Case

The Base Case assumes prices and other parameters discussed throughout this report. They are documented in the Appendices, Section 15.8, where the Base Case model is provided. Key parameters are:

- Initial Capital expenditure of \$24.4M, with on-going minor capital works of \$2.3M over 20 years of operation
- A capital expenditure of 10% of the total initial capital (i.e., \$2.4M) is expended at the end of operations, for clean-up and restoration works
- Total production of 3.48 Mt, comprised of
 - 255kt of Coarse Garnet, >710 μ
 - 600kt of Coarse Garnetblende, >710 μ
 - 226kt of Medium Garnet, <710 μ >250 μ
 - 2401kt of Medium Garnetblende, <710 μ >250 μ
- No sales of <250 μ material
- The plant produces at its design basis for the second half of FY 2004-05 (i.e., from January to June 2005).

The key results of the Base Case are:

- An Internal Rate of Return of 26.4%
- An NPV of \$34.9M at a discount rate of 10%
- An initial payback period of approximately 5 years.

12.5. Sensitivities

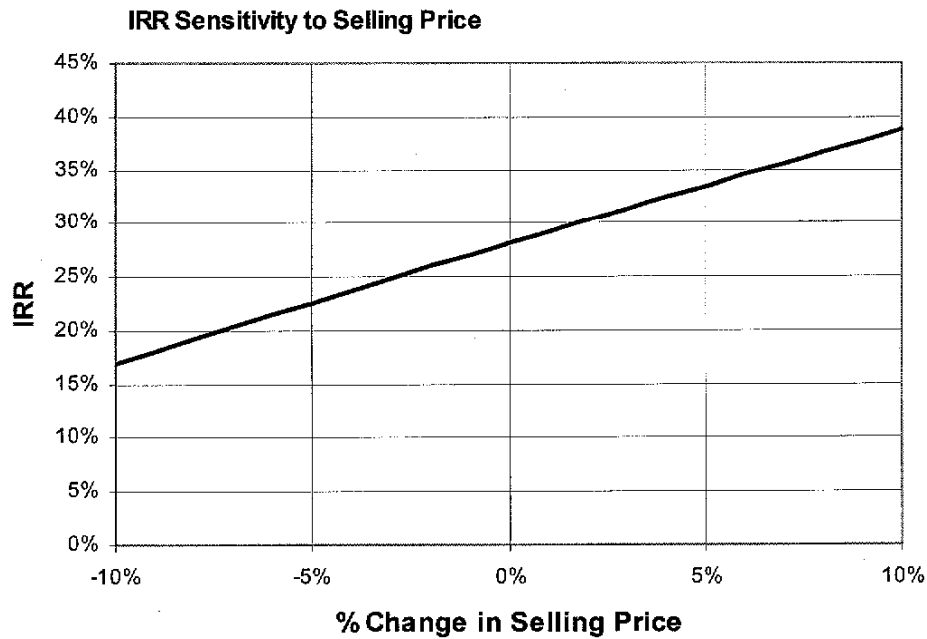
12.5.1. Exchange Rate

Some of Olympia Resources' sales will be denominated in US dollars. The proportion of these will vary, but the company expects the larger proportion of its products to be sold to Australian, European or South East Asian customers, so sensitivity to the USD exchange rate will not be very direct. For this study Olympia Resources has assumed selling prices in A\$ terms, and the potential impact of a rising Australian dollar

versus its US counterpart is covered in the sensitivity of project returns to selling price changes more generally, as discussed below.

12.5.2. *Selling Price*

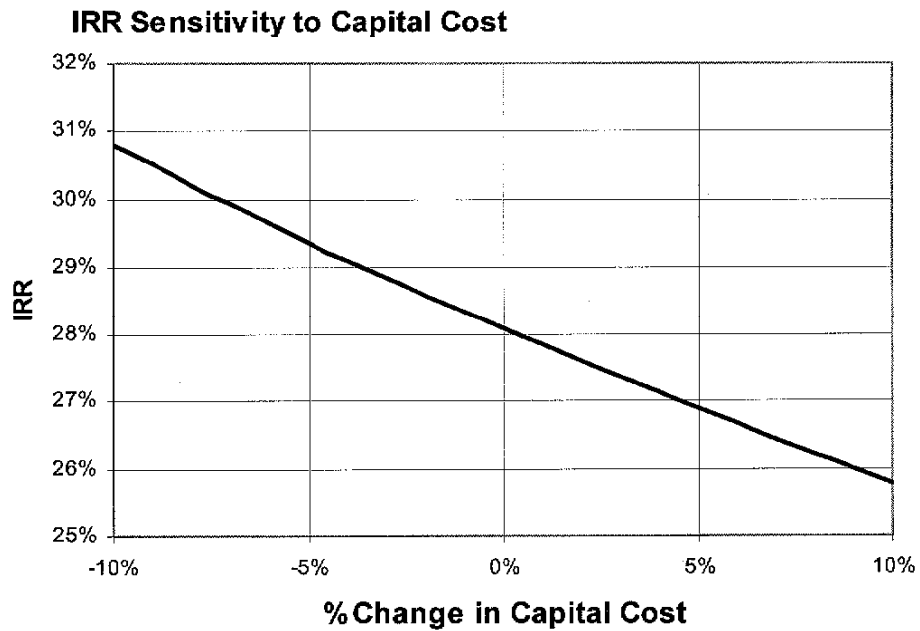
The Base Case assumptions on product selling prices were tested over a range of $\pm 10\%$, as shown in the following figure:



As can be seen, project economics are sensitive to selling price (revenue). An increase in Base Case selling price of 5% increases the Internal Rate of Return to about 32%, while a similar reduction sees IRR drop to about 20.5%.

12.5.3. Capital Cost

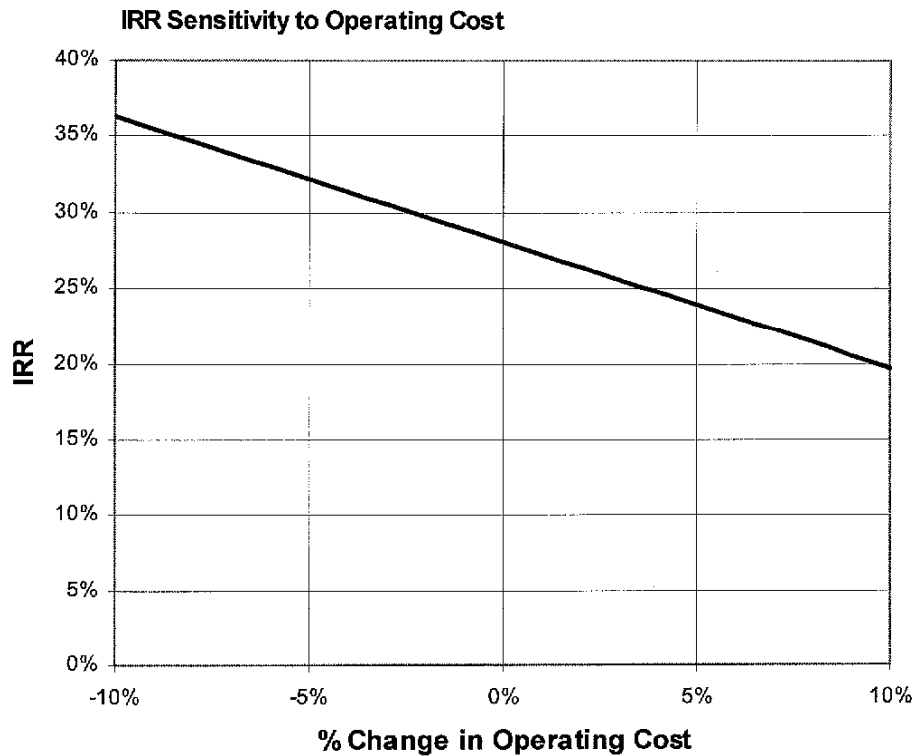
The economics of the project are less sensitive to capital cost than to selling price, as is demonstrated in the next diagram:



A capital cost overrun of 10% would result in an Internal Rate of Return reduced from 26.4% to about 24%, while a similar saving would lift the IRR to just about 28.5%.

12.5.4. *Operating Cost*

The project Internal Rate of Return is more sensitive to operating cost than to capital cost. This is shown in the following figure:



A 5% reduction in operating cost (which includes the costs of transport) will result in an increase of about 4.5% (from 26.4% to 30.9%) in the Internal Rate of Return. This provides Olympia Resources with a strong incentive to contain and reduce costs when the project goes into operation. Equally, operating cost overruns will damage returns on investment.

12.5.5. *Sale of <250 μ Material*

Olympia Resources has foreshadowed the possible sale of this finer product. The model was tested with a nominal sales level of 50kt/a commencing in year 5 of production, and continuing at this level until the end of the project. This represents about 22% of the total of this material produced over the life of the project; the remainder is retained in a stockpile or returned to the mined areas. At a nominal selling price of \$96.50/t, this assumed sale of <250 μ increases the IRR of the pro-

ject to 28.1%, and the NPV₁₀ to \$41.3M.

Clearly the project will benefit if Olympia Resources is able to develop a market for this fine product.

12.5.6.

Other

The Base Case assumes that 50% of capacity is sold during the first six months of operation. This assumption might be optimistic, if the following factors are considered:

- Early operations can experience difficulties, as the plant is optimised for maximum recovery and minimum operating costs, and as the personnel become familiar with plant new to them; and
- Olympia Resources may need to penetrate markets and to progressively obtain sales contracts for the full suite of minerals on offer.

Any decrease in the proportion of first year production to capacity below 50% reduces the project Internal Rate of Return. This provides Olympia Resources with a strong incentive to put in place sales contracts for the first year's production.

12.6.

Discussion

The overall return on investment in this project is adequate, as it achieves Internal Rate of Returns under various scenarios which are attractive, and positive NPVs at a hurdle rate of 15%, a rate often adopted by major minerals companies when contemplating an investment. However, the sensitivity of project outcomes to sales in years 1, selling price generally, and operating cost, are important pointers to Olympia Resources' strategies for the future, particularly in early years of operation.

13. RISK ASSESSMENT

13.1. Resource Risk

Olympia Resources has based this feasibility study on reserves determined from a limited number of its leases. Its resource base is considerably greater, and Olympia Resources is very confident that its reserves base will be substantially increased by further exploration.

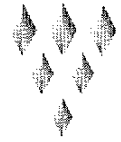
Olympia Resources considers that the risk to the project, of insufficient reserves, is minimal.

13.2. Process Risks

During the evolution of this project two phases of testwork were completed by laboratories contracted to Olympia Resources, under the supervision of HBH Consultants (phase 1) and METS (phase 2). The first phase entailed testing a process concept designed to produce as high a quality garnet stream as possible. This process concept was tested successfully, albeit on small feed samples from Harts Range. Bulk samples were then extracted from the orebody for further testing.

In mid-2003 Olympia Resources determined that the project should alter its direction somewhat, by focussing on selling both garnet and aluminomagnesio-hornblende (AMH) in coarse and fine blends. Purity was less important in this process concept than was reducing the complexity (and hence the cost) of the process, because Olympia Resources had come to believe that the blended products were marketable. The new, simplified flowsheet was trialled in the laboratory using bulk sample material, although the testwork omitted one part of the flowsheet, the hydrosizer. These tests produced satisfactory examples of the product streams in sufficient volume for trialling by potential customers, but they did not fully simulate the proposed process design upon which this study is based.

While there is, therefore, some risk that in practice the mineral suite will not behave as the testwork and theoretical analysis would dictate, it is considered that enough work has been completed to demonstrate that the proposed process will function as predicted. The proposed process is similar to other operating mineral sands plants in Australia and elsewhere, giving confidence that knowledge gained elsewhere will be relevant in adjusting plant performance to suit real-world behaviour. Furthermore, the plant design will have sufficient flexibility to allow Olympia Resources to optimise plant performance in the face of variable feedstock composition and sizing. It is therefore considered that the risk of the process failing is manageable.



13.3. Market Risks

Olympia Resources proposes to sell four different products, in both bulk and packaged form. While the ratio of bulk to packaged is controllable (to meet market expectations), the ratio of the products will largely be the result of processing the ore that is mined. If demand for one of the products exceeds supply, Olympia Resources will not be able to alter its product mix to match this demand. The challenge for Olympia Resources, therefore, is to ensure all of its products are sold, in the ratios in which they are produced. Olympia Resources considers this risk to be manageable.

Olympia Resources is aware of the interest in the Harts Range project of its potential competitors, GMA Garnet in Western Australia, and international producers (India, for example). If Olympia Resources challenges these producers head-on, competition based on price can be expected. Olympia believes that its products will meet market needs, particularly as a replacement for copper slag in surface treatment, where environmental concerns override cost. In other markets Olympia Resources does expect price-based competition. Its corporate strategies are designed to resist such pressure on its prices; long-term sales contracts and alternative markets for Olympia's products are expected to minimise risk to the project from price-discounting by the competition.

Technology continually advances, and there is thus the risk that an alternative material, with better performance or lower cost, may appear in the market. To an extent Olympia Resources is adopting this strategy itself, by introducing the AMH products to displace copper slag at the lower-cost end of the surface treatment market. Olympia Resources cannot prevent new technology from emerging, but through long-term contracts, operating cost vigilance and customer relations, Olympia believes that it will remain in business well beyond the time taken to recover capital, and to return profits to investors.

There is the risk in projects of this nature that the selling prices achieved for the products do not meet expectations, thereby affecting corporate profits. Sensitivity analysis of this risk (see Section 11) shows that the project Internal Rate of Return declines, as expected, with falling sales price. Olympia Resources is managing this risk in the following ways:

- Long-term sales contracts at prices which ensure operating profits will be signed before the project is committed.
- Sales will occur in multiple currencies, with much of the product sold in Australian dollars, avoiding over-exposure to fluctuations in the US\$ / A\$ exchange rate



13.4. Infrastructure Risks

Olympia Resources has yet to identify and reserve to itself sufficient water to support the project at Harts Range. The Northern Territory government as well as independent hydrologists believe that there is a high probability that the required flowrate of water will be obtained from a borefield centred 15km east of the process plant site. For example, a table grape-growing operation near the junction of Plenty Highway and the Stuart Highway extracts more water from aquifers than Harts Range will need, which demonstrates the region has underground resources capable of supporting the project.

Olympia Resources is confident that the water requirements of the project can be met at an economic cost.

The Port of Darwin does not have a bulk materials ship-loading capability at present. The logistics contractor selected by Olympia Resources, Perkins, has proposed an alternative approach using bulk material containers which will suffice until the Port acquires a bulk materials ship-loader. There is no risk posed to the project by the lack of this capability in the Port at this time.

When the project was first proposed the Alice Springs-Darwin railway had not been committed. Now the railway is almost complete, with operations expected to begin in early 2004. There is thus no longer any risk that the railway will not be in place to affect the costs and reliability of bulk product transport from the project to market.

Harts Range is not connected to Alice Springs by all-weather road, and there is thus some risk that the site will be cut off from Alice Springs from time to time. Olympia Resources will maintain reserves of product in Alice Springs of sufficient volume to avoid any impact on customers arising from any road flooding. Personnel safety and victualling will be manageable risks, through the use of aerial transport or surface transport by other routes – from Queensland, along the Plenty Highway, or from Alice Springs by more circuitous routes through the ranges east of Alice Springs. Product could be removed from Harts Range by such routes in an emergency. The risk to project success posed by the remoteness of the site and the lack of all-weather roads leading to it is considered minimal.

13.5. Capital Cost Overrun

Major projects have often exhibited large overruns to budget in capital investment. This risk can be mitigated by a variety of measures, including

- Further advancing engineering design and equipment specification before committing to construction

- Fixed price contracting, based on well-documented engineering design
- Adequate contingencies in the approved funding
- Strict control over the "nice-to-haves", which often arise as new people are recruited to the project to commission and operate the plant
- Project delays extend the need for project management to be in place, causing an overrun in overheads
- Careful management of industrial relations.

Olympia Resources' Harts Range project is not a major resources project of the type which attracts trades union pressure, so industrial relations generally are not expected to expose the project to capital cost overruns.

Olympia Resources' engineers, HBH Consultants, have not proceeded with detailed design of the process plants. However, their prior experience with mineral sands projects generally, and garnet in particular, has allowed equipment to be sized and specified reliably. The full scope of the project is unlikely to exceed what is described in this study by any significant margin. The Harts Range project schedule (see the Appendices, Section 15.10) allows sufficient time for HBH to take the process plant and infrastructure design to an advanced stage before construction commences, mitigating the risk inherent in design changes post-contract award.

The project budget includes an adequate contingency for the project, given the state of design so far achieved. HBH Consultants has advised Olympia Resources on the appropriate level of contingency for a project of this nature at its current status.

The project schedule is considered practical. Olympia Resources and HBH Consultants are committed to avoiding delays in decision-making, given that both are small organisations without the "bureaucracy" often apparent on major projects. Legislative impediments to progress are less of a factor in the Northern Territory than in other states of Australia. There is only a small risk of schedule overrun affecting capital cost, and that this risk is manageable.



14. CONCLUSIONS

Olympia Resources believes that this and other earlier studies of the Harts Range Project demonstrate that:

- There are sufficient quantities of ore at economic grades in the Harts Range leases to support a 20-year operation mining 1.2 Mt/a and producing 178 kt/a of garnet and garnet – AMH blended products in sizes >250 μ .
- Further exploration and assessment of resources within Olympia Resources' control can reasonably be expected to provide the company with further economic ore, allowing Olympia to expand the production rate or to extend it beyond 20 years.
- There are no fatal flaws in the overall project development concept.
- The project will benefit the Northern Territory, the local indigenous peoples, and Australia's exports.
- The environmental impact of the project is limited, and manageable through normal industry best practice.
- The capital cost of the project will be approximately \$24.4 M initially, with this investment occurring largely in calendar years 2004.
- The mine and process plant can be commissioned at the end of 2004, with full production being possible early in 2005.
- The project allows for future expansion.
- The mineral process can be extended to produce more saleable product, improving project returns.
- The project can deliver satisfactory economic returns if the identified risks are managed prudently.

This feasibility study identifies the risks to project success, and Olympia's plans to mitigate these risks by taking necessary precautions. These risks include:

- Operating cost overruns
- Failing to sell the full capacity of the process plant, particularly in early years of production
- Having to reduce selling prices in order to achieve or maintain sales volume.