
CAPRICORN COPPER MINE ECONOMIC IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

The \$151.8 million refurbishment construction of the Capricorn Copper mine will unlock significant value for North West Queensland:

- Output of \$81.7 million (\$260.3 million Queensland)
- Gross Regional Product (GRP) of \$35.2 million (\$69.1 million Queensland)
- Wages and salaries of \$20.4 million (\$61.1 million Queensland)
- Full Time Equivalent (FTE)¹ employment of 212 persons (640 FTEs Queensland).

The ongoing operations of the mine will contribute further significant economic activity to North West Queensland's economy annually, including:

- Output of \$256.6 million (\$432.6 million Queensland)
- GRP of \$116.7 million (\$201.7 million Queensland)
- Wages and salaries of \$34.7 million (\$77.1 million Queensland)
- FTE employment of 359 persons (885 FTEs Queensland).

The Capricorn Copper mine development represents an important project for the North West Queensland area and the State of Queensland. The project has been identified as providing significant economic benefits both during refurbishment construction and once fully operational.

BACKGROUND

Capricorn Copper mine is one of the largest copper deposits currently being developed by Australian companies. It is located approximately 120 km north of Mount Isa, in North West Queensland, Australia.

Capricorn Copper mine (formerly Mt Gordon and Gunpowder mines) was acquired by Lighthouse Minerals (LHM) and EMR Capital (EMR) in October 2015. The mine has been in care and maintenance mode for three years.

The proponents will spend \$151.8 million in construction and operating activities associated with the project. The development includes refurbishing key infrastructure related to the mine and restoring the mining and processing facilities to operational capabilities, as the mine has been in care and maintenance since 2013.

The refurbishment is scheduled to begin in early 2017, with production expected to begin in the last quarter of 2017. Production in 2017 is estimated at just under 5,000 tonnes of copper and 37,500 troy ounces silver, with production increasing during the peak production years of 2018-2026 to approximately 31,500 tonnes copper and 350,000 troy ounces silver per annum on average. The company's exploration portfolio and prospects indicate mine life could continue beyond the current schedule of 2027.

PURPOSE OF THIS REPORT AND APPROACH

This report has been developed to identify the socio-economic benefits associated with reactivating the Capricorn Copper mine. This report considers the construction and operational employment and economic activity generated by the reactivated mine.

Input-Output (I-O) modelling has been used in this study to assess the economic impacts associated with Capricorn Copper reactivation and operations. Additional socio-economic impacts are discussed qualitatively.

The findings of this report will assist with raising awareness of the socio-economic contribution that will be generated through the Capricorn Copper mine project.

¹ Where one FTE represents one person working full time for a period of one year.

ASSESSMENT FINDINGS

The \$151.8 million refurbishment construction of the Capricorn Copper mine will unlock significant value for North West Queensland. Economic impacts (including direct and flow-on activity) are estimated at:

- Output of \$81.7 million (\$260.3 million Queensland)
- Gross Regional Product (GRP) of \$35.2 million (\$69.1 million Queensland)
- Wages and salaries of \$20.4 million (\$61.1 million Queensland)
- Full Time Equivalent (FTE) employment of 212 persons (640 FTEs Queensland).

The ongoing operations of the mine will contribute further significant economic activity to North West Queensland's economy. Estimated annual impacts once the mine has reached full production include:

- Output of \$256.6 million (\$432.6 million Queensland)
- GRP of \$116.7 million (\$201.7 million Queensland)
- Wages and salaries of \$34.7 million (\$77.1 million Queensland)
- FTE employment of 359 persons (885 FTEs Queensland).

OTHER SOCIO-ECONOMIC IMPACTS

The reactivation of the Capricorn Copper mine will generate a broad range of socio-economic benefits within the surrounding region, including (but not limited to) the economic impacts considered above.

Key socio-economic benefits which can be expected to be generated by the development include:

- Opportunities for local and Queensland based input suppliers through project expenditure and associated flow-on activity. This will present additional employment opportunities along the supply chain to meet the increased demand for these goods and services
- Employment, education and training opportunities for the local indigenous population to enhance career opportunities as well as intergenerational employment aspirations and awareness
- Changes in population and demographics through direct employment which add capacity in the local area and likely benefit community connections, togetherness and cohesion
- A greater critical mass of population and economic activity within North West Queensland to support a greater level of public and private sector services.

The Capricorn Copper mine is an important and significant development for the North West Queensland and State economy, generating substantial ongoing socio-economic benefits through reactivation/construction and operations which are expected to continue beyond 2027.

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1. INTRODUCTION

1.1 BACKGROUND

Lighthouse Minerals (LHM) and EMR Capital (EMR) are proposing to recommence mining operations at the Capricorn Copper mine in Mount Isa. The project will unlock significant value for Queensland, and in particular, North West Queensland.

The proponents will spend \$151.8 million in construction and capital activities over the life of the project. The development includes refurbishing key infrastructure related to the mine and restoring the mining and processing facilities to operational stage, as the mine has been in care and maintenance since 2013. The refurbishment is scheduled to begin in early 2017, with production expected to begin in the final quarter of 2017.

1.2 PURPOSE OF THIS REPORT AND APPROACH

This report has been developed to identify the socio-economic benefits associated with reactivating the Capricorn Copper mine. This report considers the construction and operational employment and economic activity generated by the reactivated mine.

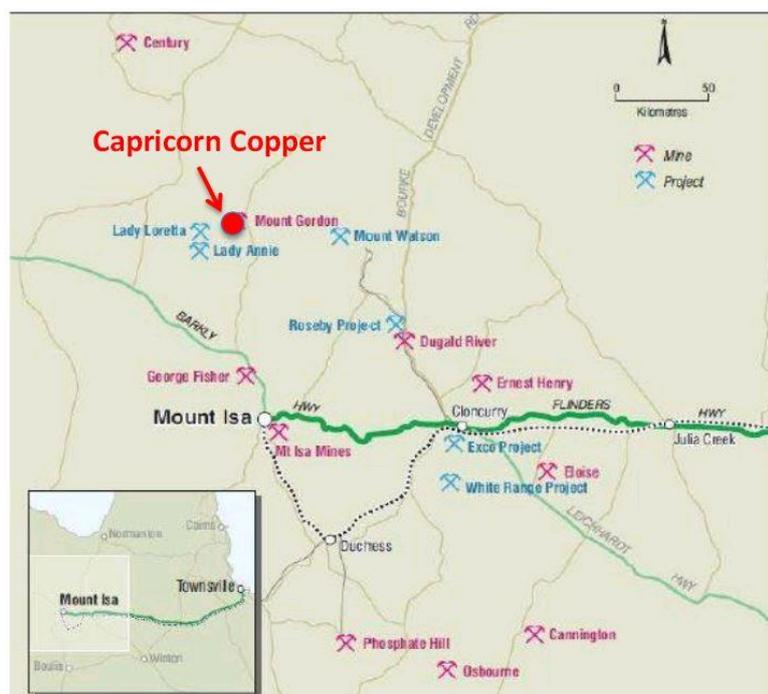
Input-Output modelling has been used in this study to assess the impact of the construction and operational phases of the Capricorn Copper mine development. A description of the model used and limitations are provided in Appendix A. Assumptions and model drivers used in conducting the economic modelling are outlined in sections 2.1.2 and 2.1.3.

The findings of this report will assist with raising awareness of the socio-economic contribution that will be generated through the Capricorn Copper mine project.

1.3 PROJECT DESCRIPTION

Capricorn Copper mine is one of the largest copper (and silver) deposits currently being developed by Australian companies. It is located approximately 120 km north of Mount Isa, in North West Queensland, Australia.

Figure 1.1: Location of Capricorn Copper Mine



Source: OreCorp (2015)

The following table lists a brief history of the Capricorn Copper mine (site life ownership and operation). The Capricorn Copper mine was formerly known as the Mt Gordon mine, and the Gunpowder mine prior to that.

Table 1.1: Mine Site History

Year	Company	Activity
1927	The Shah brothers	Discovered by the Shah Brothers – small scale mining.
1969 – 1977	VAM, then Consolidated Goldfields / Mitsubishi	Developed Mammoth deposit, producing 4-11ktpa Cu.
1978 – 1982	Renison Goldfields	Heap leach/SXEW pilot.
1989 – 1996	Adelaide Brighton Cement	In situ leach 7.5 - 14ktpa Cu.
1996 – 1998	Aberfoyle	Exploration of Esperanza and Mammoth deposits. Developed low P-T autoclave/SXEW plant producing 45ktpa Cu.
1998 – 2003	Western Metals	Western Metals takeover of Aberfoyle. Production from Esperanza deposit of 2.6Mt grading 8.4% Cu = 222,583t Cu.
2003 – 2015	Aditya Birla	Aditya Birla acquired mine from Western Metals. Focus on underground development of Mammoth deposit.
2013 – 2015	Aditya Birla	Placed into care and maintenance.
2015	Capricorn Copper	Capricorn Copper Holdings, an incorporated joint venture between Lighthouse Minerals and EMR Capital, acquired mine.

Source: LHM (2016)

Capricorn Copper mine was acquired by Lighthouse Minerals (LHM) and EMR Capital (EMR) in October 2015. The mine has been in care and maintenance mode for three years and the present owners have committed to recommencing production.

The refurbishment is scheduled to begin in early 2017, with production expected to begin in the final quarter of 2017. Production in 2017 is estimated at just under 5,000 tonnes of copper and 37,500 troy ounces silver, with production increasing during the peak production years of 2018-2026 to approximately 31,500 tonnes copper and 350,000 troy ounces silver per annum on average. The company's exploration portfolio and prospects indicate mine life could continue beyond the current schedule of 2027.

The acquisition and strategy to restart operations at the mine have been well received by regional stakeholders, Local and State Government, and other industry bodies.

Capricorn Copper's preference to employ locally and it has implemented a point of hire policy that encourages employees to be sourced from Mount Isa initially ahead of other nearby regional centers. While Capricorn Copper's preference is to maximize the local employment, it is recognized that not all employees will be able to be sourced from Mount Isa. Therefore, regional centers such as Townsville and Cairns will be targeted as the primary source for the balance of the workforce. Employees will be transported to site via bus from Mount Isa including those employees who elect to fly in and fly out to their home base.

Modelling in this assessment assumes a significant local Mount Isa labour force (35% of construction and operational labour). However, it should be noted that the ability to maximise the local employment is effected by the condition of local roads which would be the responsibility of local and State governments.

2. NORTH WEST QUEENSLAND REGION

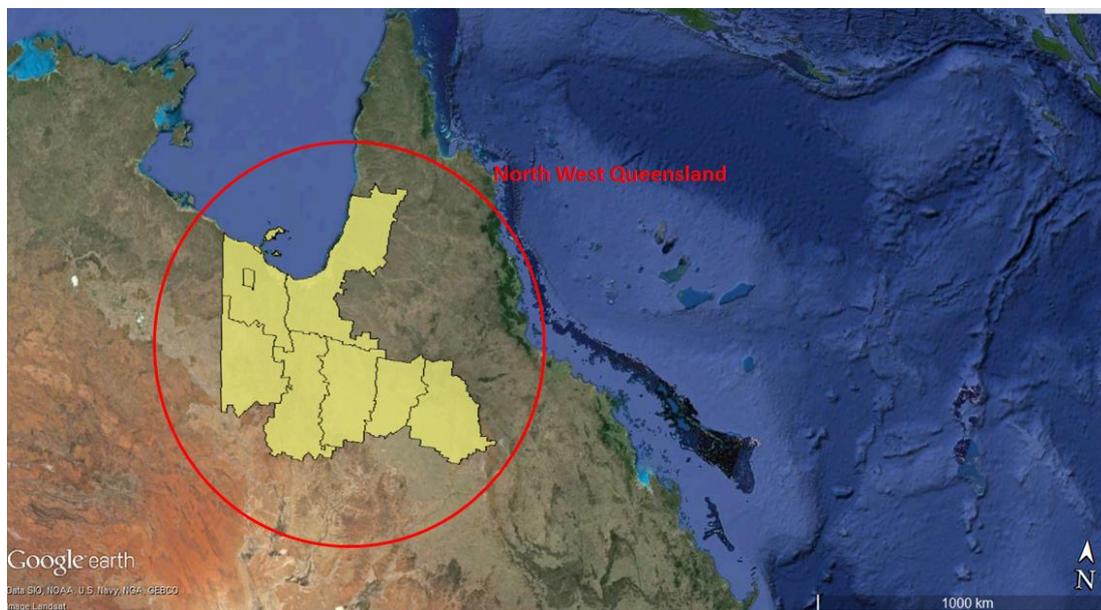
The following chapter provides a summary of the North West Queensland economy and an overview of the Capricorn Copper business operating environment to provide background and context for the Economic Impact Assessment.

2.1 NORTH-WEST QUEENSLAND

For the purposes of this study the North West Queensland Region is defined as the North West Statistical Division (SD) (see Figure 2.1) which includes the nine Local Government Areas (LGAs) of:

- Mount Isa
- Burke
- Carpentaria
- Cloncurry
- Doomadgee
- Flinders
- McKinlay
- Mornington
- Richmond.

Figure 2.1: North West Queensland



Source: Google Earth Pro (2016)

2.2 NORTH-WEST QUEENSLAND ECONOMY

The North West Queensland regional economy has slowed over recent years, with falling commodity prices impacting on regional output and investment levels. Significant drought in the key agricultural sector and reduced household spending levels have also impacted on the North West Queensland economy over recent years.

Despite the challenging operating environment, the region has experienced solid economic Gross Regional Product (GRP) growth over the past five years as a whole. The key industry drivers of mining, beef cattle, minerals processing, and construction will continue to underpin the regional economy over the longer term.

However, GRP declined in 2014-15 and the region has experienced rising unemployment and a declining population over the past two years, which is indicative of the difficult trading conditions for the region's key industries.

Key economic indicators and five-year average annual growth rates for the North West Queensland region are provided in the table below.

Table 2.1: North West Queensland Region Economic Indicators

Indicator	Period	Measure	Five Year Av. Ann. Growth %
Population	Jun 2015	35,002	0.05%
Labour Force	Sep 2016	18,538	-2.2%
Unemployment Rate	Sep 2016	10.7%	+5.5 ppts ^(a)
GRP	2014-15	\$4.9 billion	4.7%
Key Industry Sectors	2014-15	<ul style="list-style-type: none"> • Mining (51.6% of IVA^(b)) • Agriculture forestry and fishing (8.9%) • Construction (6.0%) <ul style="list-style-type: none"> • Ownership of dwellings (4.8%) • Manufacturing (3.6%) 	<ul style="list-style-type: none"> • Mining (12.2%) • Agriculture forestry and fishing (-5.6%) • Construction (4.5%) <ul style="list-style-type: none"> • Ownership of dwellings (4.1%) • Manufacturing (4.6%)

Notes: ^(a) Unemployment outcome based on total five-year percentage point (ppt) change. ^(b) IVA: Industry Value Add (i.e. contribution to GRP). Sources: QGSO (2016), AEC

2.3 COPPER INDUSTRY OUTLOOK

Copper (and silver) mining operations are based in the North West Queensland economy due to the long and proven history of copper production from the area and it hosting a significant number of highly prospective copper, zinc, lead, gold and silver deposits. The North West Queensland economy also provides a skilled labour force, sophisticated supply chain, transport and export facilities (to the Port of Townsville), as well as economic stability, to support Capricorn Copper operational activities on an ongoing basis.

Australia is the world's sixth largest producer of copper. Copper is one of Australia's top ten commodity exports, worth about \$6 billion a year. Copper is an important metal widely used in electrical applications, plumbing and other building applications, and in metal alloys because of its high thermal and electrical conductivity and ductile behavior.

Similar to a number of Australia's key commodities, copper prices have declined by more than 40% from their 2011 highs (Office of the Chief Economist, 2016). However, prices have rebounded over recent months, with the London Metals Exchange price recently reaching a 12-month high of over US\$6,000/ tonne.

Over the medium term, copper prices are projected to recover, increasing to around US\$6,300/ tonne in 2016 dollar terms or US\$7,100 in nominal terms in 2021 (Office of the Chief Economist, 2016). Consumption growth is also projected to recover over the next five years, supported by stronger economic growth in emerging economies.

3. ECONOMIC IMPACT

3.1 ECONOMIC IMPACT ASSESSMENT

An economic impact assessment of the Capricorn Copper mine was conducted for the North West Statistical Division (SD) as well as the State of Queensland.

Full details of the methodology used for this assessment are outlined in Appendix A.

3.1.1 Methodology

Input-Output modelling of the Capricorn Copper mine refurbishment was conducted using an Input-Output model developed from localised North West SD and Queensland transaction tables (see Appendix A).

Key metrics reported in this assessment are:

- **Output:** Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once
- **Gross Product:** Refers to the value of output after deducting the cost of goods and services inputs in the production process. Gross product defines the true net contribution and is subsequently the preferred measure for assessing economic impacts
- **Income:** Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the project
- **Employment:** Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow-on activity, and is expressed in terms of full time equivalent (FTE) positions².

3.1.2 Refurbishment Construction

The refurbishment construction cost of the Capricorn Copper mine refurbishment and capital expenditure over the life of mine is estimated at \$151.8 million. For modelling purposes activity was allocated to the most relevant Australia and New Zealand Standard Industrial Classification (ANZSIC) sectors, a summary breakdown of this cost by ANZSIC sector is provided in the table below. Refer to Appendix B for the detailed costing breakdown.

Table 3.1: Project Cost

ANZSIC	\$M
Heavy and Civil Engineering Construction	\$86.5
Construction Services	\$25.8
Professional, Scientific and Technical Services	\$16.9
Specialised and other Machinery and Equipment Manufacturing	\$12.0
Exploration and Mining Support Services	\$8.4
Electrical Equipment Manufacturing	\$1.4
Retail Trade	\$0.4
Non-Residential Building Construction	\$0.2
Water Supply, Sewerage and Drainage Services	\$0.2
Professional, Scientific, Computer and Electronic Equipment Manufacturing	\$0.1

² Where one FTE represents one person working full time for a period of one year.

ANZSIC	\$M
Health Care Services	\$0.03
Total	\$151.8

Note: Totals may not sum due to rounding.
Source: LHM (Unpublished), AEC

Reported economic impacts relate to capital works over the life of the development, with the majority of refurbishment construction occurring over 2017.

3.1.2.1 North West SD

Drivers

Of the above capital outlay, not all activity will be undertaken within the North West SD economy. For example, some professional services and manufacturing activities are likely to be sourced from major capital cities/ interstate.

The following table outlines the assumptions used in the modelling to identify where relevant activity is anticipated to occur.

Table 3.1: Location of Construction Phase Activity by Industry

ANZSIC	% Local
Heavy and Civil Engineering Construction	100%
Construction Services	100%
Professional, Scientific and Technical Services	35%
Specialised and other Machinery and Equipment Manufacturing	20%
Exploration and Mining Support Services	100%
Electrical Equipment Manufacturing	20%
Retail Trade	35%
Non-Residential Building Construction	100%
Water Supply, Sewerage and Drainage Services	100%
Professional, Scientific, Computer and Electronic Equipment Manufacturing	0%
Health Care Services	100%

Source: LHM (Unpublished), AEC.

In interpreting the above table, it is important to recognise the location of where activity occurs can differ from where the labour or services used to undertake the activity are sourced from. For example, construction activity will (effectively) all occur on site. However, it may be that some labour and services will reside outside of North West Queensland.

The following table outlines the assumptions used in the modelling regarding the location where goods and services are sourced.

Table 3.2: Source of Construction Phase Activity by Industry

ANZSIC	% Local
Heavy and Civil Engineering Construction	35%
Construction Services	35%
Professional, Scientific and Technical Services	35%
Specialised and other Machinery and Equipment Manufacturing	20%
Exploration and Mining Support Services	50%
Electrical Equipment Manufacturing	20%
Retail Trade	35%
Non-Residential Building Construction	35%
Water Supply, Sewerage and Drainage Services	35%
Professional, Scientific, Computer and Electronic Equipment Manufacturing	0%
Health Care Services	35%

Source: LHM (Unpublished), AEC.

In undertaking economic modelling, the direct activity associated with the construction phase is based on where activity occurs (Table 3.2) rather than strictly where labour for these services is sourced from (Table 3.3). However, the amount of activity that is retained in the local economy is best considered in terms of where labour, goods and services are sourced, rather than where the activities they undertake are located. This refers to a 'retention' of incomes and profits within an economy, and reflects that labour and companies sourced from outside the North West Queensland economy are more likely to spend incomes earned within their local area than within North West Queensland.

For the purposes of modelling, it has been assumed construction companies and sub-contractors sourced from outside North West Queensland will contribute approximately one-quarter (25%) of the level of Type I (production induced) flow-on activity within the economy that a locally sourced company does, and approximately 5% of Type II (consumption induced) flow-on activity. This reflects that construction companies working on site but sourced from outside North West Queensland will contribute to local supply chains in terms of sourcing some goods and services they require locally (Type I), as well as spending some wages and salaries locally on items such as food and drink (Type II). Outcomes

The refurbishment of the Capricorn Copper mine is anticipated to directly inject approximately \$52.4 million into the North West SD economy. This injection is estimated to provide a significant boost to the North West SD economy.

Overall, the refurbishment construction phase is estimated to provide the following economic impacts:

Output of \$81.7 million (including the \$52.4 million directly injected into the economy)

Gross Regional Product (GRP) of \$35.2 million (including \$20.9 million in direct impacts)

Wages and salaries of \$20.4 million (including \$11.4 million paid to labour directly associated with the refurbishment construction)

FTE employment of 212 (including 96 direct jobs associated with the refurbishment construction phase).

These impacts represent the total impact of refurbishment construction activity over the course of construction. The following table provides an overview of the economic impact of the refurbishment construction phase.

Table 3.4: Economic Impacts of Construction to North West SD

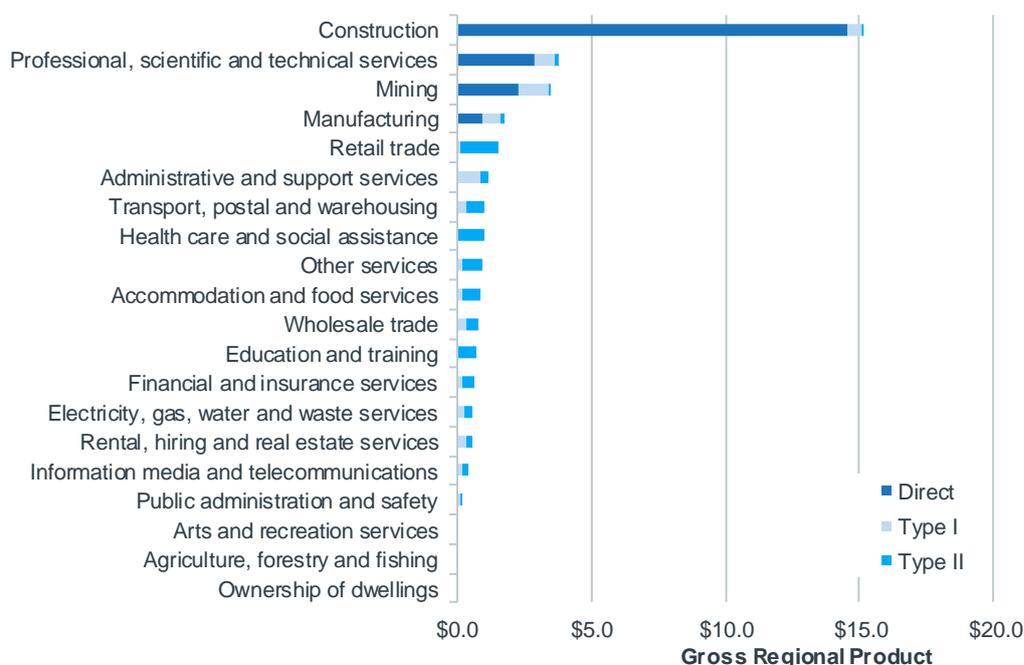
Impact Type	Output (\$M)	GRP (\$M)	Income (\$M)	Employment (FTE)
Direct Impact	\$52.4	\$20.9	\$11.4	96
Indirect Impact (Type I)	\$14.9	\$6.4	\$4.0	44
Indirect Impact (Type II)	\$14.4	\$8.0	\$5.1	72
Total Impact	\$81.7	\$35.2	\$20.4	212

Note: Totals presented in the table may not equal the sum of direct and indirect impacts due to rounding.

Source: AEC

Major North West Queensland industry beneficiaries of the refurbishment construction phase of the Capricorn Copper mine redevelopment include:

- Construction (\$15.2 million in GRP)
- Professional, scientific and technical services (\$3.8 million)
- Mining (\$3.5 million).

Figure 3.1: GRP Impact by Industry (North West SD)

Source: AEC

3.1.2.2 Queensland

Drivers

For the purposes of this assessment, it was assumed 100% of the direct expenditure on refurbishment construction activity would be sourced from businesses and labour located in Queensland.

Outcomes

The refurbishment of the Capricorn Copper mine is anticipated to directly inject approximately \$151.8 million into the Queensland economy (inclusive of the injection within North West SD).

Overall, the refurbishment construction phase is estimated to provide the following economic impacts:

- Output of \$260.3 million (including the \$151.8 million directly injected into the economy)
- GRP of \$115.3 million (including \$59.7 million in direct impacts)

- Wages and salaries of \$61.1 million (including \$32.9 million paid to labour directly associated with the refurbishment construction)
- FTE employment of 640 positions (including 282 direct jobs associated with the refurbishment construction).

These impacts represent the total impact of construction activity over the course of the development. They do not represent an average annual estimate. The following table provides an overview of the economic impact of the refurbishment construction.

Table 3.5: Economic Impacts of Construction to Queensland

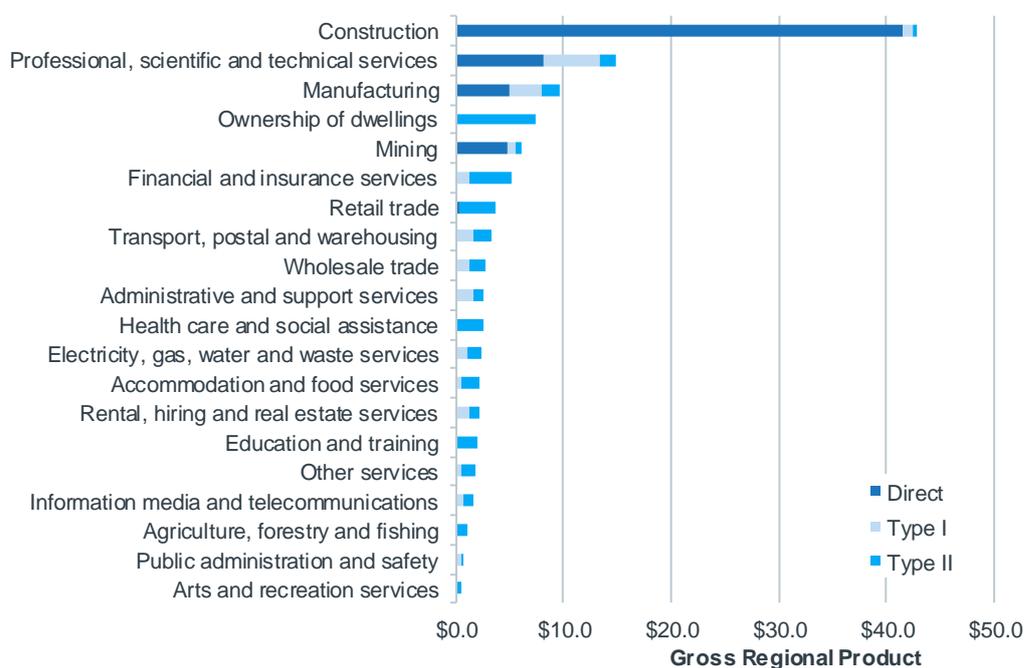
Impact Type	Output (\$M)	GRP (\$M)	Income (\$M)	Employment (FTE)
Direct Impact	\$151.8	\$59.7	\$32.9	282
Indirect Impact (Type I)	\$44.74	\$20.22	\$12.09	137
Indirect Impact (Type II)	\$63.75	\$35.35	\$16.15	221
Total Impact	\$260.3	\$115.3	\$61.1	640

Note: Totals presented in the table may not equal the sum of direct and indirect impacts due to rounding.
Source: AEC

Major Queensland industry beneficiaries of the refurbishment construction phase of the Capricorn Copper mine redevelopment include:

- Construction (\$42.8 million in GRP)
- Professional, scientific and technical services (\$14.9 million)
- Manufacturing (\$9.6 million).

Figure 3.2: GRP Impact by Industry (Queensland)



Source: AEC

3.1.3 Operational Activity

3.1.3.1 Model Drivers

Estimates for operational activity have been developed based on average annual (real \$2016) operating estimates over the years of full production from 2018-2026 (see LHM, Unpublished) including:

- Revenues averaging \$212.0 million per annum
- Operating costs averaging \$137.4 million per annum
- Average direct FTE employment of 209 positions (including permanent staff and direct contractors).

Type II flow on activity has been adjusted for the North West SD catchment to account for the impact of local (estimated 35%) and non-resident (estimated 65%) labour. It has been assumed that non-resident workers will support approximately 5% of the Type II activity of a local resident worker as per the construction assessment. It is assumed 100% of direct operational labour is sourced from Queensland.

3.1.3.2 Outcomes

North West SD

One fully operational, activity generated by the reactivated mine is estimated to provide a significant impact to the North West SD economy.

The operational phase is estimated to provide the following economic impacts per year:

- Output of \$256.6 million (including the \$212.0 million directly injected into the economy)
- GRP of \$116.7 million (including \$95.5 million in direct impacts)
- Wages and salaries of \$34.7 million (including \$22.3 million paid to labour directly associated with the mine)
- FTE employment of 359 persons (including 209 direct jobs).

These impacts represent an average annual estimate once full scale production levels are achieved. The following table provides an overview of the economic impact to the North West SD of the operations phase.

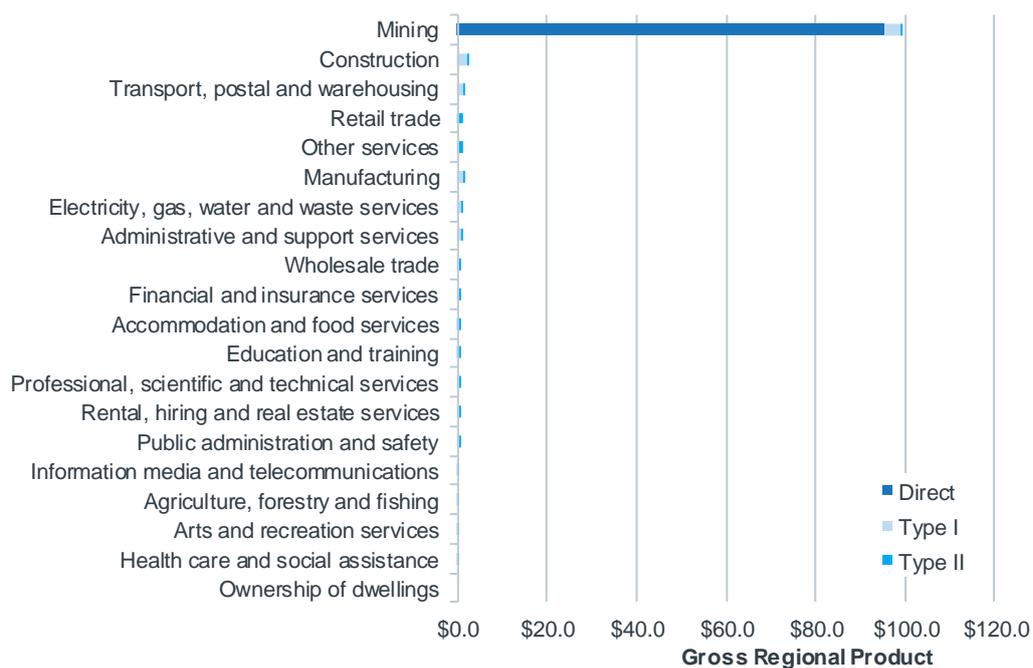
Table 3.4: Economic Impacts of Operations to North West SD (Per Annum, 2018-2026)

Impact Type	Output (\$M)	GRP (\$M)	Income (\$M)	Employment (FTE)
Direct Impact	\$212.0	\$95.5	\$22.3	209
Indirect Impact (Type I)	\$30.7	\$13.6	\$7.5	82
Indirect Impact (Type II)	\$13.9	\$7.7	\$4.9	69
Total Impact	\$256.6	\$116.7	\$34.7	359

Note: Totals presented in the table may not equal the sum of direct and indirect impacts due to rounding.
Source: AEC

Major North West SD industry beneficiaries of the operational phase of the Capricorn Copper mine redevelopment include:

- Mining (\$99.2 million in GRP per annum)
- Construction (\$2.7 million per annum)
- Transport, postal and warehousing (\$1.8 million per annum).

Figure 3.3: Operational GRP by Industry (North West SD) (Per Annum, 2018-2026)

Source: AEC

Queensland

Once fully operational, activity generated by the reactivated mine is estimated to provide a significant impact to the Queensland economy.

The operational phase is estimated to provide the following economic impacts per year:

- Output of \$432.6 million (including the \$212.0 million directly injected into the economy)
- GRP of \$201.7 million (including \$95.5 million in direct impacts)
- Wages and salaries of \$77.1 million (including \$22.3 million paid to labour directly associated with the mine)
- FTE employment of 885 persons (including 209 direct jobs).

These impacts represent an average annual estimate once full scale production levels are achieved. The following table provides an overview of the economic impact to Queensland of the operations phase.

Table 3.5: Economic Impacts of Operations to Queensland (Per Annum, 2018-2026)

Impact Type	Output (\$M)	GRP (\$M)	Income (\$M)	Employment (FTE)
Direct Impact	\$212.0	\$95.5	\$22.3	209
Indirect Impact (Type I)	\$149.1	\$66.6	\$36.7	428
Indirect Impact (Type II)	\$71.41	\$39.61	\$18.09	248
Total Impact	\$432.6	\$201.7	\$77.1	885

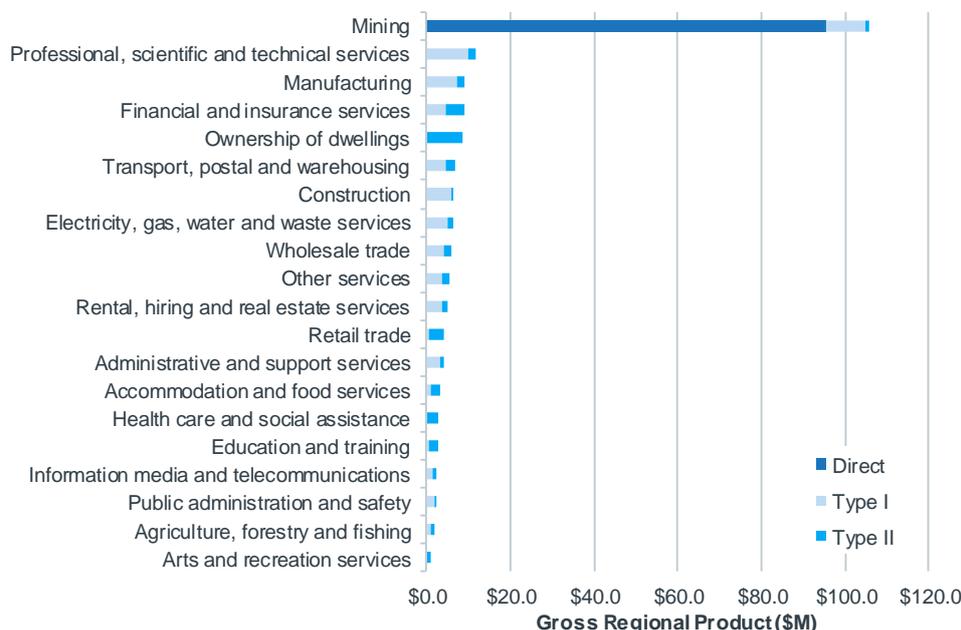
Note: Totals presented in the table may not equal the sum of direct and indirect impacts due to rounding.
Source: AEC

Major Queensland industry beneficiaries of the operational phase of the Capricorn Copper mine redevelopment include:

- Mining (\$105.6 million in GRP per annum)
- Professional, scientific and technical services (\$11.5 million per annum)
- Manufacturing (\$9.1 million per annum)

- Financial and insurance services (\$9.0 million per annum).

Figure 3.4: Operational GRP by Industry (Queensland) (Per Annum, 2018-2026)



Source: AEC

3.2 OTHER SOCIO-ECONOMIC IMPACTS

The reactivation of the Capricorn Copper mine will generate a broad range of socio-economic benefits within the surrounding region, including (but not limited to) the economic impacts considered above.

Key socio-economic benefits which can be expected to be generated by the development include:

- Opportunities for local and Queensland based input suppliers through project expenditure and associated flow-on activity. This will present additional employment opportunities along the supply chain to meet the increased demand for these goods and services
- Employment, education and training opportunities for the local indigenous population to enhance career opportunities as well as intergenerational employment aspirations and awareness
- Changes in population and demographics through direct employment which add capacity in the local area and likely benefit community connections, togetherness and cohesion
- A greater critical mass of population and economic activity within North West Queensland to support a greater level of public and private sector services.

The Capricorn Copper mine is an important and significant development for the North West Queensland and State economy, generating substantial ongoing socio-economic benefits through reactivation/construction and operations which are expected to continue beyond 2027.

REFERENCES

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APPENDIX A: INPUT-OUTPUT METHODOLOGY

INPUT-OUTPUT MODEL OVERVIEW

Input-Output analysis demonstrates inter-industry relationships in an economy, depicting how the output of one industry is purchased by other industries, households, the government and external parties (i.e. exports), as well as expenditure on other factors of production such as labour, capital and imports. Input-Output analysis shows the direct and indirect (flow on) effects of one sector on other sectors and the general economy. As such, Input-Output modelling can be used to demonstrate the economic contribution of a sector on the overall economy and how much the economy relies on this sector or to examine a change in final demand of any one sector and the resultant change in activity of its supporting sectors.

The economic contribution can be traced through the economic system via:

- **Direct impacts**, which are the first round of effects from direct operational expenditure on goods and services
- **Flow on impacts**, which comprise the second and subsequent round effects of increased purchases by suppliers in response to increased sales. Flow on impacts can be disaggregated to:
 - **Industry Support Effects (Type I)**, which represent the production induced support activity as a result of additional expenditure by the industry experiencing the stimulus on goods and services in the intermediate usage quadrant, and subsequent round effects of increased purchases by suppliers in response to increased sales
 - **Household Consumption Effects (Type II)**, which represent the consumption induced activity from additional household expenditure on goods and services resulting from additional wages and salaries being paid within the economic system.

These effects can be identified through the examination of four types of impacts:

- **Output**: Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once
- **Value added**: Refers to the value of output after deducting the cost of goods and services inputs in the production process. Value added defines the true net contribution and is subsequently the preferred measure for assessing economic impacts
- **Income**: Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the project
- **Employment**: Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow on activity, and is expressed in terms of full-time equivalent (FTE) positions.

Input-Output multipliers can be derived from open (Type I) Input-Output models or closed (Type II) models. Open models show the direct effects of spending in a particular industry as well as the indirect or flow on (industrial support) effects of additional activities undertaken by industries increasing their activity in response to the direct spending.

Closed models re-circulate the labour income earned as a result of the initial spending through other industry and commodity groups to estimate consumption induced effects (or impacts from increased household consumption).

MODEL DEVELOPMENT

Multipliers used in this assessment are derived from sub-regional transaction tables developed specifically for this project. The process of developing a sub-regional transaction table involves developing regional estimates of gross production and purchasing patterns based on a parent table, in this case, the 2013-14 Australian transaction table (ABS, 2016a).

Estimates of gross production (by industry) in the study area were developed based on the percent contribution to employment (by place of work) of the study area to the Australian economy (ABS, 2012), and applied to Australian gross output identified in the 2013-14 Australian table.

Industry purchasing patterns within the study area were estimated using a process of cross-industry location quotients and demand-supply pool production functions as described in West (1993).

Where appropriate, values were rebased from 2013-14 (as used in the Australian national IO transaction tables) to 2016 values using the Consumer Price Index (ABS, 2016b).

MODELLING ASSUMPTIONS

The key assumptions and limitations of Input-Output analysis include:

- **Lack of supply-side constraints:** The most significant limitation of economic impact analysis using Input-Output multipliers is the implicit assumption that the economy has no supply-side constraints, so the supply of each good is perfectly elastic. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or near capacity
- **Fixed prices:** Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using Input-Output multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. The system is in equilibrium at given prices, and prices are assumed to be unaffected by policy and any crowding out effects are not captured. This is not the case in an economic system subject to external influences
- **Fixed ratios for intermediate inputs and production (linear production function):** Economic impact analysis using Input-Output multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production. That is, the input function is generally assumed linear and homogenous of degree one (which implies constant returns to scale and no substitution between inputs). As such, impact analysis using Input-Output multipliers can be seen to describe average effects, not marginal effects. For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount. Further, it is assumed each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies there is only one method used to produce each commodity and that each sector has only one primary output
- **No allowance for economies of scope:** The total effect of carrying on several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the "additivity assumption". This generally does not reflect real world operations
- **No allowance for purchasers' marginal responses to change:** Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production
- **Absence of budget constraints:** Assessments of economic impacts using multipliers that consider consumption induced effects (type two multipliers) implicitly assume that household and government consumption is not subject to budget constraints.

Despite these limitations, Input-Output techniques provide a solid approach for taking account of the inter-relationships between the various sectors of the economy in the short-term and provide useful insight into the quantum of final demand for goods and services, both directly and indirectly, likely to be generated by a project.

In addition to the general limitations of Input-Output Analysis, there are two other factors that need to be considered when assessing the outputs of sub-regional transaction table developed using this approach, namely:

- It is assumed the sub-region has similar technology and demand/ consumption patterns as the parent (Australia) table (e.g. the ratio of employee compensation to employees for each industry is held constant).

Intra-regional cross-industry purchasing patterns for a given sector vary from the national tables depending on the prominence of the sector in the regional economy compared to its input sectors. Typically, sectors that are more prominent in the region (compared to the national economy) will be assessed as purchasing a higher proportion of imports from input sectors than at the national level, and vice versa.

APPENDIX B: DETAILED COSTING

Table B.1: Capital Expenditure Breakdown

Expenditure	Cost (\$M)	ANZSIC Allocation 1	%	ANZSIC Allocation 2	%
Mine Development					
Development (Lat and Vert)	\$64.4	Heavy and Civil Engineering Construction	100%		
HV Power Extensions and Repairs	\$0.6	Electrical Equipment Manufacturing	50%	Construction Services	50%
Primary Fan Refurb (ESS and Mam)	\$0.6	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Paste Plant	\$7.7	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Mammoth Pumping Upgrade	\$1.1	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Primary Fan ESS Stage 2	\$1.2	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Sustaining Capital	\$3.4	Heavy and Civil Engineering Construction	100%		
Owner's Team and Minor Projects	\$4.7	Heavy and Civil Engineering Construction	100%		
Total Mine Development	\$83.8				
Processing Capex					
Plant Refurbishment Program	\$8.8	Construction Services	100%		
Crusher Apron Feeder	\$0.9	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
HV Power Reticulation Upgrades	\$1.8	Electrical Equipment Manufacturing	50%	Construction Services	50%
New SAG Mill Feed Chutes	\$0.3	Specialised and other Machinery and Equipment Manufacturing	100%		
New Rougher Cell 1 Concentrate Pump	\$0.1	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Pump Upgrades	\$0.3	Electrical Equipment Manufacturing	50%	Construction Services	50%
Reagent Infrastructure Upgrades	\$0.1	Heavy and Civil Engineering Construction	100%		
Regrind Mill	\$8.6	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Concentrate Storage Capacity Improvement	\$0.5	Heavy and Civil Engineering Construction	100%		
Reagent Shed	\$0.2	Non-Residential Building Construction	100%		
Critical Spares (rotation and refurb)	\$0.2	Specialised and other Machinery and Equipment Manufacturing	100%		
Sustaining Capital	\$8.2	Heavy and Civil Engineering Construction	50%	Construction Services	50%
One-Off's and First Fills	\$0.5	Heavy and Civil Engineering Construction	100%		
Pebble Crusher	\$2.9	Specialised and other Machinery and Equipment Manufacturing	50%	Construction Services	50%
Water Treatment Plant	\$2.8	Heavy and Civil Engineering Construction	100%		

Expenditure	Cost (\$M)	ANZSIC Allocation 1	%	ANZSIC Allocation 2	%
Sludge Treatment Plant	\$0.6	Heavy and Civil Engineering Construction	100%		
Total Processing Capex	\$36.5				
Site Support and Services Upgrade					
Recruitment costs	\$0.7	Professional, Scientific and Technical Services	100%		
Employment medicals	\$0.0	Health Care Services	100%		
Contract reviews (Legal)	\$0.1	Professional, Scientific and Technical Services	100%		
Computer equipment	\$0.1	Professional, Scientific, Computer and Electronic Equipment Manufacturing	100%		
Stocking	\$0.1	Retail Trade	100%		
ICT	\$0.9	Professional, Scientific and Technical Services	100%		
Medical supplies	\$0.2	Retail Trade	100%		
STP repairs	\$0.2	Water Supply, Sewerage and Drainage Services	100%		
Total Support Services	\$2.4				
Tailings Storage Facility	\$5.5	Heavy and Civil Engineering Construction	100%		
Total Site Support and Other Infrastructure	\$7.9				
Resource Conversion Drilling	\$8.46	Exploration and Mining Support Services	100%		
Professional Services and Project Management	\$15.2	Professional, Scientific and Technical Services	100%		
Total Capex	\$151.8				

Source: LHM (Unpublished), AEC

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