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FIVE YEAR REVIEW

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EXECUTIVE SUMMARY

Overview

The Minerals Research Institute of Western Australia (MRIWA) is a statutory body established by the Western Australian Government under the *Minerals Research Institute of Western Australia Act 2013* (the Act) to stimulate minerals research to support investment in, and operation of, a globally competitive minerals industry in Western Australia.

The MRIWA's primary function is to provide and administer funding grants to carry out minerals research. The Institute collaborates with industry, research and government entities in Australia and overseas. The MRIWA funds PhD students, and makes funds available for projects, programs and events that promote public awareness of, and interest in, minerals research, and to support related academic activities.

In June 2018, ACIL Allen was engaged by the Minerals Research Institute of Western Australia (MRIWA) to undertake an independent review of the operations and effectiveness of the *Minerals Research Institute of Western Australia Act 2013*.

ACIL Allen's assessment against each of these core evaluation questions has been primarily drawn from a **detailed examination of MRIWA's performance** from key documents, including its strategic and operational plans, finances, and research outcomes, along with a **comprehensive stakeholder consultation process**.

Also supporting this review is separate report that ACIL Allen has undertaken for MRIWA to conduct an **economic impact assessment** centred on the impact of the application of minerals sector research projects funded by the MRIWA. The assessment applies a case study approach to quantification, and seeks to value the impact of the application of technologies that the MRIWA's funding was used to conceptualise, develop, commercialise and/or implement in the Western Australian mining industry. This valuation was estimated using ACIL Allen's computable general equilibrium model, *Tasman Global*, to estimate the economy-wide impacts of the selected MRIWA funded research. A **benefit cost assessment** (BCA) was also undertaken, bringing in the quantitative impacts of the individual research programs and additional qualitative benefits uncovered through the assessment but which were not quantified for reasons discussed in the report.

Overall Assessment

Consistent with the Department of Treasury's Evaluation Guide, ACIL Allen's Review of MRIWA has focussed on the following key evaluation questions:

1. ***Is MRIWA operating efficiently?***

   This question goes to the core evaluation criteria of efficiency, by exploring how MRIWA is operating, and how efficient it is in delivering its key activities.

2. ***Has MRIWA been effective in meeting its overall objectives?***

   This question goes to the core evaluation criteria of effectiveness. That is, the extent to which MRIWA's key activities deliver on the objectives of the activity, and more broadly the objectives of MRIWA and the Government.

3. ***Does a demonstrable need exist for MRIWA?***

   This question goes to the overall evaluation criteria of appropriateness. That is, the extent to which MRIWA continues to address a demonstrable need, and is aligned to Government priorities and responsibilities.

Is MRIWA operating efficiently?

The MRIWA has an **established governance and project selection process** that ensures the funding provided to selected research projects is consistent with MRIWA's and the WA Government strategic goals to support minerals research for the benefit of the State. Overall, there was broad consensus that the governance of MRIWA was strong, and that this ensured that project selection was objective and consistent, and ensured that it delivered value for money to industry and Government. Stakeholders were of the view that the MRIWA's processes provided it with the kinds of information on projects that allowed it to "pick winners" efficiently.

With respect to financial performance, the MRIWA has been successful in **meeting its key efficiency KPI** in the last two financial years. This is a reflection of growth in the MRIWA's portfolio of projects, and the low growth in non-grant expenditure (averaging around $1 million per annum or around 19 per cent of total expenditure between 2013-14 and 2017 18). The efficiency KPIs should not guide the performance of MRIWA in isolation. From an efficiency perspective, MRIWA must keep an eye to the "outputs" of its functions (being project funding and economic impact), not just the inputs (being the cost of services).

ACIL Allen's **BCA framework provides a more holistic view on MRIWA's relative efficiency** as it captures both the costs and benefits in a single framework. Using this frame of reference, ACIL Allen estimates the MRIWA is forecast to deliver a net social benefit of $37 million between 2018-19 and 2027-28, being that the selection of its research program analysed in the study is forecast to deliver benefits of $54.5 million versus the cost to the State of the MRIWA's operations of $17.4 million.

Based on these results, the benefit cost ratio (BCR) of the MRIWA operations since its inception is 3.12, implying that for these research programs every dollar of State Government funding is forecast to produce at least $3.12 of benefits.

The BCR is significant insofar as MRIWA has funded more than 350 individual research projects over its history (MRIWA and MERIWA), including 50 projects since MRIWA's inception with a total project value of $19.2 million (nominal terms). The BCR considers the potential benefits of just 20 of those research projects.

This BCR provides a means of demonstrating the role the MRIWA has played in fostering research projects that began under its precursor body. These are ultimately expected to result in the translation of significant benefits to the State's minerals industry well in excess of the MRIWA's cost of services in its current form.

Has MRIWA been effective in meeting its overall objectives?

Since its establishment on 1 February 2014, MRIWA has allocated $19.2 million to research projects across the **five research themes**. Of this amount, $7.12 million has been allocated to 15 projects under the "Find More Resources" theme, with a further $3.1 million allocated to 10 projects under the

"Expand the Mining Envelope", $1.62 million to 10 projects under the "Increase Recoverable Value" theme, and $0.14 million to one project under the "Develop New Products and Markets" theme.

Under the "Improve Productivity" theme, a total of $7.24 million has been funded to 14 projects since 2014, however, the majority of this funding was most recently allocated to the Future Batteries CRC ($5.5 million) in 2018. This funding allocated to the Future Batteries CRC is the highest amount that MRIWA has allocated to a single project since its establishment.

The quantum of funding allocated to projects by MRIWA has varied year to year, suggesting that MRIWA's **rigorous project section process**, rather than its annual budget drives funding decisions.

Stakeholders spoke positively that MRIWA's processes were well documented and understood, and well supported by MRIWA. The process is important in ensuring there is clarity surrounding the information required for each funding application, which ultimately ensures that value for money is achieved for MRIWA and ultimately the WA Government – or as one stakeholder suggested, the process ensures MRIWA is best able to "pick winners".

The **leverage ratio** is the ratio of total cash investments in research projects to total approved MRIWA cash investment in those research projects. The MRIWA's effectiveness KPI is to achieve a leverage ratio of three or higher as it relates to the total value of projects approved in a given financial year. It has not achieved this KPI since its inception.

While MRIWA has been unable to meet this KPI at a headline level, it has still managed to ensure that additional funding is secured from other partners for research projects. Across the five research themes, MRIWA has been **successful in leveraging its funding** in line with this KPI across projects relating to the Expanding the Mining Envelope research theme (leverage ratio of 3.24 between 2014 and 2018) and was just under this target for the New Products and Markets research theme (leverage ratio of 2.87 between 2014 and 2018).

Since its inception, the MRIWA (and its pre-cursor body MERIWA) have funded over 350 individual research projects with a combined State funding contribution of at least $35 million.

In consultation with MRIWA, it was decided the economic impact assessment would centre on the quantification of forecast future realised benefits of research funded over the period 2018-19 to 2027-28. This "future focussed" economic impact assessment inherently involved the use of financial projections and modelling based on assumptions, which were derived via consultation with researchers and members of industry plus a review of research reports prepared by MRIWA funded researchers at the conclusion of research engagements.

ACIL Allen sought out research that had resulted or was likely to result in the development of a new technology or process that could be readily identified and applied a minerals producer or explorer currently operating in Western Australia.

Based on a conservative set of modelling assumptions, ACIL Allen estimates the **direct industry benefits arising from the selected MRIWA projects will generated $142.2 million in benefits** over the ten years from 2018-19 to 2027-28 in real (2017-18) dollars. The research program case studies provide evidence that the MRIWA has been effective in delivering its statutory objective regarding delivery of benefits to the Western Australian minerals industry.

Stakeholders noted the MRIWA's benefits extended to intangibles such as **fostering collaboration** and assisting to **create linkages between stakeholders** who would otherwise have no means of connecting organically. In addition to this, stakeholders noted in some instances the MRIWA acted as a "clearing house" for research projects, creating linkages and generating ideas for research projects which then proceeded without the MRIWA's direct involvement.

An important and consistent point raised by stakeholders regarding the MRIWA's effectiveness was the need for **greater certainty of funding** over the forward estimates period and beyond. Stakeholders from industry and the research community noted without a long term funding commitment it was difficult for them to secure matching funds from internal sources. Stakeholders more directly involved in the management and governance of MRIWA indicated to ACIL Allen that a lack of future funding certainty was beginning to impact upon their ability to source new projects.

Most projects seeking funding have a multi-year time horizon, or are part of a longer term research program which requires a number of projects to achieve the full outcome. ACIL Allen notes that four the six research case studies assessed for the economic impact assessment developed over a series of individual research projects, sometimes stretching over decades. Without funding from MRIWA, these projects would not have commenced and the benefits from them would not have materialised.

There were stakeholders that suggested that more could be done to **increase the awareness of MRIWA, and its role, objectives and functions**. Principally, there was a view the MRIWA was delivering significant value to the State, and as a small statutory authority has an excellent story to tell regarding its effectiveness in delivering on its objectives. It was noted the MRIWA has a good relationship with its responsible Minister and within the Department of Mines, Industry Regulation and Safety, but its visibility within Government outside of these groups was more limited.

Improved awareness would not only help to demonstrate the important role that MRIWA plays in industry, but also open the door to other potential funding opportunities.

In relation to the lifecycle of a MRIWA funded project, a useful suggestion was that after a project is "closed", there is follow up in the subsequent years to document the progress of each project and the outcomes and benefits achieved. This would help improve future project selection as the MRIWA would have a consistent view of the relative success of its portfolio in relation to all projects.

Does a demonstrable need exist for MRIWA?

ACIL Allen's review has not identified any issues or concerns that require a change to the *Minerals Research Institute Act 2013*. The Act does not constrain the MRIWA in any way, and as demonstrated by the assessments of efficiency and effectiveness the MRIWA has delivered on its statutory objectives.

As to the ongoing need for MRIWA, there was **universal endorsement of the important role MRIWA** is playing in supporting the minerals industry in Western Australia. This became evident in a number of ways, both quantitative and qualitative, which are discussed below.

ACIL Allen's economic impact assessment estimates that the funding allocated to MRIWA and its corresponding impact on the mining industry will provide a significant boost to the WA economy over the forecast period from 2018-19 to 2027-28. Based on ACIL Allen's CGE model, *Tasman Global*, it is estimated that the MRIWA funded research into the selected case studies will generate:

- **real incomes** of $121.5 million over the forecast period, averaging $12.1 million per annum;
- **real output** of $166 million over the forecast period, averaging $16.6 million per annum;
- **real consumption** impact of $42.8 million over the forecast period, averaging $4.3 million per annum;
- **government taxation** of $6.6 million over the forecast period, averaging $0.7 million per annum; and
- **employment** generation of 91.3 FTE jobs per annum over the forecast period.

While WA's mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges. The minerals industry is the most important industry in Western Australia. The mining industry has been the State's largest industry for some time, though its share of activity has increased in recent times on account of the mining boom.

Given the role of the mining industry in Western Australia's economy, the State should look to ways of helping it address these competitive challenges.

The MRIWA is an important part of this emerging story. While MRIWA has been around for some time, its role is arguably more vital than ever as a **catalyst for mining innovation and technology** development in Western Australia, as the industry moves evolves beyond the blunt instrument of billions of dollars of new mines and turns to the more specific toolkit enabled by technology and innovation.

It was widely accepted that MRIWA fills a gap in the market between science and application; between industry and academia.

The MRIWA is seen by stakeholders as part of the State's comparative and competitive advantage in the mining and minerals industry. Industry representatives saw part of the MRIWA's role as facilitating

collaboration and creating linkages, and not just as a pool of money for research. The MRIWA and its unique model also afforded the State Government a means to act quickly to capture Commonwealth funding opportunities (such as through CRC bids).

There was a consensus view across most stakeholders that if MRIWA did not exist then the level of funded research in WA would diminish, and by extension the application of the research in WA would also diminish.

In relation to the projects that are funded by MRIWA, there was a view by industry stakeholders that there could be a **greater share of the funding portfolio dedicated towards technology and supply chain innovation** as opposed to minerology and geoscience – addressing the competitive challenges faced by the State's minerals industry. By providing grants targeted at specific, industry-led solutions to problems, the MRIWA has been able to provide tangible opportunities for research to be translated into outcomes for industry, which has been demonstrated in ACIL Allen's economic impact assessment.

Generally speaking, the view was MRIWA could enhance its role in the industry if it were to shift its focus and potentially expand its scope to participate in the **funding of projects that were further along the so-called Technology Readiness (TRL) scale** – assisting projects that had moved past feasibility and were looking towards commercial trials and more large scale applications in the prototype phase. MRIWA has funded some projects which would fit this type in recent years

Where and how the MRIWA directs its funds is ultimately a decision for MRIWA and its board, in consultation with industry, so it can best achieve its statutory objectives. ACIL Allen suggests the MRIWA consider stakeholder perspectives regarding the direction of funding using the TRL spectrum as a framework to guide discussions and external engagement.

In this vein, the Act requires that the Institute must have regard to its Research Priority Plan, as revised from time to time, when performing its functions. The timing for a review of the RPP is at the discretion of the MRIWA Board. It is recommended that the **RPP should be reviewed** to ensure that each of the research themes are still contemporary and reflective of current and emerging trends in the industry.

Key Findings

KEY FINDING IMPORTANCE OF MINING TO THE WA ECONOMY

The mining industry is Western Australia's largest and most important industry, accounting for more than a third of total economic output and employing over 100,000 people each year. While the mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges.

MRIWA is an important part of this emerging story. While MRIWA has been around for some time, its role is arguably more vital than ever as a catalyst for mining innovation and technology development in Western Australia, as the industry moves evolves beyond investing billions of dollars for new mines and turns to the more specific toolkit enabled by technology and innovation.

KEY FINDING GOVERNANCE

MRIWA has an **established governance and project selection process** that ensures the funding provided to selected research projects is consistent with MRIWA's and the WA Government strategic goals to support minerals research for the benefit of the State.

KEY FINDING STRATEGY AND PLANNING

Based on the research themes established under the Research Priority Plan, since 2014 MRIWA funding has primarily been directed to the "Find More Resources" and "Improve Productivity" research themes to a greater extent than the other four research themes. The largest single investment made by MRIWA over the past five years has been the recently announced Future Batteries CRC of $5.5 million.

The quantum of funding allocated to projects by MRIWA has varied year to year, suggesting that MRIWA's rigorous project section process, rather than its annual budget drives funding decisions.

It is recommended that the **RPP should be reviewed to ensure that each of the research themes are still contemporary and reflective of current and emerging trends in the industry**.

KEY FINDING MRIWA KEY PERFORMANCE INDICATORS

MRIWA's KPIs provide a broad assessment of the degree to which MRIWA has been effective in leveraging its project funding with co-funding from other sources, and the degree to which MRIWA has been operating efficiently by keeping growth in non-grant expenditure to a minimum.

Against these KPIs, MRIWA has not been successful in meeting its key effectiveness KPI over the past four years, but it has been successful in meeting its key efficiency KPI in the last two financial years.

However, these **KPIs should not guide the performance of MRIWA in isolation**.

Ultimately, the performance of MRIWA – and the value for money that is realised for the WA Government from its operations – will be measured over the longer term by the economic benefit derived by Western Australia from the Institute's activities and, ultimately, the impact these have on optimising the minerals royalties paid to the State. A summary of the economic impact assessment that ACIL Allen has undertaken for MRIWA, which includes estimates of the impact of a selected number of MRIWA funded projects in output, income, employment and taxation terms, is provided in Chapter 4 and should be read in conjunction with MRIWA's KPI performance when assessing its overall value for money.

KEY FINDING BUDGET AND FUNDING TRENDS

From an **efficiency** perspective, MRIWA's administrative costs have not increased beyond its original levels, averaging around $1 million per annum or around 19 per cent of total expenditure between 2013-14 and 2017-18.

From an **effectiveness** perspective, MRIWA has generally been effective in dispersing its annual appropriation to research projects over its first five years. While the 2017-18 Annual Report suggests that there was accumulated cash reserves of $12.83 million by 30 June 2018, ACIL Allen notes that the majority of this amount had been allocated to current and future projects approved by the MRIWA Board.

KEY FINDING KEY FINDINGS FROM STAKEHOLDER CONSULTATION

- The Minerals Research Institute of Western Australia (MRIWA) is a unique (in Australia) model for research funding, and was seen to be **highly effective** by all stakeholders consulted.
- The MRIWA **addressed a specific gap** in the market for research funding, and stakeholders stressed the importance of the MRIWA's ability to act a **long term funding partner** for research.
- An important and consistent point raised by stakeholders was the need for **greater certainty of funding** over the forward estimates period and beyond. Most projects seeking funding have a multi-year time horizon, or are part of a longer term research program which requires a number of projects to achieve the full outcome.
- MRIWA's **treatment of IP** was raised by stakeholders, with a variety of views. One consistent theme was that the MRIWA should consider reviewing its approach to the treatment of IP, with a view to potentially tailoring its approach depending on the situation rather than a blanket rule of requiring all research was open access.
- The MRIWA is seen by stakeholders as **part of the State's comparative and competitive advantage** in the mining and minerals industry. Industry representatives saw part of the MRIWA's role as **facilitating collaboration and creating linkages**, and not just as a pool of money for research. The MRIWA and its unique model also afforded the State Government a means to **act quickly to capture Commonwealth funding opportunities** (such as through CRC bids).
- Stakeholders had a variety of views regarding the **allocation of MRIWA research funding**. This could be summarised as a view that the MRIWA could adjust its portfolio to fund more **applied technological research**, perhaps at the expense of some more fundamental research into the State's geology (this was not a uniform view). However this view tended to be coloured by the industry/affiliation of the stakeholder.
- The major area of improvement suggested was branding and communications, with many stakeholders advising they "stumbled upon" the MRIWA when investigating research funding. This is seen as an opportunity to improve the "sell" of the MRIWA to important stakeholders, and address issues regarding the long term security of funding from the State Government.

KEY FINDING DIRECT INDUSTRY BENEFITS OF SELECTED MRIWA PROJECTS

Based on a conservative set of modelling assumptions, ACIL Allen estimates the **direct industry benefits arising from the selected MRIWA projects will generated $142.2 million** in benefits over the ten years from 2018-19 to 2027-28 in real (2017-18) dollars.

KEY FINDING ECONOMIC IMPACT OF MRIWA

ACIL Allen estimates that the funding allocated to MRIWA and its corresponding impact on the mining industry will provide a significant boost to the WA economy over the forecast period from 2018-19 to 2027-28. Based on ACIL Allen's CGE model, *Tasman Global*, it is estimated that the MRIWA funded research into the selected case studies will generate:

- **real incomes** of $121.5 million over the forecast period, averaging $12.1 million per annum;
- **real output** of $166 million over the forecast period, averaging $16.6 million per annum;
- **real consumption** impact of $42.8 million over the forecast period, averaging $4.3 million per annum;
- **government taxation** of $6.6 million over the forecast period, averaging $0.7 million per annum; and
- **employment** generation of 91.3 FTE jobs per annum over the forecast period.

KEY FINDING BENEFIT COST ASSESSMENT OF MRIWA

ACIL Allen estimates MRIWA's six research programs are forecast to deliver at least a net benefit of $50.1 million, being that the research program is forecast to deliver benefits of $54.5 million versus a research funding cost to the State of $4.4 million. Based on these results, ACIL Allen has estimated that the **BCR of the MRIWA's research program is 12.46**, implying that for these research programs every dollar of State Government funding is forecast to produce $12.46 of benefits.

ACIL Allen estimates MRIWA's cost of services are forecast to deliver at least a net benefit of $37 million, being that the research program is forecast to deliver benefits of $54.5 million versus the cost to the State of the MRIWA's operations since its inception on 1 February 2014 of $17.4 million. Based on these results, the **BCR of the MRIWA operations since its inception is 3.12**, implying that for these research programs every dollar of State Government funding is forecast to produce at least $3.12 of benefits. This BCR provides a means of demonstrating the role the MRIWA has played in fostering research projects that began under its precursor body. These are ultimately expected to result in the translation of significant benefits to the State's minerals industry well in excess of the MRIWA's cost of services in its current form.

The BCR is also significant insofar as MRIWA has funded more than 350 individual research projects over its history (MRIWA and MERIWA), including 50 projects since MRIWA's inception with a total project value of $19.2 million (nominal terms). The BCR considers the potential benefits of just 20 of those research projects.

KEY FINDING EFFICIENCY – OVERALL ASSESSMENT

MRIWA has met its efficiency KPI in each of the past two years, and has operated with a tight control on its non-grant expenditure while maintaining a rigorous and transparent project selection process. ACIL Allen's BCA framework suggests MRIWA is forecast to deliver a social benefit in excess of the cost of the MRIWA to the State between 1 February 2014 and 30 June 2018.

KEY FINDING OVERALL ASSESSMENT – EFFECTIVENESS

MRIWA has been effective in meeting its overall objectives as established in its Act and Research Priority Plan, and as articulated in its annual reports, notwithstanding it has yet to meet its formal effectiveness KPI regarding funding leverage. The ultimate measure of effectiveness is the delivery of benefits to the WA minerals sector, which ACIL Allen has established both quantitatively and qualitatively. The MRIWA's effectiveness could be improved with greater funding certainty, improved awareness and development of a formal benefits measurement process.

KEY FINDING OVERALL ASSESSMENT – ONGOING NEED FOR MRIWA

The minerals industry is the most important industry in Western Australia. While WA's mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges.

This alone presents a clear and objective need for the MRIWA, which has been quantified by ACIL Allen's economic impact assessment, and reinforced through feedback provided to ACIL Allen during stakeholder consultation.

However, the changing needs of the minerals industry provides an opportune time for the MRIWA to review and revise its Research Priority Plan, to ensure its efforts are directed at the current and emerging challenges of the State's minerals industry. The MRIWA may also consider shifting its focus further along the Technology Readiness Level scale, to target research projects that address specific and identified industry needs as oppose to more base level research – which is funded by a number of other government bodies.

1 INTRODUCTION AND BACKGROUND

The Minerals Research Institute of Western Australia (MRIWA) is a statutory body established by the Western Australian Government under the *Minerals Research Institute of Western Australia Act 2013* (the Act) to stimulate minerals research to support investment in, and operation of, a globally competitive minerals industry in Western Australia.

The MRIWA's primary function is to provide and administer funding grants to carry out minerals research. The Institute collaborates with industry, research and government entities in Australia and overseas. The MRIWA funds PhD students, and makes funds available for projects, programs and events that promote public awareness of, and interest in, minerals research, and to support related academic activities.

In June 2018, ACIL Allen was engaged by the Minerals Research Institute of Western Australia (MRIWA) to undertake an independent review of the operations and effectiveness of the *Minerals Research Institute of Western Australia Act 2013.*

As required under the Act, this review is required to be carried out as soon as practicable after the fifth anniversary of the commencement of the Act. Section 74 of the Act stipulates that:

1. *The Minister must carry out a review of the operation and effectiveness of this Act as soon as is practicable after the fifth anniversary of the commencement of this section.*
2. *In the course of the review the Minister must consider and have regard to —*
   a) *the effectiveness of the operations of the Institute; and*
   b) *the need for the continuation of the Institute's functions; and*
   c) *such other matters as appear to the Minister to be relevant to the operation and effectiveness of this Act.*
3. *The Minister must prepare a report based on that review and, as soon as is practicable after the report is prepared, cause it to be laid before each House of Parliament or dealt with under section 73.*

ACIL Allen was engaged by the MRIWA to conduct the Review of the Act on behalf of the Minister, as a means of delivering an independent perspective on the operation and effectiveness of the Act.

1.1 Evaluation Methodology

ACIL Allen has based the Review on the Department of the Treasury's 2015 Evaluation Guide[1]. As stated in the Evaluation Guide:

The Western Australian Government is committed to delivering programs which provide value for money for the people of Western Australia. Evaluation is a key tool for ensuring efficient, effective and

[1] Program Evaluation Unit 2015 , *Evaluation Guide,* Department of Treasury, Government of Western Australia, Perth.

appropriate delivery of government services through evidence based policy and decision making across the public sector[2].

Consistent with the Evaluation Guide, ACIL Allen's Review of MRIWA has focussed on the following key evaluation questions:

1. ***Is MRIWA operating efficiently?***

   This question goes to the core evaluation criteria of efficiency, by exploring how MRIWA is operating, and how efficient it is in delivering its key activities.

2. ***Has MRIWA been effective in meeting its overall objectives?***

   This question goes to the core evaluation criteria of effectiveness. That is, the extent to which MRIWA's key activities deliver on the objectives of the activity, and more broadly the objectives of MRIWA and the Government.

3. ***Does a demonstrable need exist for MRIWA?***

   This question goes to the overall evaluation criteria of appropriateness. That is, the extent to which MRIWA continues to address a demonstrable need, and is aligned to Government priorities and responsibilities.

ACIL Allen's assessment against each of these core evaluation questions has been primarily drawn from a **detailed examination of MRIWA's performance** from key documents, including its strategic and operational plans, finances, and research outcomes, along with a **comprehensive stakeholder consultation process**.

Also supporting this review is separate report that ACIL Allen has undertaken for MRIWA to conduct an economic impact assessment centred on the impact of the application of minerals sector research projects funded by the MRIWA. The assessment applies a case study approach to quantification, and seeks to value the impact of the application of technologies that the MRIWA's funding was used to conceptualise, develop, commercialise and/or implement in the Western Australian mining industry.

In undertaking the economic impact assessment, ACIL Allen has completed two separate but related pieces of analysis to provide a perspective on the economic impact of the MRIWA using the individual research program case studies analysed as part of the report. These are:

- a **quantitative economic impact assessment** using ACIL Allen's in-house Computable General Equilibrium (CGE) model Tasman Global to determine the direct and indirect economic impacts of the combined quantified benefits of the research programs studied. Further information on Tasman Global can be found in Appendix B. The outputs of the economic impact assessment have been produced for the Western Australian economy only.
- a **benefit cost assessment** (BCA), bringing in the quantitative impacts of the individual research programs and additional qualitative benefits uncovered through the assessment but which were not quantified for reasons discussed in the report. The BCA is useful as a means of establishing the extent to which the MRIWA is delivering value for money on the funds it is investing in research. The output of a BCA is a Benefit Cost Ratio (BCR), which is the identified benefits divided by the identified costs. It is also important to consider non-quantified or qualitative benefits when discussing the findings of a BCA.

1.2 Report Structure

This report is structured in a way that provides the evidence base to answer the three core evaluation questions. The remainder of the report consists of six chapters as set out below.

- **Chapter 2** provides an examination of MRIWA's operations, including its governance, strategy, key performance indicators, and budget.
- **Chapter 3** provides a summary of the stakeholder consultation process, including the key themes that emerged through the consultation.
- **Chapter 4** presents a summary of the economic impact assessment and benefit cost assessment ACIL Allen undertook for MRIWA, which was undertaken in part to support this evaluation.

[2] WA Government, sourced from: http://www.programevaluation.wa.gov.au/About/The-Government-s-Committment-to-Program-Evaluation

— **Chapter 5** draws together the evidence in the previous three chapters to provide an overall evaluation of MRIWA through the lens of **efficiency** (*Is MRIWA operating efficiently?*), **effectiveness** (*Has MRIWA been effective in meeting its overall objectives?*) and **need** (*Does a demonstrable need exist for MRIWA?*).

2 ROLE AND FUNCTIONS OF MRIWA

This chapter examines the role and functions of MRIWA based on key strategic and operational plans, budget and funding trends, which together provide critical evidence to assess the performance of MRIWA over the past five years.

2.1 Overview

2.1.1 Establishment of MRIWA

The Minerals Research Institute of Western Australia (MRIWA) is a statutory body established by the Western Australian Government under the *Minerals Research Institute of Western Australia Act 2013* (the Act) to stimulate minerals research to support investment in, and operation of, a globally competitive minerals industry in Western Australia.

The Act encapsulates a number of key design principles for MRIWA (which is referred to as "the Institute" in the Act), namely[3]:

- Funding for minerals research projects is on a competitive basis that directs State funds directly to specific research projects.
- All investment decisions made by the Institute are guided by a comprehensive Research Priority Plan (RPP).
- State funds for research projects are directed to the requirements of the Western Australian minerals endowment, as identified in the RPP.
- State funds are not available exclusively to Western Australian research organisations: the intention is to ensure scarce funds are not wasted by replicating accessible research capability and capacity that resides elsewhere.
- The Institute is to seek to optimise industry co-investment in its research activities through a leveraged grant model: State investment is to be an incentive for industry investment.
- The Institute adopts a portfolio approach to managing its research investments across research needs and through the research-development spectrum.
- The Institute seeks to engage constructively with the challenges that face the many Small to Medium Enterprise businesses that participate in the State's exploration and mining, equipment, technology and services sectors.
- The Institute will adopt contemporary best practice principles of grant administration.

The Act provides that MRIWA's Board is its governing body, provides for appointment of its seven members by the Minister, and sets out requirements regarding its constitution and procedures.

[3] Sourced from: MRIWA 2017-18 Annual Report.

Prior to its establishment on 1 January 2014, MRIWA was constituted as the Minerals and Energy Research Institute of Western Australia ('MERIWA'). MERIWA had existed since it was established by legislation in 1987, and was similarly tasked with the responsibilities above though was also able to fund projects centred on the State's energy resources. While established as a new entity, MRIWA inherited all of MERIWA's assets, rights and liabilities and other material aspects of MERIWA (such as the MEIRWA CEO, all applications in progress, and all projects which had received funding but were not yet completed).

2.1.2 Functions of MRIWA

The functions granted to MRIWA in the Act are for the specific purpose of fostering and promoting minerals research for the benefit of the State. These functions are to:

- Undertake, procure or manage minerals research projects;
- Provide funding to individuals or corporations to enable them to undertake or participate in minerals research or other associated activities, or to engage other persons to do so;
- Keep records about minerals research projects it undertakes, procures, manages or funds;
- Work with other people, authorities and institutions about minerals research;
- Maintain current knowledge of minerals research being undertaken;
- Promote public awareness and interest in minerals research;
- Foster academic activities related to minerals research; and
- Advise the Minister about minerals research.

To assist it in achieving its objectives, MRIWA has established a rigorous advisory structure centred on the MRIWA board as the final decision maker regarding project funding. The board is supported by a research advisory committee, which in turn is supported by five "theme" committees (one for each research theme in the RPP) that are responsible for screening and providing advice for the purpose of improving on proposals which are at first assisted by the MRIWA executive.

2.1.3 Strategic Goals of MRIWA

The MRIWA strategy is founded on a business model for the Institute which focuses on the contribution that MRIWA makes to enabling the results of research projects to be used in the operating mining industry.

To achieve its vision of promoting minerals research to optimise economic outcomes for Western Australia, MRIWA has identified and adopted several strategic goals. As detailed in its 2017-18 Annual Report, MRIWA's strategic goals are:

- Become an influential stakeholder in the national minerals innovation system
- Extend from 'enabling research' to 'enabling research and commercialisation'
- Diversify its financing strategy beyond current government funding
- Balance the varying needs of both government and industry stakeholders; and
- Identify and strengthen MRIWA's core competencies.

These are strategic goals reflect the focus of MRIWA's operations. However, in the absence of key performance indicators or targets linked to these strategic goals, it is unclear the degree to which progress has been achieved.

2.1.4 MRIWA Alignment to WA Government Goals

From a fiscal perspective, the State Government investment in minerals research is part of the strategy to ensure that the State's mining operations are competitive with operations in lower cost jurisdictions, nationally and internationally. The State's co-investment in minerals research contributes to securing the significant revenues generated for the State by the minerals industry.

MRIWA represents a strategic model for minerals research in Western Australia. It provides an efficiency gain for the State with research for the minerals industry being better managed, coordinated and strategically targeted than would otherwise be the case.

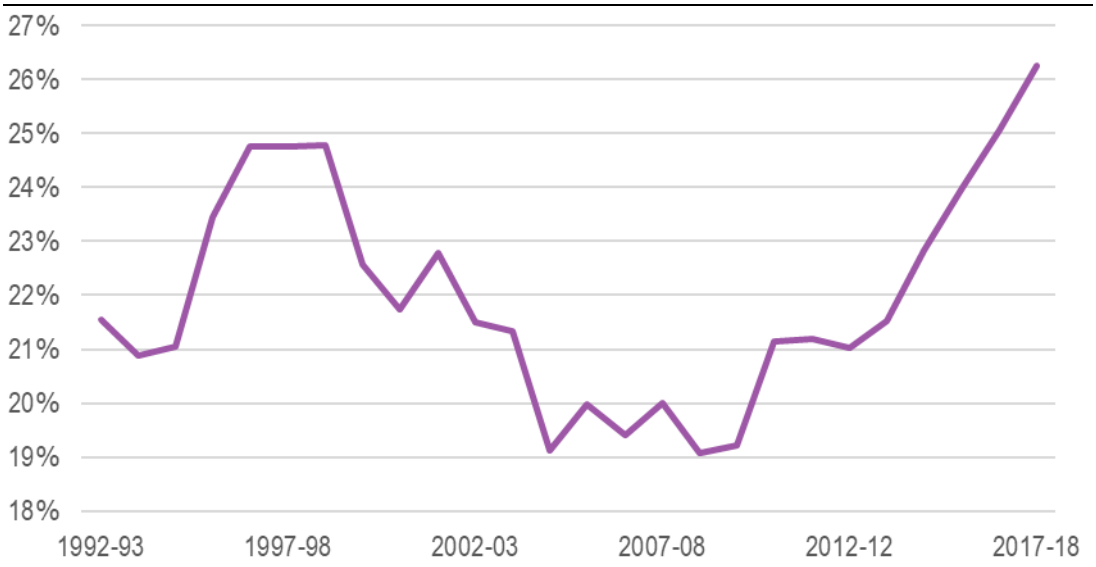
MRIWA is contributing to implementing the Western Australia Science and Innovation Framework 2018-2022. The Institute is focused on the Mining Priority Area and its activities support many of the Framework's Outcomes, particularly:

- Diversification of the State's economy with attendant job creation;
- Local, national and global recognition of the State's strength's; and
- Collaboration and innovation are fostered across industry, researchers and government.

2.1.5 Importance of Mining to the WA Economy

The minerals industry is the most important industry in Western Australia. In 2016-17, mining accounted for 26 per cent of total gross value added (GVA) for the Western Australian economy, the largest single sector of any sector in any State or Territory. The mining industry has been the State's largest industry for some time, though its share of activity has increased in recent times on account of the mining boom (**Figure 2.1**).

FIGURE 2.1 WA MINING INDUSTRY SHARE OF WA GROSS VALUE ADDED



SOURCE: ACIL ALLEN CONSULTING, ABS

In line with this, the mining industry has also provided significant employment opportunities for the population of WA. The industry employed 105,200 people at the end of the September quarter of 2018, down from a boomtime high of 113,700 but still well above the levels of ten (71,800) and 20 (30,200) years ago, highlighting the magnitude of the industry's recent growth.

The vast majority of Western Australia's mineral production is for export, with the mining industry generating $92.4 billion of export earnings in 2017-18, or 71 per cent of the State's total export earnings. Similarly, Western Australia's mineral industry accounted for 29 per cent of Australia's total merchandise exports in 2017-18, similarly the largest single industry-state share of any combination across the States.

Mining is also an important driver of State taxes, with the sector's $5.2 billion in royalty income accounting for 18 per cent of WA General Government revenue in the 2017-18 financial year. The minerals industry is also an important source of payroll tax, transfer duty and regulatory (such as mining leases and exploration licences) fees and charges. Minerals industries are also the major customer of many of Western Australia's State-owned ports, delivering the State additional revenue as minerals leave the State's shores bound for overseas customers.

While WA's mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges. The iron ore industry is a case in point, continually exploring ways of

becoming more productive and to reduce cash costs; seeking higher grade iron ore deposits[4], introducing automation and remote operations,[5] and relentlessly optimising their operations from mine head to port.[6] With the miners having cut significant cost out of their respective businesses, the way forward is continued investment in technology and innovation as a way to both improve their existing operations and help spur new mines or approaches to mining the State's rich resources.

The MRIWA is an important part of this emerging story. While MRIWA has been around for some time, its role is arguably more vital than ever as a catalyst for mining innovation and technology development in Western Australia, as the industry moves evolves beyond the blunt instrument of billions of dollars of new mines and turns to the more specific toolkit enabled by technology and innovation.

KEY FINDING 1 IMPORTANCE OF MINING TO THE WA ECONOMY

The mining industry is Western Australia's largest and most important industry, accounting for more than a third of total economic output and employing over 100,000 people each year. While the mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges.

MRIWA is an important part of this emerging story. While MRIWA has been around for some time, its role is arguably more vital than ever as a catalyst for mining innovation and technology development in Western Australia, as the industry moves evolves beyond investing billions of dollars for new mines and turns to the more specific toolkit enabled by technology and innovation.

2.2 Governance

The governance of MRIWA is depicted in **Figure 2.2** below. Broadly speaking, the control and management of MRIWA is vested in a Board of seven directors, who are appointed by the Minister. The Minister appoints one director as Chair and one as Deputy Chair.

The Minister does not have day-to-day control over Board decisions, but the Board is ultimately subject to Ministerial directions.

The CEO administers the day-to-day operations of the Institute, subject to the control of the Board.

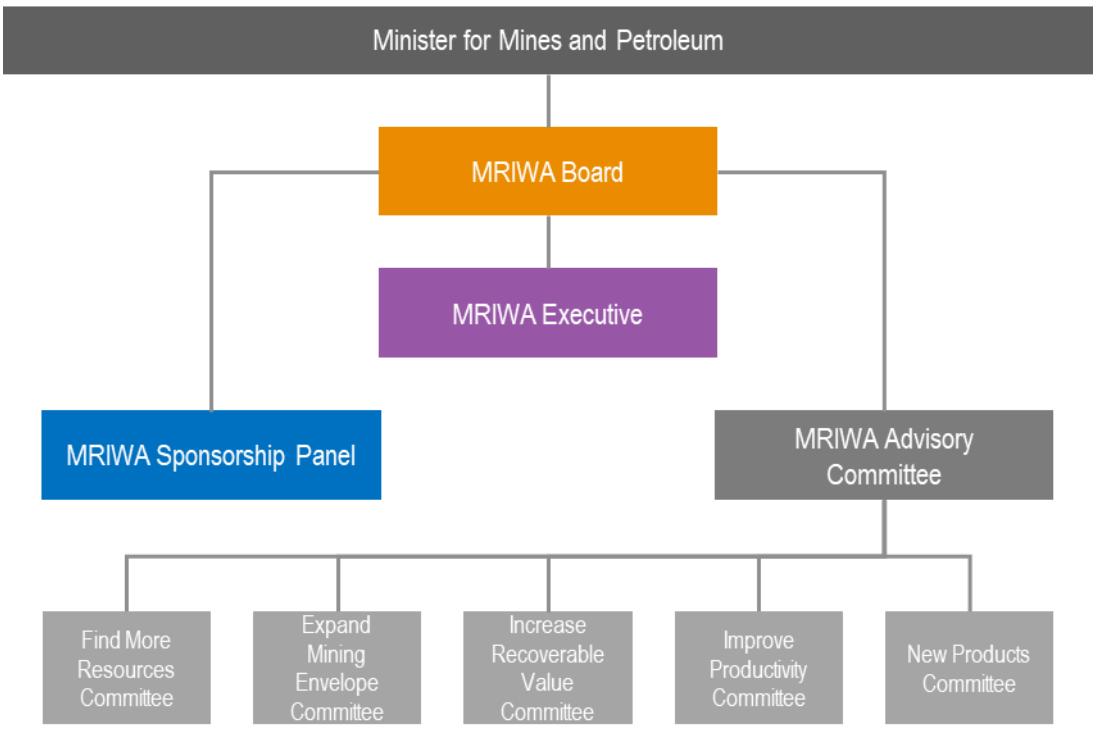
Supporting the Board is an Advisory Committee of seven members and subject specialist advisory committees provide advice to the Board on various matters, especially on the merit of Applications for research grants. The members of all advisory committees are appointed by the Board. The MRIWA also has a Sponsorship Panel which provides advice regarding MRIWA sponsorship of events, conferences and other initiatives for the purpose of meeting its statutory objectives.

MRIWA's governance is critical to ensuring that research projects undergo appropriate levels of due diligence, and are guided by the requirements of the RPP. A stylised representation of MRIWA's project selection process is detailed in **Figure 2.3** below, highlighting the critical steps in the process that have been established to ensure the best project applications are successful in sourcing funding from MRIWA.

The number of layers of endorsement ahead of eventual approval is also likely to result in a high level of probity regarding decision making, as there are multiple points of accountability regarding a project through its lifecycle as it is being developed.

[4] See: Thompson, B. 2018. *Rio Tinto counting on Koodaideri in $2.2bn new iron ore mine spend*; Letts, S. 2018. *BHP approves $4b iron ore mine as new boom hits the Pilbara;* Newell, D. 2018. *FMG green lights $1.7b Eliwana with 500 jobs to come*.
[5] Hastie, H. 2018. *One HAL of a ride: Rio's Pilbara robot makes first iron ore delivery*. Accessed online at http://www.thewest.com.au/
[6] Mining Monthly. 2018. *Very large fleet now complete: The final vessel in Fortescue Metals Group's very large ore carrier fleet has arrived*. Accessed online at http://www.miningmonthly.com.au/

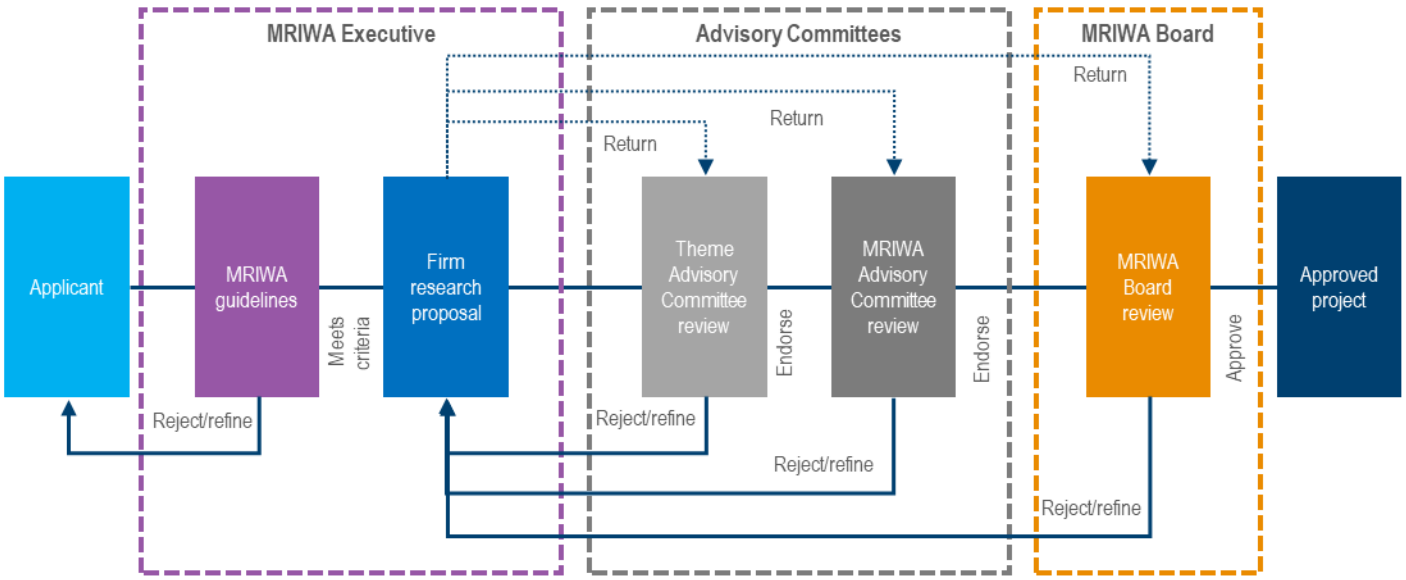
FIGURE 2.2 MRIWA GOVERNANCE



SOURCE: MRIWA ANNUAL REPORT 2017-18

Further details on stakeholder perceptions of the project selection process is provided in Chapter 3, while a detailed examination of the economic and social impact of a selection of MRIWA funded case studies is provided in Chapter 4.

FIGURE 2.3 MRIWA RESEARCH PROJECT SELECTION PROCESS



SOURCE: ACIL ALLEN BASED ON FEEDBACK FROM MRIWA

KEY FINDING 2 GOVERNANCE

MRIWA has an **established governance and project selection process** that ensures the funding provided to selected research projects is consistent with MRIWA's and the WA Government strategic goals to support minerals research for the benefit of the State.

2.3 Activities

2.3.1 Research Priority Plan

The MRIWA Act requires it to have a Research Priority Plan (RPP) that identifies and prioritises the medium- to long-term knowledge and technology needs of the State's minerals industry. MRIWA continues to be guided by the first edition of the RPP, which was completed in 2013. The current RPP was prepared in 2013 after extensive consultation with representatives from industry, research and government.

The result is five core "research themes", which have guided MRIWA's decision making since. These are:[7]

- **Find More Resources**: develop methods and tools to meet the challenging exploration environments in Western Australia
- **Expand the Mining Envelope**: allow deeper mining of more geotechnically challenging ore bodies
- **Increase Recoverable Value**: develop advanced modelling for processing circuits to efficiently recover minerals from increasingly low grade and complex mineralisation.
- **Improve Productivity**: reduce the operating and capital costs of mining in Western Australia.
- **Develop New Products and Markets**: develop processes that lead to new mineral products and markets for Western Australia.

All of these areas have a common objectives at their heart: optimisation of the local benefits of research, including delivering increased State revenues.

Since its establishment on 1 February 2014, MRIWA has allocated $19.2 million to research projects across the five research themes. Of this amount, $7.12 million has been allocated to 15 projects under the "Find More Resources" theme, with a further $3.1 million allocated to 10 projects under the "Expand the Mining Envelope", $1.62 million to 10 projects under the "Increase Recoverable Value" theme, and $0.14 million to one project under the "Develop New Products and Markets" theme.

Under the "Improve Productivity" theme, a total of $7.24 million has been funded to 14 projects since 2014, however, the majority of this funding was most recently allocated to the Future Batteries CRC ($5.5 million) in 2018. This funding allocated to the Future Batteries CRC is the highest amount that MRIWA has allocated to a single project since its establishment.

These trends are reflected in the first chart in **Figure 2.4** below.

The quantum of funding allocated to projects by MRIWA has varied year to year, suggesting that MRIWA's rigorous project section process, rather than its annual budget drives funding decisions.

As highlighted in the second chart in **Figure 2.4** below, the number of projects funded and the corresponding levels of funding has varied from a low of $0.81 million and 7 projects in 2015, before progressively increasing in the subsequent years to a high of $7.83 million to 8 projects in 2018.

The total grant value allocate to each of the five core research themes is made up of contributions from MRIWA and is supplemented by additional funding (Sponsors and a Direct Amount).

The MRIWA funding and the additional funding means that Total Grants equated to $17.01 million for "Find More Resources", $10.31 million for "Improve Productivity", $10.02 million for "Expand Mining

[7] MRIWA. 2013. *MRIWA Research Priority Plan, June 2013*. Accessed online at http://www.mriwa.wa.gov.au/

Envelope", $3.71 million for "Increase Recoverable Value" and $0.41 million for "New Products and Markets".

As a proportion of Total Grants, MRIWA funds 41.9 per cent of "Find More Resources", 30.9 per cent of "Expand Mining Envelope", 43.8 per cent of "Increase Recoverable Value", 70.3 per cent of "Improve Productivity" and 34.8 per cent of "New Products and Markets".

The Leverage ratio is the ratio of total cash investments in research projects to total approved MRIWA cash investment in those research projects. One of MRIWA's KPIs has a target for the Leverage Ratio of 3 (see following section). Across the five research themes, "Expand Mining Envelope" has the highest leverage ratio at 3.24, followed by New Products and Markets (2.87), Find More Resources (2.39), Increase Recoverable Value (2.28) and Improve Productivity (1.42).

As it stands, the Improve Productivity leverage ratio does not reflect the true leverage ratio of the research theme, as it includes a State Government investment of $5.5 million slated for the Future Batteries CRC project which has been approved by the MRIWA Board contingent on the selection of the project by the Commonwealth Government and the project being headquartered in Western Australia. This project currently has a leverage ratio of 1.00, as there are no additional funds linked to it. The underlying Improve Productivity ratio, which removes the influence of the Future Batteries CRC project, is 2.76.

These trends are reflected in the third chart in **Figure 2.4** below.

Looking forward, the Act requires that the Institute must have regard to its Research Priority Plan, as revised from time to time, when performing its functions. The timing for a review of the RPP is at the discretion of the MRIWA Board.

According to its 2017-18 Annual Report:

The Board's view is that the research fields described in Theme 1 (Find More Resources), Theme 2 (Expand the Mining Envelope), Theme 3 (Increase Recoverable value) and Theme 5 (Develop New Products and Markets) are still entirely relevant and that Theme 4 (Improve Productivity) needs to be amplified to better describe research needs that have emerged in recent years.

The Board is mindful that whilst the RPP must remain contemporary it also needs to provide some continuity for stakeholders.

The Board decided to defer finalising the review of the RPP until there was greater clarity of the consequences of the Minister assigning MRIWA a role in delivering to the Government's election commitment regarding renewable technology manufacturing and work to develop battery technologies, and the transition to the new CEO was completed.

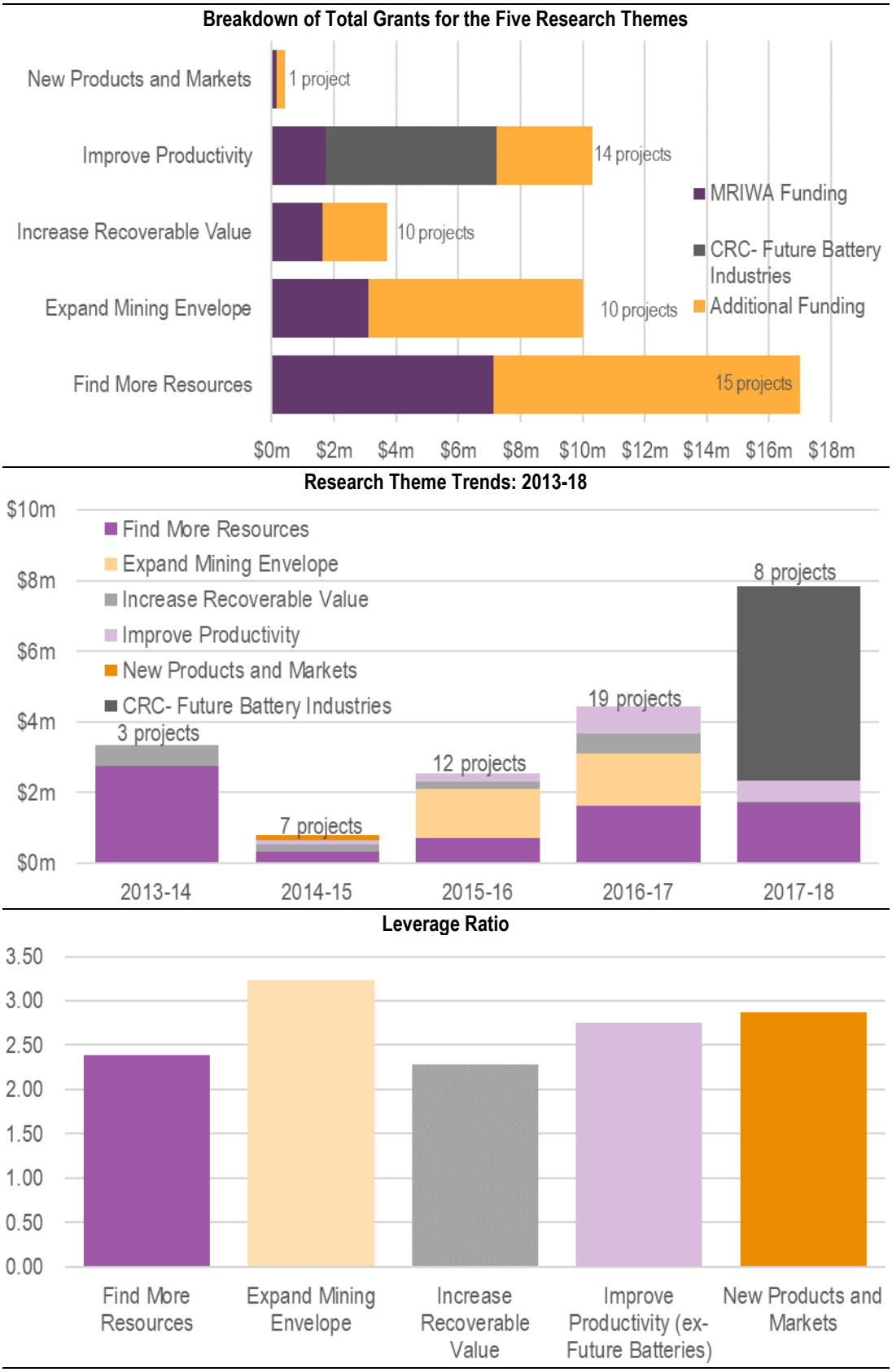
KEY FINDING 3 STRATEGY AND PLANNING

Based on the research themes established under the Research Priority Plan, since 2014 MRIWA funding has primarily been directed to the "Find More Resources" and "Improve Productivity" research themes to a greater extent than the other four research themes. The largest single investment made by MRIWA over the past five years has been the recently announced Future Batteries CRC of $5.5 million.

The quantum of funding allocated to projects by MRIWA has varied year to year, suggesting that MRIWA's rigorous project section process, rather than its annual budget drives funding decisions.

It is recommended that the **RPP should be reviewed to ensure that each of the research themes are still contemporary and reflective of current and emerging trends in the industry**.

FIGURE 2.4 RESEARCH PRIORITY PLAN (RPP)



SOURCE: MRIWA

NOTE: THE CRC FUTURE BATTERIES INDUSTRIES RESEARCH PROJECT IS HAS BEEN APPROVED BY THE MRIWA BOARD AND SO IS INCLUDED IN THE VALUE OF PROJECTS FOR COMPLETENESS. HOWEVER, FUNDING IS CONTINGENT ON ACCEPTANCE OF THE FUTURE BATTERIES INDUSTRIES RESEARCH CENTRE BY THE COMMONWEALTH GOVERNMENT, AND THAT THE RESEARCH CENTRE IS BASED IN WA. TO REFLECT THIS, THE FUNDING COMMITMENT HAS BEEN EXCLUDED FROM THE LEVERAGE RATIO PRESENTED IN PANEL 3, AND CALLED OUT SPECIFICALLY ELSEWHERE.

2.3.2 Scholarships

As detailed in its 2017-18 Annual Report, MRIWA has committed a total of $1.46 million to tertiary student scholarships since it commenced on 1 February 2014. The design principles for the MRIWA PhD Scholarships Programme focus on two criteria:

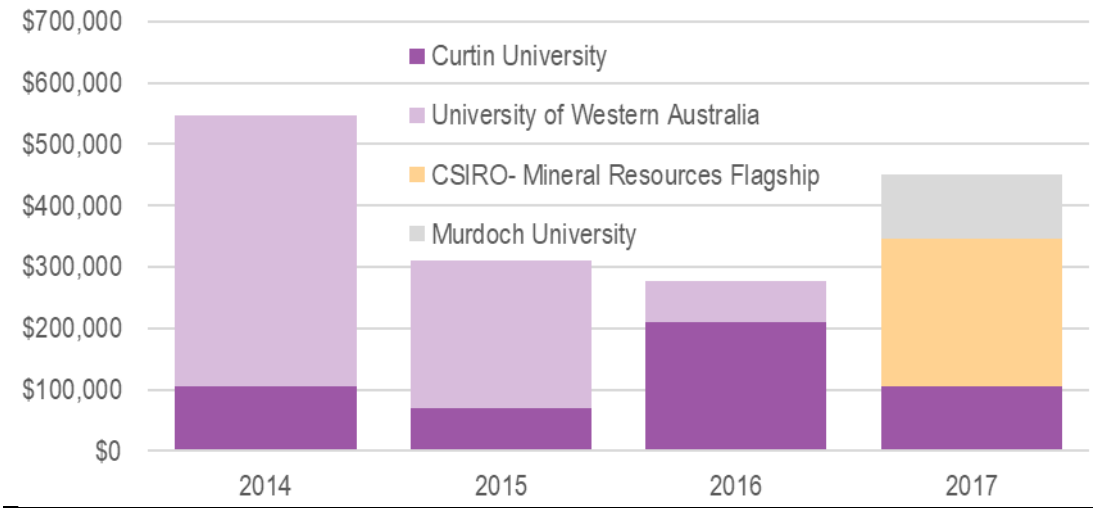
— to make a significant contribution to MRIWA's objectives; and

— to attract applicants with exceptional academic capability.

The universities and research organisations that MRIWA have allocated funds to support student scholarships are the University of Western Australia (UWA), Curtin University, Murdoch University and CSIRO's Mineral Resources Flagship. UWA have received the highest distribution of funds from MRIWA for student scholarships ($752,384) allocated to 8 projects.

Below in **Figure 2.4**, the total funds allocated to the PhD Scholarships Programme and to support student scholarships have been broken down by university and research organisation.

FIGURE 2.5 RECIPIENTS OF STUDENT SCHOLARSHIPS



SOURCE: MRIWA

2.4 Key Performance Indicators

The Outcome-Based Management Structure and Key Performance Indicators (KPI) for MRIWA were approved by the Department of Treasury in March 2015, to apply from the 2014-15 annual reporting period.

MRIWA's activities contribute to the Government goal of responsibly managing the State's finances through effective and efficient delivery of services, encouraging economic activity and reducing the regulatory burdens on the private sector.

Ultimately, the performance of MRIWA will be measured over the longer term by the economic benefit derived by Western Australia from the Institute's activities and, ultimately, the impact these have on optimising the minerals royalties paid to the State. Chapter 4 provides a summary of the economic impact assessment that ACIL Allen has undertaken for MRIWA, which includes estimates of the impact of a selected number of MRIWA funded projects in output, income, employment and taxation terms.

The KPIs, revised from those applying for the predecessor Minerals and Energy Research Institute of Western Australia (MERIWA), are:

— Key Effectiveness Indicator: the ratio of total cash investments in research projects to total approved MRIWA cash investment in those research projects.

— Key Efficiency Indicator: total administration cost for the year as a percentage of the total cash value of research projects and the education program under management during the year.

MRIWA's performance over time in meeting these KPIs is provided in **Figure 2.6** below.

FIGURE 2.6 MRIWA PERFORMANCE AGAINST ITS KEY PERFORMANCE INDICATORS

	2014-15	2015-16	2016-17	2017-18
Key Performance Indicator 1 *Ratio of total cash investments in research projects to total approved MRIWA cash investment in those research projects (ratio)* KPI is intended to provide MRIWA with the incentive to seek investment projects that deliver on industry needs, as reflected by its desire to co-fund.	**Target** 3 **Actual** 1.9 ✗	**Target** 3 **Actual** 2.14 ✗	**Target** 3 **Actual** 2.55 ✗	**Target** 3 **Actual** 1.52* ✗
Key Performance Indicator 2 *Total administration cost for the year as a percentage of the total cash value of research projects and the education program under management during the year. (%)* KPI is intended to provide MRIWA with incentive to limit non-grant expenditure.	**Target** 4.5 **Actual** 6.4 ✗	**Target** 4.5 **Actual** 5.7 ✗	**Target** 5.0 **Actual** 4.4 ✓	**Target** 4.5 **Actual** 3.4 ✓

INCLUDES FUTURE BATTERIES INDUSTRIES CRC, WHICH THE MRIWA HAS COMMITTED FUNDS TO BUT IS YET TO BE APPROVED AND SO DOES NOT COUNT TOWARDS FINANCIAL LEVERAGE. ACIL ALLEN HAS INCLUDED THIS IN THE TABLE ABOVE AS THE ACTUAL FOR 2017-18 AS UNDER THE MRIWA'S APPROVALS PROCESS AND KPI STRUCTURE THIS IS THE CORRECT FIGURE. HOWEVER, EXCLUDING THIS VALUE YIELDS AN **UNDERLYING RATIO OF 2.44, WHICH STILL SEES THE MRIWA MISS ITS TARGET BUT BY A SMALLER AMOUNT.*

SOURCE: MRIWA ANNUAL REPORTS

While MRIWA has been unable to meet KPI 1 relating to leveraging its project funding over the past four financial years, it has still managed to ensure that additional funding is secured from other partners for research projects. However, as highlighted in the third chart in **Figure 2.4**, across the five research themes, MRIWA has been successful in leveraging its funding in line with this KPI across projects relating to the Expanding the Mining Envelope research theme (leverage ratio of 3.24 between 2014 and 2018) and was just under this target for the New Products and Markets research theme (leverage ratio of 2.87 between 2014 and 2018).

The MRIWA's performance against KPI 1 in 2017-18 is depressed by the MRIWA Board's approval of funding for the Future Batteries Industries CRC bid, which has zero leverage recorded as leveraged funds will not materialise until the Research Centre bid is accepted (and then only if the Research Centre is based in Western Australia). However the value has been included as it appears in the annual report as it has been prepared in accordance with the MRIWA's KPI. The "underlying ratio" (which excludes the influence of the Future Batteries Industry CRC contingent funding) for the 2017-18 financial year is 2.44, which is still below the MRIWA's target but by a smaller amount.

In relation to KPI 2, which provides an indication of the degree to which MRIWA is operating efficiently, this target has been met in the past two financial years on account of the MRIWA's containment of non-grant costs (discussed in Section 2.5).

KEY FINDING 4 MRIWA KEY PERFORMANCE INDICATORS

MRIWA's KPIs provide a broad assessment of the degree to which MRIWA has been effective in leveraging its project funding with co-funding from other sources, and the degree to which MRIWA has been operating efficiently by keeping growth in non-grant expenditure to a minimum.

Against these KPIs, MRIWA has not been successful in meeting its key effectiveness KPI over the past four years, but it has been successful in meeting its key efficiency KPI in the last two financial years.

However, these **KPIs should not guide the performance of MRIWA in isolation**.

Ultimately, the performance of MRIWA – and the value for money that is realised for the WA Government from its operations – will be measured over the longer term by the economic benefit derived by Western Australia from the Institute's activities and, ultimately, the impact these have on optimising the minerals royalties paid to the State. A summary of the economic impact assessment that ACIL Allen has undertaken for MRIWA, which includes estimates of the impact of a selected number of MRIWA funded projects in output, income, employment and taxation terms, is provided in Chapter 4 and should be read in conjunction with MRIWA's KPI performance when assessing its overall value for money.

2.5 Budget and Funding

MRIWA is primarily funded by the WA Government through an annual appropriation, with additional funding received from industry sponsorship each year, as well as interest income received as a result of its strong cash balance.

Over the last five financial years, MRIWA's appropriation has averaged $3.94 million per annum, with the peak of $6.02 million in 2014-15 offset by a smaller appropriation of $1.82 million the following year.

Revenue sourced from industry sponsorship averaged $1.26 million between 2013-14 and 2017-18, while interest income has increased over the five years as MRIWA's cash balance increased, reaching a high of $230,163 in 2017-18.

In relation to expenditure, over the past five years MRIWA has progressively increased its funding to research projects, from $1.22 million in 2013-14 to $3.4 million in 2017-18 (which excludes the investment associated with the Future Batteries Industries CRC bid). The remainder of MRIWA's expenditure was largely of an administrative nature, with the exception of payments for scholarships, which have averaged $148,496 per annum over the past five years.

MRIWA's non-funding expenditure (administrative costs) has been stable over the past five years, averaging around $1 million per annum, equating to around 19 per cent of total expenditure between 2013-14 and 2017-18.

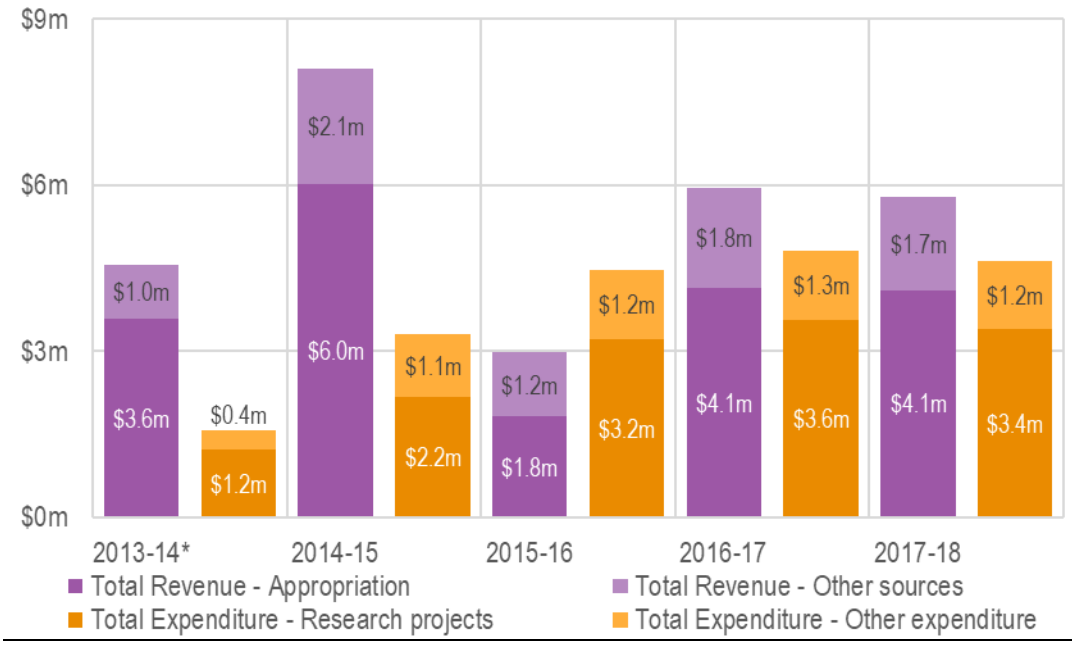
Further details are provided below in **Figure 2.7** below.

Aside from 2015-16 when the WA Government appropriation was significantly reduced following a larger appropriation in 2014-15, MRIWA has generated a cash surplus each year since formation. The larger appropriation was the result of a bring forward of the MRIWA's 2015-16 appropriation (which flowed through the former Department of Mines and Petroleum), resulting in the appearance of a "spike" in funding.

MRIWA's 2017-18 Annual Report shows that total cash reserves were $12.83 million in that year, with almost half of this amount considered "restricted cash" that is held by MRIWA for future payments to funded research projects that had been previously approved by the Board.

While the 2017-18 Annual Report states that the remaining cash balance ($6.8 million) is "unrestricted", ACIL Allen has been advised that the majority of this balance ($5.1 million) had already been allocated to projects that had received Board approval but did not have a condition of grant in place at the time the Annual Report was published.

FIGURE 2.7 MRIWA REVENUES AND EXPENSES, 2013-14 TO 2017-18, $M

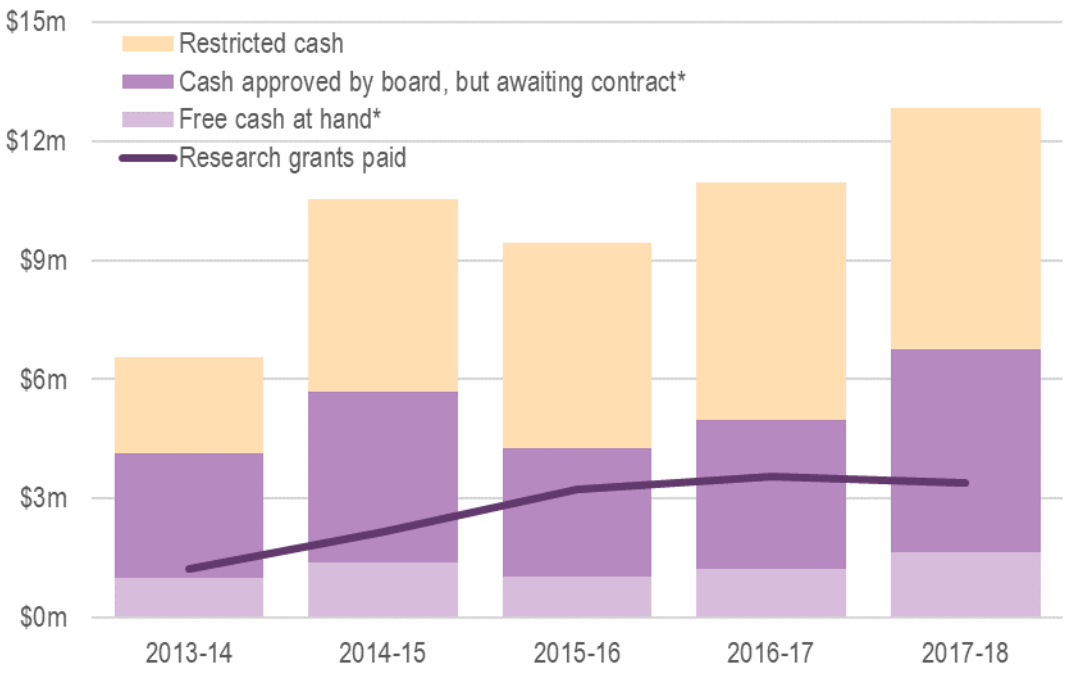


SOURCE: MRIWA ANNUAL REPORTS

Reflecting this clarification, there was approximately $1.6 million is unrestricted cash that had not been committed to any projects by 30 June 2018. However, MRIWA has advised that there was a potential future net commitment of almost $0.8 million as at 30 June 2018 which relates to unapproved projects that the board will consider in the near future.

Further details are provided in **Figure 2.8** below.

FIGURE 2.8 RESEARCH PROJECT FUNDING VS CASH RESERVES, 2013-14 TO 2017-18, $M



SOURCE: MRIWA ANNUAL REPORTS **APPROVED CASH VS FREE CASH ESTIMATED FOR 2013-14 TO 2016-17; DATA IS ACTUAL FOR 2017-18*

KEY FINDING 5 BUDGET AND FUNDING TRENDS

From an **efficiency** perspective, MRIWA's administrative costs have not increased beyond its original levels, averaging around $1 million per annum or around 19 per cent of total expenditure between 2013-14 and 2017-18.

From an **effectiveness** perspective, MRIWA has generally been effective in dispersing its annual appropriation to research projects over its first five years. While the 2017-18 Annual Report suggests that there was accumulated cash reserves of $12.83 million by 30 June 2018, ACIL Allen notes that the majority of this amount had been allocated to current and future projects approved by the MRIWA Board, and that the MRIWA will include a note in future annual reports that provides further clarity regarding the status of its cash reserves.

3 STAKEHOLDER PERSPECTIVES ON MRIWA

A critical dimension to any formal evaluation is to undertake a formal stakeholder consultation process. This chapter provides details of the stakeholder consultation process that was undertaken by ACIL Allen as part of the Review the MRIWA.

3.1 Overview of consultation

During August and September 2018, ACIL Allen consulted with key stakeholders as a primary means of gathering feedback on the effectiveness of the operations of MRIWA, and its ongoing need, as required under its enabling legislation. All up, ACIL Allen has consulted with 30 stakeholders across 24 organisations.

The list of stakeholders consulted as part of this review process is detailed in the table below (**TABLE 3.1**). Some stakeholders listed were primary consulted with respect to the economic impact assessment task which is underway, but views on the MRIWA were also sought.

TABLE 3.1 LIST OF STAKEHOLDERS

Stakeholders	Organisation	Affiliation/relationship to MRIWA
Matthew Hart	Soter Analytics	Recipient of MRIWA funding for project assessed as part of the EIA
Ben Adair, Paul Revell	CRC Ore	Recipient of MRIWA funding for project assessed as part of the EIA
Ian Hardwick	DEC CRC/MinEx CRC	Recipient of MRIWA funding for project assessed as part of the EIA
Silvia Black, Peter McCafferty	ChemCentre	Recipient of MRIWA funding for project assessed as part of the EIA
John Walshe	CSIRO	Recipient of MRIWA funding for project assessed as part of the EIA
Christine Neskudla, Yves Potvin	Australian Centre for Geomechanics	Recipient of MRIWA funding for project assessed as part of the EIA
Cameron McCuaig	BHP	Member of industry
Aleks Nikoloski	Murdoch University	Member of research community (funding recipient)
Gerard Danckert	Rio Tinto	Member of industry, member of MRIWA advisory committee

Stakeholders	Organisation	Affiliation/relationship to MRIWA
Ric Gross	METS Ignited (former Commonwealth Government Industry Growth Centre)	Member of industry
Steve Rowins	UWA	Member of research community (funding recipient)
Ben Hammond	Centrex Metals	Member of industry (funding recipient)
John Kirkman	ET Partners/Manufacturing Intelligence	Member of industry (funding recipient)
Gordon Stewart	GlobalTech	Member of industry (funding recipient)
Chris Moran	Curtin University (Vice Chancellery)	Member of research community
Cameron Adams	UWA (PhD student)	Member of research community (scholarship recipient)
Peter Klinken, Fiona Roche	Department of Jobs, Tourism, Science and Innovation	Member of government
Chris Wijns	First Quantum Minerals	Member of industry (funding recipient). Research peer reviewer
Richard Sellers	Department of Transport (former Director General of Department of Mines and Petroleum)	Member of government
Ian Tyler	Department of Mines, Industry Regulation and Safety (GIS WA)	Member of government
Paul Lever	Mining3	Member of research community (recipient of funding)
Jane Hammond	Department of Mines, Industry Regulation and Safety (Director, Labour Relations)	Member of government. MRIWA board member
Denise Goldsworthy	Chair, MRIWA	MRIWA board member
Mark Woffenden	CEO, MRIWA	MRIWA

SOURCE: ACIL ALLEN CONSULTING

The consultation process itself was structured around a series of questions focussed on the effectiveness of, and need for, MRIWA, which are the key criteria from which the Minister is required to review MRIWA under its Act. A consultation guide was provided to each stakeholder to provide context to the review ahead of the meeting, a copy of which is provided in the Appendix to this report.

The following sections provide a summary of the key themes that emerged from the consultation process.

3.2 Key Themes

Throughout consultation, ACIL Allen uncovered a number of consistent themes and opinions regarding the efficiency, effectiveness and ongoing need for the MRIWA. These are summarised below.

3.2.1 MRIWA model

Stakeholder groups all saw the MRIWA as an important institution. However as may be expected there were different views as to the most important role the MRIWA played in the State's mining sector.

— Stakeholders from a research background primarily saw the MRIWA as a source of funding for research

— Stakeholders from industry saw the MRIWA as part of the State's commitment to their industry, and as an important means to "de-risk" more fundamental/long term research that is difficult to justify internally. Industry also saw the MRIWA as an important way to "bring in" technologies developed elsewhere and apply them in a Western Australian context

— Stakeholders from government saw the MRIWA as a vehicle to achieve whole-of-State outcomes, like capturing national research funding opportunities and creating employment

Overall, stakeholders held the view that the MRIWA model is highly effective, and creates benefits for the State that would otherwise not be realised. On a secondary basis, the MRIWA is seen as effective in so far as it is able to leverage funds from industry, is transparent, helps to "shepherd and build a project from initial application to completion".

In relation to the quantum of funding, the broad consensus was that if the funding and resourcing available to MRIWA was increased, this would increase the benefits that could be realised from the research – by not only funding a greater portfolio of projects, but also by helping to streamline processes further and ultimately accelerate the benefits realised from the initial funding of a project through to its application or commercialisation.

Given the funding constraints that are applied to MRIWA, one stakeholder suggested that MRIWA look at other funding models in order to gain greater "buy in" from industry, such as the model used by the Australian Coal Industry's Research Program (ACARP), which imposes a levy of 5 cents per tonne of coal to support research in the sector. While the application of this model is more problematic for MRIWA because it is across all minerals, this should still be considered.

In relation to the other roles of MRIWA, there was general consensus that MRIWA was the "glue" and "catalyst" to deeper engagement between industry and academia. Members of both industry and the research community suggested to ACIL Allen that creating opportunities for networking and collaboration was a substantial intangible benefit. Critically, stakeholders suggested to ACIL Allen that without the MRIWA it is difficult to foresee another entity or group take up that role.

Government stakeholders considered the MRIWA provided the State Government with an important vehicle to assist in the capture of Commonwealth Government research funding (such as through CRC applications, Industry Growth Centres, AMIRA grants), which others States do not have access to. This point was also raised in the negative by some stakeholders when considering the allocation of funding (see below).

3.2.2 Governance

Stakeholders raised no issues or concerns in relation to the Act itself.

Overall, there was broad consensus that the governance of MRIWA was strong, and that this ensured that project selection was objective and consistent, and ensured that it delivered value for money to industry and Government.

In relation to the governance of MRIWA, there were a number of stakeholders that suggested there should be a focus on building capability at a Board, subcommittee and in the Executive to ensure funding applications that focussed more on technology are adequately assessed and prioritised against other more "traditional" funding applications. This was raised constructively not critically, noting some stakeholders had a view that the MRIWA should allocate more of its funding to this area of research.

Stakeholders expressed a uniform view that the executive staff of MRIWA were competent, professional and above all knowledgeable about their industry. Stakeholders commended the MRIWA staff for their collective ability to consistently achieve outcomes despite relatively modest budgets and the challenging nature of the MRIWA's brief.

Stakeholders spoke positively that MRIWA's processes were well documented and understood, and well supported by MRIWA. The process is important in ensuring there is clarity surrounding the information required for each funding application, which ultimately ensures that value for money is achieved for MRIWA and ultimately the WA Government – or as one stakeholder suggested, the process ensures MRIWA is best able to "pick winners".

In relation to the lifecycle of a MRIWA funded project, a useful suggestion was that after a project is "closed", there is follow up in the subsequent years to document the progress of each project and the outcomes and benefits achieved. This would help improve future project selection as the MRIWA would have a consistent view of the relative success of its portfolio in relation to all projects. It would also assist with the "branding and communication" aspect of the MRIWA discussed later.

An additional consideration raised was in regards to the treatment of Intellectual Property (IP) generated as a result of the research funded by MRIWA. As it stands, the MRIWA requires all IP developed under an MRIWA funded project to be made open access and able to be used by all. There was a balance between two somewhat opposing views:

— that the MRIWA's approach to IP allowed for the delivery of benefits to the whole minerals industry, which is the ultimate objective of the MRIWA, and

— that the MRIWA's approach to IP may limit its effectiveness, as companies pursue R&D as a means of developing a competitive advantage, and so the "best" projects may not be put forward

A consistent view in regards to IP was the MRIWA should consider reviewing its approach and adopt a more tailored approach to the treatment of IP, instead of adopting a blanket rule that all IP should be open access. While this view was held it is likely a reflection of some stakeholders being unaware that this approach is currently taken by MRIWA (for instance, in some cases MRIWA has granted a two year deferral in the release of the final reports of some research projects to allow the researchers to gain an initial advantage, where a judgement has been made that this is to the benefit of the State).

3.2.3 Strategic focus of funding

From an industry perspective, it was noted that the need for MRIWA exists because of the tension between the need to fund long term research, but also deliver a return on investment in an environment where funding is allocated to projects that deliver a return on investment in the shortest possible timeframe. As expressed by one stakeholder: "Miners have access to capital, but there are multiple priorities and initiatives that are presented each year, which means short term projects with an early ROI tend to be prioritised. MRIWA is therefore needed for tomorrow's projects".

The existence of MRIWA ensures longer term projects are progressed, but also ensures that there is stability and continuity in funding research through the swings in the economic cycles. As noted above "access to money isn't the issue" for the State's large mining companies, but the fact the MRIWA was able to step in and help "de-risk" projects helped make internal funding submissions more attractive to capital owners.

Given the above, an important and consistent point raised by stakeholders was the need for greater certainty of funding over the forward estimates period and beyond. Stakeholders from industry and the research community noted without a long term funding commitment it was difficult for them to secure matching funds from internal sources. Stakeholders more directly involved in the management and governance of MRIWA indicated to ACIL Allen that a lack of future funding certainty was beginning to impact upon their ability to source new projects.

Most projects seeking funding have a multi-year time horizon, or are part of a longer term research program which requires a number of projects to achieve the full outcome. ACIL Allen notes that four the six research case studies assessed for the economic impact assessment developed over a series of individual research projects, sometimes stretching over decades. Without funding from MRIWA, these projects would not have commenced and the benefits from them would not have materialised.

In relation to the projects that are funded by MRIWA, there was a view by industry stakeholders that there could be a greater share of the funding portfolio dedicated towards technology and supply chain innovation as opposed to minerology and geoscience, and a focus away from the larger funded projects (eg. CRC programs where MRIWA funding only represents a small percentage of the total funding) towards smaller projects.

There was a view of some stakeholders that MRIWA fills a need in the so-called Technology Readiness Level (TRL) of the research and development spectrum, where funding is generally difficult to source. The view was largely summarised as the fact that there was plenty of funding available for

basic research (TRL 1-3) and in the commercialisation and application phases (TRL 6-10), but the gap between these two was a challenge.

By providing grants targeted at specific, industry-led solutions to problems, the MRIWA was able to provide tangible opportunities for research to be translated into outcomes for industry, which has been demonstrated in ACIL Allen's economic impact assessment (see Section 4). However, some stakeholders presented a view that MRIWA was geared towards projects which sat at the lower end of the spectrum, where there are a number of funding options for researchers.

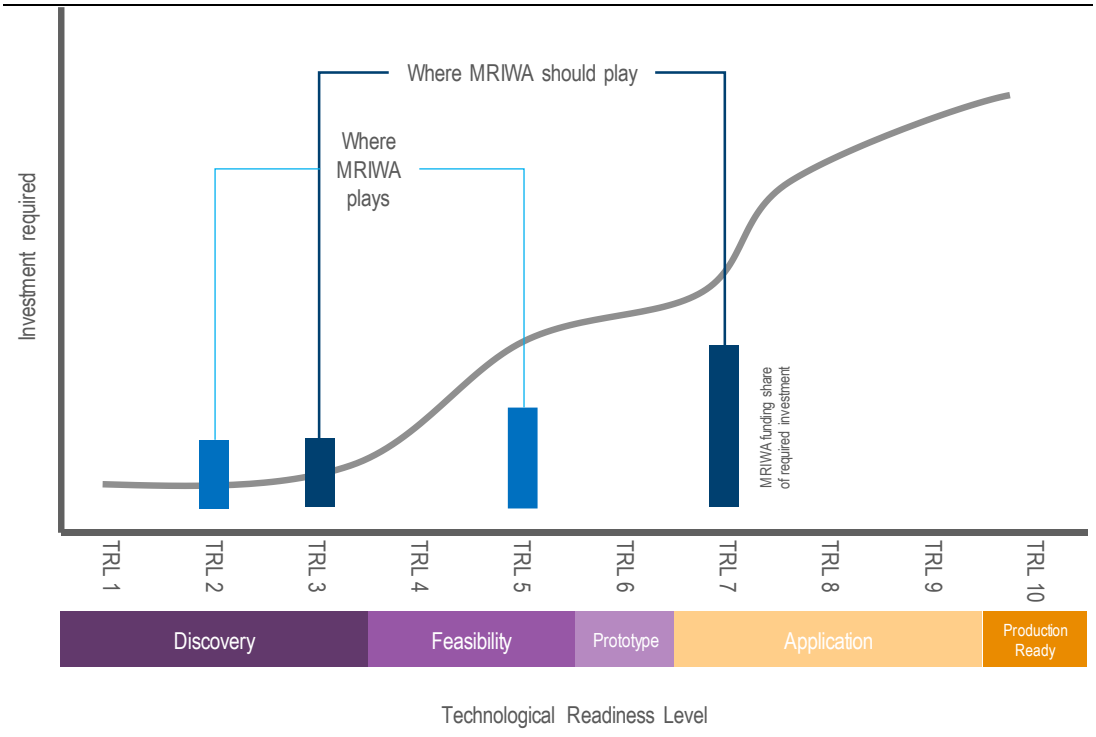
Overall, ACIL Allen has summarised the various stakeholder perspectives in the diagram below (**Figure 3.1**).

Generally speaking, the view was MRIWA could enhance its role in the industry if it were to shift its focus and potentially expand its scope to participate in the funding of projects that were further along the TRL scale – assisting projects that had moved past feasibility and were looking towards commercial trials and more large scale applications in the prototype phase. MRIWA has funded some projects which would fit this type in recent years; within ACIL Allen's economic impact assessment, the Soter Analytics Wearable Technologies for Safety project was around this level on the TRL scale.

However, this was not a universal view, reflecting that stakeholders who operate at particular levels on the TRL scale felt as though MRIWA's funding was being directed at the right level. For instance, stakeholders involved in the university sector completing more fundamental research suggested the MRIWA could direct more funding at this level; stakeholders from resources companies felt funding could be further directed at applied research.

Where and how the MRIWA directs its funds is ultimately a decision for MRIWA and its board, in consultation with industry, so it can best achieve its statutory objectives. The MRIWA plans to review its RPP once it secures some certainty with respect to future State Government funding. ACIL Allen suggests the MRIWA consider stakeholder perspectives regarding the direction of funding using the TRL spectrum as a framework to guide discussions and external engagement.

FIGURE 3.1 MRIWA FUNDING FOCUS – TECHNOLOGY READINESS LEVELS



SOURCE: ACIL ALLEN

3.2.4 Benefits of MRIWA

MRIWA is a small organisation but has helped deliver significant benefits to industry and the WA economy. A number of comments were made that suggested that the research that MRIWA helps to fund delivers a ROI that is analogous to that which was estimated by ACIL Allen in relation to the Exploration Incentive Scheme (between 23:1 and 38:1). It is noted ACIL Allen is currently undertaking an economic impact assessment of five research case studies (groups of projects) funded by the MRIWA, and the findings of this would inform the Review of the Act.

More broadly, it was widely accepted that MRIWA fills a gap in the market between science and application; between industry and academia. There was a consensus view across most stakeholders that if MRIWA did not exist then the level of funded research in WA would diminish, and by extension the application of the research in WA would also diminish.

The MRIWA model is seen as unique in Australia, which helps to enhance WA's reputation and competitiveness as a mining province, helping to bring explorers and researchers to WA.

As discussed above, it was also noted the MRIWA's benefits extended to intangibles such as fostering collaboration and assisting to create linkages between stakeholders who would otherwise have no means of connecting organically. In addition to this, stakeholders noted in some instances the MRIWA acted as a "clearing house" for research projects, creating linkages and generating ideas for research projects which then proceeded without the MRIWA's direct involvement.

3.2.5 Brand and communications

MRIWA is held in high regard by the minerals industry and by applicable aspects of academia.

However, there were stakeholders that suggested that more could be done to increase the awareness of MRIWA, and its role, objectives and functions. Principally, there was a view the MRIWA was delivering significant value to the State, and as a small statutory authority has an excellent story to tell regarding its effectiveness in delivering on its objectives. It was noted the MRIWA has a good relationship with its responsible Minister and within the Department of Mines, Industry Regulation and Safety, but its visibility within Government outside of these groups was more limited.

It was noted that a number of stakeholders that the first time they had heard of the MRIWA was when they were seeking funding for their research projects. Some recipients of funding admitted to simply "stumbling upon" the MRIWA when looking for research funding.

Improved awareness would not only help to demonstrate the important role that MRIWA plays in industry, but also open the door to other potential funding opportunities. As one stakeholder commented, "By not communicating its role and impact more broadly, MRIWA is effectively undervaluing itself".

KEY FINDING 6 KEY FINDINGS FROM STAKEHOLDER CONSULTATION

- The Minerals Research Institute of Western Australia (MRIWA) is a unique (in Australia) model for research funding, and was seen to be **highly effective** by all stakeholders consulted.
- The MRIWA **addressed a specific gap** in the market for research funding, and stakeholders stressed the importance of the MRIWA's ability to act a **long term funding partner** for research.
- An important and consistent point raised by stakeholders was the need for **greater certainty of funding** over the forward estimates period and beyond. Most projects seeking funding have a multi-year time horizon, or are part of a longer term research program which requires a number of projects to achieve the full outcome.
- MRIWA's **treatment of IP** was raised by stakeholders, with a variety of views. One consistent theme was that the MRIWA should consider reviewing its approach to the treatment of IP, with a view to potentially tailoring its approach depending on the situation rather than a blanket rule of requiring all research was open access.
- The MRIWA is seen by stakeholders as **part of the State's comparative and competitive advantage** in the mining and minerals industry. Industry representatives saw part of the MRIWA's role as **facilitating collaboration and creating linkages**, and not just as a pool of money for research. The MRIWA and its unique model also afforded the State Government a means to **act quickly to capture Commonwealth funding opportunities** (such as through CRC bids).
- Stakeholders had a variety of views regarding the **allocation of MRIWA research funding**. This could be summarised as a view that the MRIWA could adjust its portfolio to fund more **applied technological research**, perhaps at the expense of some more fundamental research into the State's geology (this was not a uniform view). However this view tended to be coloured by the industry/affiliation of the stakeholder.
- The major area of improvement suggested was branding and communications, with many stakeholders advising they "stumbled upon" the MRIWA when investigating research funding. This is seen as an opportunity to improve the "sell" of the MRIWA to important stakeholders, and address issues regarding the long term security of funding from the State Government.

4 ECONOMIC IMPACT OF MRIWA PROJECTS

This chapter represents a summary of the ACIL Allen report for MRIWA, *The Economic Impact of the Minerals Research Institute of Western Australia*. This study quantified a series of research projects that are part of a chain of MERIWA/MRIWA-funded projects (a 'research program') that have resulted in the development of a new technology or approach which has produced or is considered very likely to produce an identifiable benefit to minerals producers in Western Australia.

4.1 Approach

ACIL Allen's general approach was to quantify the application of these new technologies or approaches using real examples of the operations of companies or industries, taking a conservative approach (such as applying a new approach to one or two companies, or applying a sector-wide technology to a sub-set of a single industry) as a means of establishing a baseline level of quantitative impact. The intent of this approach is to account for the uncertainty associated with the application of new technologies or approaches, while also ensuring the analysis is grounded in the potential real world application of these technologies or approaches. Benefits have been quantified for the ten year period 2018-19 to 2027-28, and are for the Western Australian minerals sector only.

In undertaking the economic impact assessment itself, ACIL Allen has completed two separate but related pieces of analysis to provide a perspective on the economic impact of the MRIWA using the individual research program case studies analysed as part of the report. These are:

- a quantitative economic impact assessment using ACIL Allen's in-house Computable General Equilibrium (CGE) model *Tasman Global* to determine the direct and indirect economic impacts of the combined quantified benefits of the research programs studied. The outputs of the economic impact assessment have been produced for the Western Australian economy only.
- a benefit cost assessment (BCA), bringing in the quantitative impacts of the individual research programs and additional qualitative benefits uncovered through the assessment but which were not quantified for reasons discussed in the report. The BCA is useful as a means of establishing the extent to which the MRIWA is delivering value for money on the funds it is investing in research. The output of a BCA is a Benefit Cost Ratio (BCR), which is the identified benefits divided by the identified costs. It is also important to consider non-quantified or qualitative benefits when discussing the findings of a BCA.

Importantly, the economic impact assessment and BCA have been completed from the perspective of the State Government as the investor in the research program case studies.

4.1.1 Selected Case Studies

Since its inception, the MRIWA (and its pre-cursor body MERIWA) have funded over 350 individual research projects with a combined State funding contribution of at least $35 million.[8] It is not technically feasible to assess each of these projects, for a combination of reasons. These include mostly centred on the notion that the application of the outcomes of research are likely to have become "business as usual" for the State's minerals producers over time if they are successful, and the researchers who undertook the research and/or companies that funded it are no longer active in the industry.

In consultation with MRIWA, it was decided the economic impact assessment would centre on the quantification of forecast future realised benefits of research funded over the period 2018-19 to 2027-28. This "future focussed" economic impact assessment inherently involved the use of financial projections and modelling based on assumptions, which were derived via consultation with researchers and members of industry plus a review of research reports prepared by MRIWA funded researchers at the conclusion of research engagements.

ACIL Allen sought out research that had resulted or was likely to result in the development of a new technology or process that could be readily identified and applied a minerals producer or explorer currently operating in Western Australia. This was a means of ensuring case studies selected had the best chance of being able to be quantified using real world information and data, as a means of leaning against the uncertainty associated with the general approach of estimating the potential future benefits of MRIWA-funded research.

In addition, acknowledging the fact the study was centred on understanding a limited number (six) of what is more than 350 MRIWA/MERIWA funded projects, ACIL Allen sought MRIWA's assistance to build a group of research programs that were considered the most prospective by way of benefits to the State. Projects selected ultimately reflect the MRIWA's Research Priority Plan, and address the application of new technologies or techniques in a range of the State's individual minerals industries.

Following this case study selection process, ACIL Allen and MRIWA agreed to centre the study on the assessment of the following six research program case studies.

1. **Grade Engineering**: a group of four projects (with additional projects to come) funded by MRIWA and completed as part of the CRC ORE II program. Grade Engineering seeks to improve mine economics in a range of ways through the application of advanced and real-time mineral grade assessment techniques.
2. **Wearable Technologies for Safety**: a single project which saw the MRIWA co-fund with Roy Hill Holdings the commercial trial of a technology product that aims to reduce the incidence of avoidable musculoskeletal injuries – currently in mining but with application across industry.
3. **mXrap Platform**: a nine project, multi-decade research program centred on building a more informed understanding of the science of rockburst and rockfall events in underground hard rock mines. The research has ultimately culminated in the development of a software platform that is in operation across a number of mine sites around the world, which acts as both a real-time data capture and information platform.
4. **Gold Exploration Targeting**: a four project research program centred on building a better understanding of the Yilgarn Craton in the Eastern Goldfields region of Western Australia. The program has resulted in development of a new, data-based exploration screening approach which has worldwide application, but in the short term may lead to additional gold and precious metals discoveries in the target region.
5. **Standardisation of Leaching Risk Assessments for Environmental Impact Assessments**: a two project program with the ChemCentre (another WA Government statutory authority) centred on the development of a more time and cost effective approach to environmental leaching risk assessments for new mine proposals. The project will result in a standardised approach to apply initially across the State's iron ore mine environmental assessment approval processes, reducing the time taken to go through the EIA process.

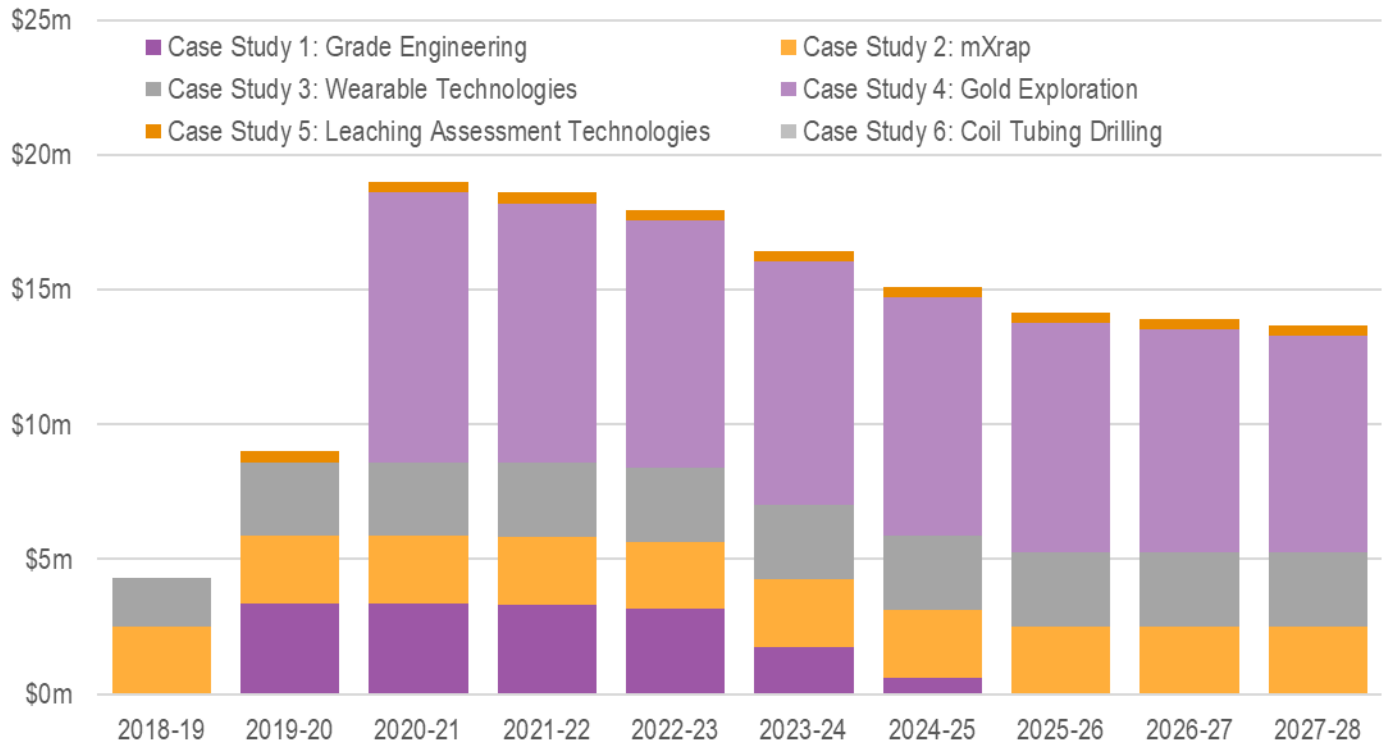
[8] MRIWA was able to provide disaggregated funding information for projects undertaken with an MRIWA/MERIWA project code of M236 or later (projects funded since approximately the 1994-95 financial year).

6. **Coiled Tubing Drilling Fluid**: a single research project centred on solving a specific problem as part of the commercialisation process of the DET CRC's coiled tubing drill rig exploration technology.

4.1.2 Overall benefits summary

Overall, the quantified benefits of the six research program case studies selected for analysis total $142.2 million over the ten years 2018-19 to 2027-28 in real (2017-18) dollars, or approximately $14.2 million per annum. The estimated annual benefits sorted by research program case study are presented below.

FIGURE 4.1 DIRECT BENEFITS OF RESEARCH PROGRAM CASE STUDIES, REAL 2017-18 DOLLARS, $M



SOURCE: ACIL ALLEN CONSULTING

The largest modelled benefit accrues as a result of Case Study 4 (CSIRO's Gold Exploration Technology research program), while Case Study 6 (DET CRC's Coil Tubing Drilling research program) does not produce any quantified benefits in this framework. This schedule of real benefits are the input into ACIL Allen's CGE model framework and are used to estimate the overall direct and indirect economic benefits of the combined research program case studies to Western Australia.

The table below summarises the total quantified benefits of each of the research program case studies included in this study, with real and discounted values included. Alongside each of the quantified benefits for each research program case study are the non-quantified benefits that ACIL Allen has assessed as part of its research.

TABLE 4.1 MRIWA RESEARCH PROGRAM CASE STUDY BENEFITS, SUMMARY

Research Program Case Study	Gross benefit ($m, 2018-19 dollars)	Discounted benefit ($m, 2018-19 dollars, 15% discount rate)	Non-quantified benefits of research
Case Study 1: Grade Engineering	15.5	10.6	– Application of technology to additional gold mines – Application of technology to additional mineral sectors – Additional positive impact on grades (ie larger impact magnitude) – Bring additional mines into scope
Case Study 2: mXrap	25.1	14.5	– Avoided human cost of seismic events – Additional research projects funded from mXrap profits
Case Study 3: Wearable Technologies	26.6	14.9	– Application to additional mines – Application to additional industries (non-minerals)
Case Study 4: Gold Exploration	71.5	35.6	– Potential for new mineral discoveries and additional mines – Development of new commercial business applying technology
Case Study 5: Leaching Assessment Technologies	3.5	1.9	– Cost savings for miners applying technology – Faster approvals, leading to improved mine economics – Application of technology to additional mineral sectors
Case Study 6: Coil Tubing Drilling	N/A	N/A	– Potential for new mineral discoveries and additional mines
Total benefits	142.2	77.5	N/A

SOURCE: ACIL ALLEN

KEY FINDING 7 DIRECT INDUSTRY BENEFITS OF SELECTED MRIWA PROJECTS

Based on a conservative set of modelling assumptions, ACIL Allen estimates the **direct industry benefits arising from the selected MRIWA projects will generated $142.2 million** in benefits over the ten years from 2018-19 to 2027-28 in real (2017-18) dollars.

4.2 Economic Impact Assessment

The economic impact is assessed as the incremental benefits to the Western Australian economy from the baseline over the period from 2018-19 to 2027-28 on the following terms:

- the impact on **real incomes** (a measure of economic welfare or standard of living);
- the impact on **real output** (as measured in terms of Gross State Product),
- the impact on **real consumption** (as measured in terms of household consumption expenditure),
- the impact on **State Government taxation** (as measured in terms of mining royalties and payroll tax); and
- the impact on **employment** (as measured on a full time equivalent (FTE) job basis).

4.2.1 Real income

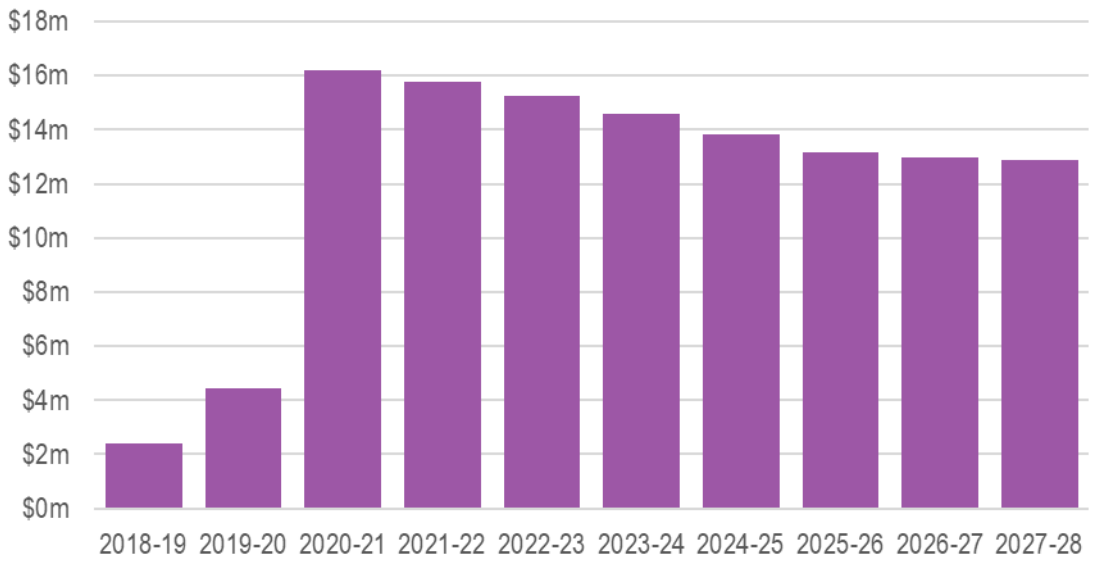
As a statutory body established to stimulate minerals research in Western Australia, the MRIWA's funding activities have a sizeable impact on the real income of the State. Real income is a measure of the economic welfare (or standard of living) improvement as a result of the MRIWA's funding activities. The change in real income captures the effect of net foreign income transfers associated with ownership of the capital along with changes in purchasing power of Australian residents.

In this assessment, the real income impact of the MRIWA's selected funding cases is largely generated by the increased mining productivity resulting from the new technologies. There are also real income benefits associated with Commonwealth taxation raised from mining revenue in terms of mining royalties.

Overall, the incremental real income impact of the MRIWA's combined research projects is estimated to total $121.5 million over the 10 year modelling period, at an average of $12.1 million per annum. The boost to real income in Western Australia is equivalent to 0.05 per cent increase to Western Australia's State Domestic Income (SDI) in 2017-18.

As shown in **Figure 4.2** the real income benefit increases significantly in 2020-21 and then slowly declines year by year. Between 2021 and 2028, the increase in real income for the State on average is $14.3 million per annum.

FIGURE 4.2 THE MRIWA'S FUNDING ACTIVITIES – REAL INCOME, DEVIATION FROM BASELINE, A$ MILLION



SOURCE: ACIL ALLEN CONSULTING

4.2.2 Real output

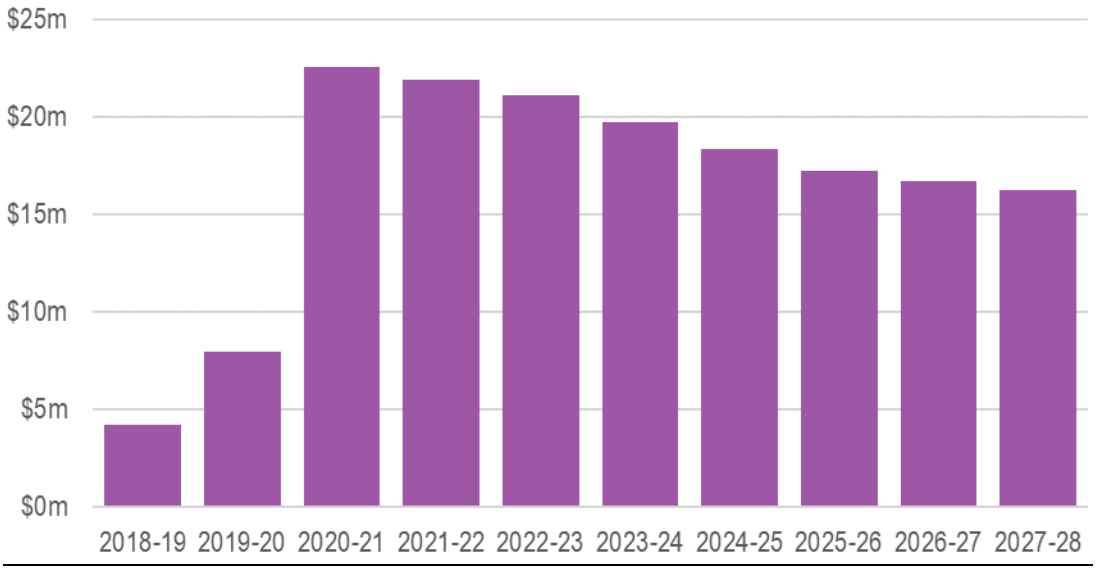
Real output is a measure of the total domestic production of an economy (region, State or country) in a given year. It differs from real income as it accounts for the effects of the import and/or export of intermediate and final goods and services, and reflects the final value of activity in an economy.

Under the MRIWA's modelled scenario, the incremental real output benefit is estimated to total $166 million at an average of $16.6 million per annum over the 10 year study period. Similarly to the real income benefit, the real output benefit grows over time in line with the research projects that generate productivity enhancements in the State's mining industry (see **Figure 4.3**). Relative to the size of the Western Australian economy, the average annual change in Western Australia's GSP as a result of this scenario is equivalent to a 0.07 per cent boost to the State's GSP.

Real consumption

Real consumption is a component of real output, which reflects the impact on consumer spending associated with the direct and indirect benefits of the MRIWA research programs. Over the study period, it is estimates that the MRIWA's research programs result in an additional $42.8 million over ten years, or $4.3 million per annum.

FIGURE 4.3 REAL OUTPUT, DEVIATION FROM BASELINE, A$ MILLION



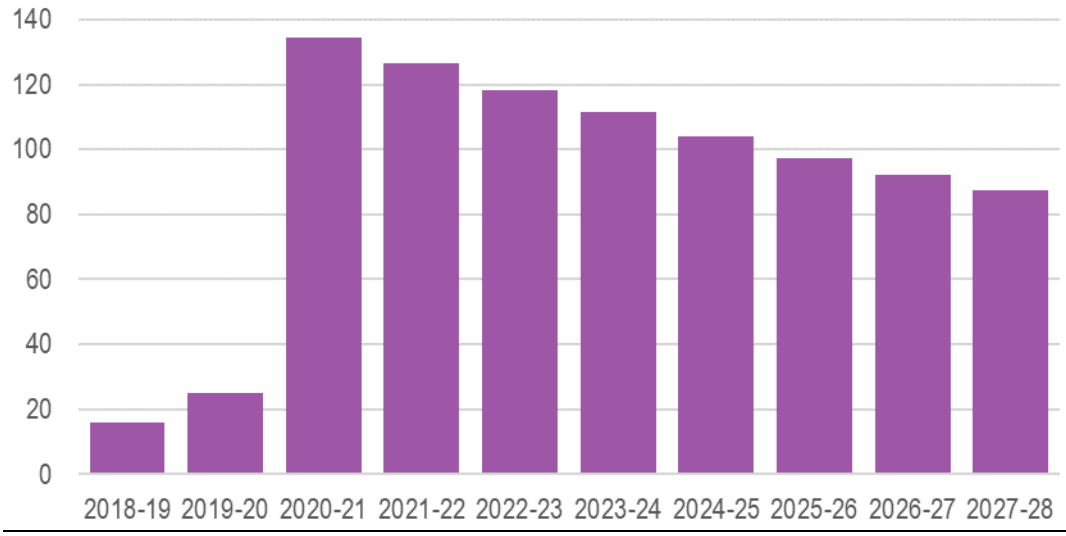
SOURCE: ACIL ALLEN CONSULTING

4.2.3 Employment

The MRIWA's research funding activities have a sizeable impact on Western Australia's labour market, as a number of new Western Australian positions are created as a result of the introduction of several new technologies to the State's mining sector.

Over the study period, it is estimated that the MRIWA's research funding activities results in an additional 913 FTE job years over the 10 year assessment period, or an average of 91.3 FTE job years per annum (see **Figure 4.4**). Growth in employment sharply increases in 2021 by about 134 FTEs. The increase above the baseline then declines year to year to increase by about 87 FTEs in 2028.

FIGURE 4.4 THE MRIWA'S FUNDING ACTIVITIES: EMPLOYMENT, DEVIATION FROM BASELINE, FTE JOB YEARS



SOURCE: ACIL ALLEN CONSULTING

4.2.4 WA Government taxation

As part of these economic impacts, there are also benefits to the State Government's key lines of taxation. ACIL Allen has estimated there are two key benefits: additional payroll tax and additional resources royalties. These impacts are a subset of real income benefits, but have been called out specifically given the frame of reference of this engagement.

ACIL Allen calculates the impact of the six research programs analysed for this assessment will deliver the State an additional $1.4 million in gold royalties (2017-18 dollars), on account of the impact of the Grade Engineering technology discussed in Case Study 1. In reality the royalty impact is likely to be significantly larger, as assumptions adopted for the assessment are very conservative.

With regards to payroll tax, ACIL Allen has used the outputs of its economic impact assessment in terms of FTE job years created above the baseline, and adopted the 2017-18 WA Average Weekly Full Time Earnings ($103,823 per annum) as the assumed real wage for these additional job years. Applying Western Australia's payroll tax rate (5.5 per cent) yields an estimated payroll tax impact of $5.2 million over ten years, or an average of $0.5 million per annum.

Combined, ACIL Allen's economic impact assessment suggests the six research program case studies prepared for the assessment will deliver the State Government an additional $6.6 million in taxation revenue over the next ten years (in real 2017-18 dollars), or $0.7 million per annum.

4.2.5 Summary

The following table summarises the economic impacts of the MRIWA's research project funding activities. Overall, the modelling shows there is a clear forecast economic upside associated with the MRIWA's funding activities, and these benefits manifest in both increase consumer spending and increased employment in the local economy.

TABLE 4.2 THE MRIWA SCENARIO – RESEARCH FUNDING ACTIVITIES

Scenario & benefit/cost	Total	Average	NPV (4%)	NPV (7%)
The MRIWA Research Funding – Western Australia Impacts				
Real income	$121.5m	$12.1m	$100.1m	$87.6m
Real output	$166.0m	$16.6m	$137.6m	$120.9m
Real *consumption*	*$42.8m*	*$4.3m*	*$34.0m*	*$28.9m*
Government taxation	$6.6m	$0.7m	$5.6m	$4.9m
Real employment (FTE)	913	91.3	N/A	N/A

SOURCE: ACIL ALLEN CONSULTING

KEY FINDING 8 ECONOMIC IMPACT OF MRIWA

ACIL Allen estimates that the funding allocated to MRIWA and its corresponding impact on the mining industry will provide a significant boost to the WA economy over the forecast period from 2018-19 to 2027-28. Based on ACIL Allen's CGE model, *Tasman Global*, it is estimated that the MRIWA funded research into the selected case studies will generate:

- **real incomes** of $121.5 million over the forecast period, averaging $12.1 million per annum;
- **real output** of $166 million over the forecast period, averaging $16.6 million per annum;
- **real consumption** impact of $42.8 million over the forecast period, averaging $4.3 million per annum;
- **government taxation** of $6.6 million over the forecast period, averaging $0.7 million per annum; and
- **employment** generation of 91.3 FTE jobs per annum over the forecast period.

4.3 Benefit Cost Assessment

In order to estimate the net social benefit of the MRIWA's research program, ACIL Allen used a Benefit Cost Assessment (BCA) framework. A BCA is a commonly used quantitative framework for logically analysing the social and economic costs and benefits of a particular policy, project or investment. The basis of a BCA is simple: for a given investment proposal or policy reform, a BCA compares the total forecast costs (including opportunity cost) to the community and economy of the investment or policy with the total forecast benefits. This determines whether the benefits outweigh the costs, and by how much.

The output of a BCA is typically expressed as a Benefit Cost Ratio (BCR) where total benefits are divided by total costs. A BCR of greater than one indicates that the net benefits of the policy, project or investment exceed the costs – this suggests economic value in investing in the option. The reverse applies for BCRs below one.

A BCA provides a framework for analysing information in a logical and consistent way by assisting policymakers to determine which investment option is the most economically effective and efficient in achieving the desired outcomes. A BCR of less than one does not automatically preclude the implementation of the policy, project or investment however the business case would typically require strong alternate reasoning such as a clear social policy mandate.

For the purposes of the study, ACIL Allen has undertaken a BCA by assessing MRIWA's research program benefits against: (1) research program costs; and (2) MRIWA's cost of services.

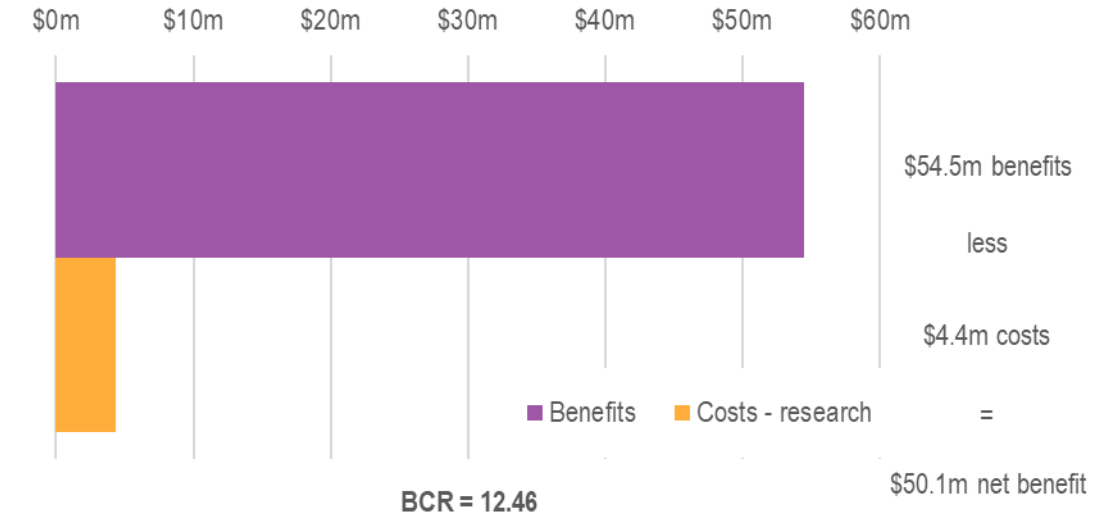
4.3.1 MRIWA Research Program Benefits vs Research Program Costs

ACIL Allen estimates MRIWA's six research program cases studies analysed for the economic impact assessment are forecast to deliver at least a net benefit of $50.1 million, being that the research

program is forecast to deliver benefits of $54.5 million versus a research funding cost to the State of $4.4 million. This BCA is summarised in **Figure 4.5** below.

Under the assumptions adopted above, the BCR of the MRIWA's research program as described above is 12.46, implying that for these research programs every dollar of State Government funding is forecast to produce $12.46 of benefits.

FIGURE 4.5 MRIWA BENEFIT COST ASSESSMENT, RESEARCH PROGRAM BENEFITS VS FUNDING OF RESEARCH PROGRAMS, $M 2017-18 DOLLARS AND BENEFIT COST RATIO

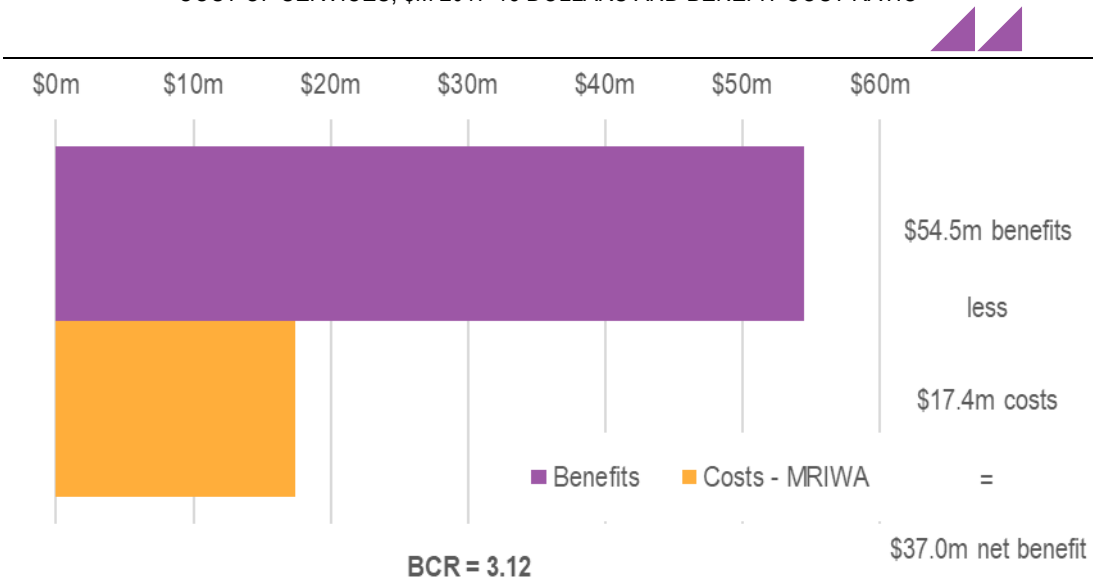


SOURCE: ACIL ALLEN CONSULTING (VALUES ROUNDED TO THE NEAREST $100,000)

4.3.2 MRIWA Research Program Benefits vs MRIWA Cost of Services

ACIL Allen estimates MRIWA's cost of services are forecast to deliver at least a net benefit of $37 million, being that the research program is forecast to deliver benefits of $54.5 million versus the cost to the State of the MRIWA's operations since its inception on 1 February 2014 of $17.4 million. This BCA is summarised in **Figure 4.6** below.

FIGURE 4.6 MRIWA BENEFIT COST ASSESSMENT, RESEARCH PROGRAM BENEFITS VS MRIWA COST OF SERVICES, $M 2017-18 DOLLARS AND BENEFIT COST RATIO



SOURCE: ACIL ALLEN CONSULTING (VALUES ROUNDED TO THE NEAREST $100,000)

Under the assumptions adopted above, the BCR of the MRIWA operations since its inception is 3.12, implying that for these research programs every dollar of State Government funding is forecast to produce at least $3.12 of benefits. ACIL Allen has calculated this BCR as a means of demonstrating the role the MRIWA has played in fostering research projects that began under its precursor body. These are ultimately expected to result in the translation of significant benefits to the State's minerals industry well in excess of the MRIWA's cost of services in its current form.

The BCR is also significant insofar as:

— MRIWA has funded more than 350 individual research projects over its history (MRIWA and MERIWA), including 50 projects since MRIWA's inception with a total project value of $19.2 million (nominal terms). The BCR considers the potential benefits of just 20 of those research projects, with a value of $2.4 million.

— The calculation of benefits has been completed using a conservative methodology (which doesn't consider many of the highest value but most difficult to predict benefits such as spurring the development of a new mine) and with a conservative discount rate (15 per cent).

— The calculation of benefits does not include the first round direct economic benefits of the MRIWA's expenditure, such as the consumption impact of wages and salaries paid to MRIWA staff or the employment impacts of research project funding (ie without funding some researchers may not be employed)

— The calculation of benefits does not include many of the intangible benefits of the MRIWA's operations, such as knowledge transfer, research linkages, and reputational benefits to the State, which all stakeholders indicated was an important part of the MRIWA's value to Western Australia

— The MRIWA's cost of services also includes $3.7 million of funds currently held in escrow, which deliver no tangible benefit but add to the MRIWA's cost of services.

Given this, even though a BCR of 3.12 demonstrates a substantial forecast return on investment for the State, it is almost certainly underselling the tangible and intangible benefits of the MRIWA to the State of Western Australia.

In addition to the quantified benefits, there are a number of other benefits delivered by the MRIWA which are more intangible in nature, including:

— MRIWA's role in creating linkages between researchers and industry members, which would have otherwise not formed. These linkages can result in knowledge transfer or the development of research programs which are entirely separate from MRIWA but still deliver upon its priorities. These kinds of relationships have not been quantified as part of this benefit cost assessment.

— One of the MRIWA's Research Priority Plan areas is Find More Resources. ACIL Allen made a conceptual decision to exclude these from its scope of quantification, as the development of a new mine requires more than simply finding the resource. Notwithstanding, if technologies supported by MRIWA resulted in the development of just one mine in Western Australia the State Government's investment in MRIWA will have a positive benefit cost ratio.

— The MRIWA helps enhance Western Australia's reputation as a positive place for the minerals industry, by signalling the State's interest in and desire to foster the minerals industries. This may attract global multinational corporations or smaller companies to set up a base of operations in the town.

KEY FINDING 9 BENEFIT COST ASSESSMENT OF MRIWA

ACIL Allen estimates MRIWA's six research programs are forecast to deliver at least a net benefit of $50.1 million, being that the research program is forecast to deliver benefits of $54.5 million versus a research funding cost to the State of $4.4 million. Based on these results, ACIL Allen has estimated that the **BCR of the MRIWA's research program is 12.46**, implying that for these research programs every dollar of State Government funding is forecast to produce $12.46 of benefits.

ACIL Allen estimates MRIWA's cost of services are forecast to deliver at least a net benefit of $37 million, being that the research program is forecast to deliver benefits of $54.5 million versus the cost to the State of the MRIWA's operations since its inception on 1 February 2014 of $17.4 million. Based on these results, the **BCR of the MRIWA operations since its inception is 3.12**, implying that for these research programs every dollar of State Government funding is forecast to produce at least $3.12 of benefits. This BCR provides a means of demonstrating the role the MRIWA has played in fostering research projects that began under its precursor body. These are ultimately expected to result in the translation of significant benefits to the State's minerals industry well in excess of the MRIWA's cost of services in its current form.

The BCR is also significant insofar as MRIWA has funded more than 350 individual research projects over its history (MRIWA and MERIWA), including 50 projects since MRIWA's inception with a total project value of $19.2 million (nominal terms). The BCR considers the potential benefits of just 20 of those research projects.

5 EVALUATION OF MRIWA

In undertaking this evaluation of MRIWA, ACIL Allen has relied on the research and analysis it has conducted on MRIWA's performance from key documents sourced for this evaluation (Chapter 2), feedback from a comprehensive stakeholder consultation process (Chapter 3), and the results of ACIL Allen's economic impact assessment of selection of minerals sector research projects funded by the MRIWA (Chapter 4).

Consistent with the Department of Treasury's Evaluation Guide, ACIL Allen's Review of MRIWA has focussed on the following key evaluation questions:

1. ***Is MRIWA operating efficiently?***

   This question goes to the core evaluation criteria of efficiency, by exploring how MRIWA is operating, and how efficient it is in delivering its key activities.

2. ***Has MRIWA been effective in meeting its overall objectives?***

   This question goes to the core evaluation criteria of effectiveness. That is, the extent to which MRIWA's key activities deliver on the objectives of the activity, and more broadly the objectives of MRIWA and the Government.

3. ***Does a demonstrable need exist for MRIWA?***

   This question goes to the overall evaluation criteria of appropriateness. That is, the extent to which MRIWA continues to address a demonstrable need, and is aligned to Government priorities and responsibilities.

ACIL Allen's assessment of MRIWA against each of these evaluation questions is discussed in this chapter.

5.1 Is MRIWA operating efficiently?

Overall, the MRIWA's efficiency has been assessed using four frames of reference:

- Do adequate **governance** and decision making processes exist?
- Has the MRIWA's met its **efficiency KPI**?
- Does the MRIWA deliver a net social benefit as measured by ACIL Allen's **BCA framework**?
- Do **stakeholders** perceive the MRIWA as operating efficiently?

The findings of each of these aspects of the assessment are discussed below.

The MRIWA has an established **governance** and project selection process that ensures the funding provided to selected research projects is consistent with MRIWA's and the WA Government strategic goals to support minerals research for the benefit of the State. Overall, there was broad consensus that the governance of MRIWA was strong, and that this ensured that project selection was objective and consistent, and ensured that it delivered value for money to industry and Government.

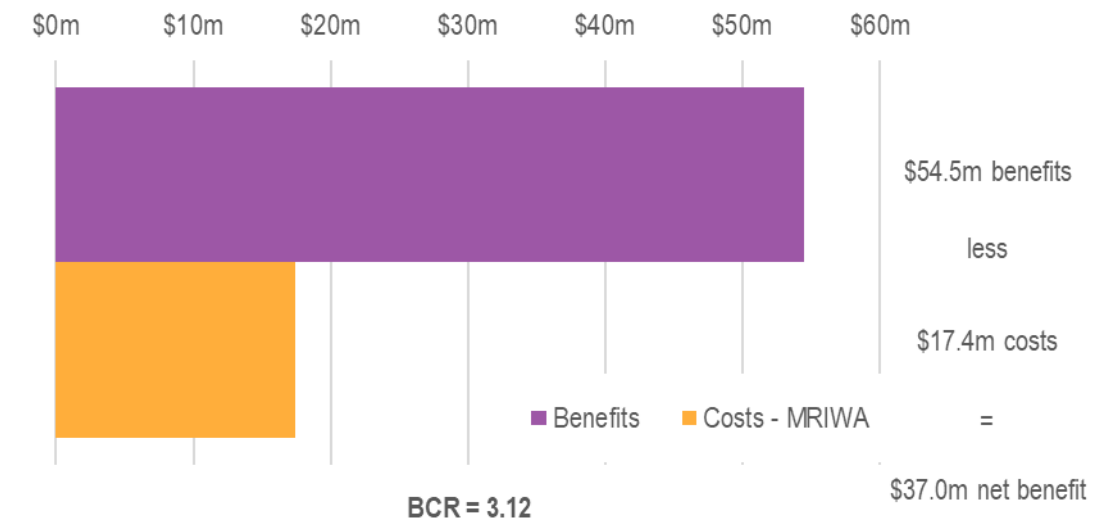
Stakeholders were of the view that the MRIWA's processes provided it with the kinds of information on projects that allowed it to "pick winners" efficiently.

With respect to financial performance, the MRIWA has been successful in meeting its **key efficiency KPI** in the last two financial years. This is a reflection of growth in the MRIWA's portfolio of projects, and the low growth in non-grant expenditure (averaging around $1 million per annum or around 19 per cent of total expenditure between 2013-14 and 2017 18). The efficiency KPIs should not guide the performance of MRIWA in isolation. From an efficiency perspective, MRIWA must keep an eye to the "outputs" of its functions (being project funding), not just the inputs (being the cost of services).

ACIL Allen's **BCA framework** provides a more holistic view on MRIWA's relative efficiency as it captures both the costs and benefits in a single framework. Using this frame of reference, ACIL Allen estimates the MRIWA is forecast to deliver a net social benefit of $37 million between 2018-19 and 2027-28, being that the selection of its research program analysed in the study is forecast to deliver benefits of $54.5 million versus the cost to the State of the MRIWA's operations of $17.4 million.

Based on these results, the BCR of the MRIWA operations since its inception is 3.12, implying that for these research programs every dollar of State Government funding is forecast to produce at least $3.12 of benefits (**Figure 5.1**).

FIGURE 5.1 MRIWA BENEFIT COST ASSESSMENT, RESEARCH PROGRAM BENEFITS VS FUNDING OF RESEARCH PROGRAMS, $M 2017-18 DOLLARS AND BENEFIT COST RATIO



SOURCE: ACIL ALLEN CONSULTING (VALUES ROUNDED TO THE NEAREST $100,000)

The BCR is significant insofar as MRIWA has funded more than 350 individual research projects over its history (MRIWA and MERIWA), including 50 projects since MRIWA's inception with a total project value of $19.2 million (nominal terms). The BCR considers the potential benefits of just 20 of those research projects.

This BCR provides a means of demonstrating the role the MRIWA has played in fostering research projects that began under its precursor body. These are ultimately expected to result in the translation of significant benefits to the State's minerals industry well in excess of the MRIWA's cost of services in its current form.

KEY FINDING 10 EFFICIENCY – OVERALL ASSESSMENT

MRIWA has met its efficiency KPI in each of the past two years, and has operated with a tight control on its non-grant expenditure while maintaining a rigorous and transparent project selection process. ACIL Allen's BCA framework suggests MRIWA is forecast to deliver a social benefit in excess of the cost of the MRIWA to the State between 1 February 2014 and 30 June 2018.

5.2 Has MRIWA been effective in meeting its objectives?

Overall, the MRIWA's effectiveness has been assessed using five frames of reference:

- Has the MRIWA met the objectives of its 2013 Research Priority Plan, against its **five research themes**?
- Has the MRIWA's **governance and operating framework** supported the achievement of its objectives?
- Has the MRIWA's met its **effectiveness KPI**?
- Have the MRIWA's funded projects delivered a direct economic benefit to the State of Western Australia as measured by ACIL Allen's research program **case study modelling**?
- Do **stakeholders** perceive the MRIWA as operating effectively?

Since its establishment on 1 February 2014, MRIWA has allocated $19.2 million to research projects across the **five research themes**. Of this amount, $7.12 million has been allocated to 15 projects under the "Find More Resources" theme, with a further $3.1 million allocated to 10 projects under the "Expand the Mining Envelope", $1.62 million to 10 projects under the "Increase Recoverable Value" theme, and $0.14 million to one project under the "Develop New Products and Markets" theme.

Under the "Improve Productivity" theme, a total of $7.24 million has been funded to 14 projects since 2014, however, the majority of this funding was most recently allocated to the Future Batteries CRC ($5.5 million) in 2018. This funding allocated to the Future Batteries CRC is the highest amount that MRIWA has allocated to a single project since its establishment.

The quantum of funding allocated to projects by MRIWA has varied year to year, suggesting that MRIWA's rigorous project section process, rather than its annual budget drives funding decisions.

Stakeholders spoke positively that MRIWA's **processes** were well documented and understood, and well supported by MRIWA. The process is important in ensuring there is clarity surrounding the information required for each funding application, which ultimately ensures that value for money is achieved for MRIWA and ultimately the WA Government – or as one stakeholder suggested, the process ensures MRIWA is best able to "pick winners".

The **leverage ratio** is the ratio of total cash investments in research projects to total approved MRIWA cash investment in those research projects. The MRIWA's effectiveness KPI is to achieve a leverage ratio of three or higher as it relates to the total value of projects approved in a given financial year. It has not achieved this KPI since its inception.

While MRIWA has been unable to meet this KPI at a headline level, it has still managed to ensure that additional funding is secured from other partners for research projects. Across the five research themes, MRIWA has been successful in leveraging its funding in line with this KPI across projects relating to the Expanding the Mining Envelope research theme (leverage ratio of 3.24 between 2014 and 2018) and was just under this target for the New Products and Markets research theme (leverage ratio of 2.87 between 2014 and 2018).

Since its inception, the MRIWA (and its pre-cursor body MERIWA) have funded over 350 individual research projects with a combined State funding contribution of at least $35 million

In consultation with MRIWA, it was decided the economic impact assessment would centre on the quantification of forecast future realised benefits of research funded over the period 2018-19 to 2027-28. This "future focussed" economic impact assessment inherently involved the use of financial

projections and modelling based on assumptions, which were derived via consultation with researchers and members of industry plus a review of research reports prepared by MRIWA funded researchers at the conclusion of research engagements.

ACIL Allen sought out research that had resulted or was likely to result in the development of a new technology or process that could be readily identified and applied a minerals producer or explorer currently operating in Western Australia.

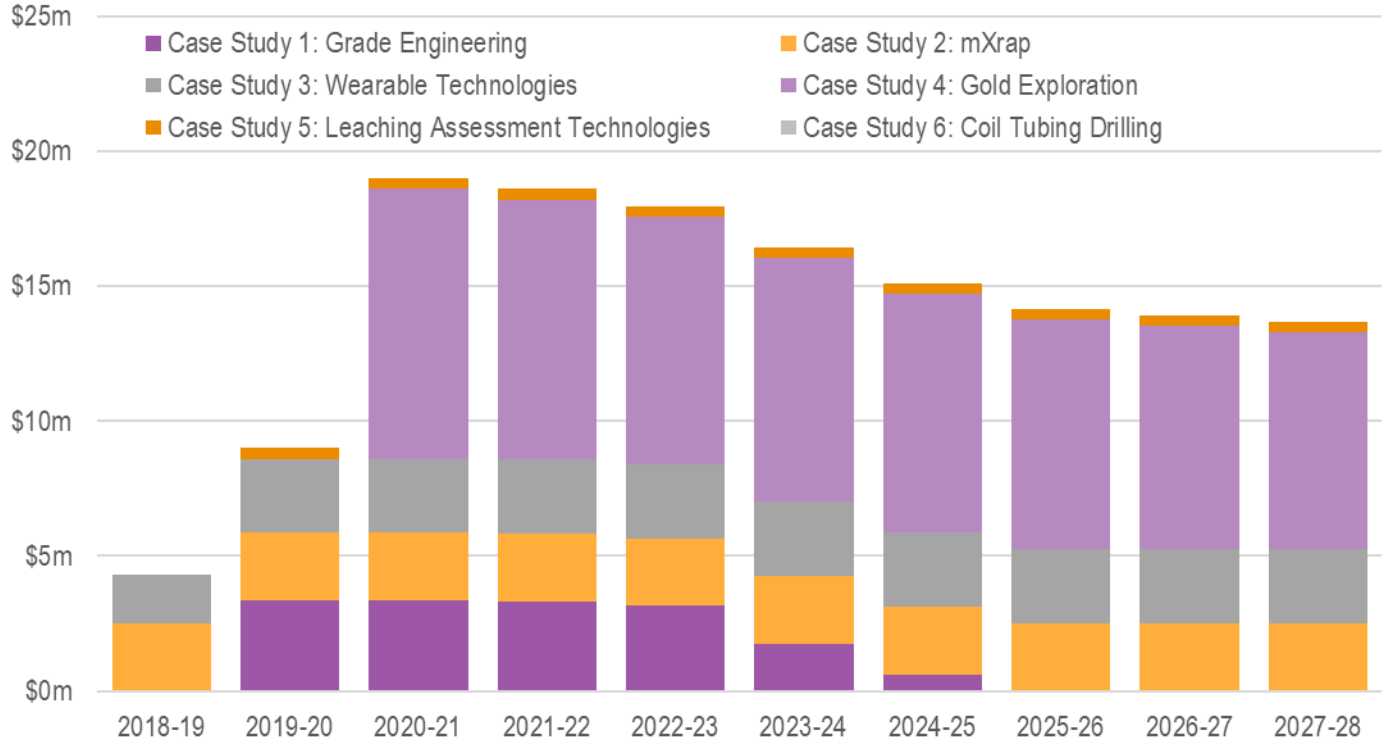
Following this case study selection process, ACIL Allen and MRIWA agreed to centre the study on the assessment of the following six research program case studies (refer to Section 4.1.1 for detailed descriptions of each research program):

1. Grade Engineering
2. Wearable Technologies for Safety
3. mXrap Platform
4. Gold Exploration Targeting
5. Standardisation of Leaching Risk Assessments for Environmental Impact Assessments
6. Coiled Tubing Drilling Fluid

Based on a conservative set of modelling assumptions, ACIL Allen estimates the **direct industry benefits arising from the selected MRIWA projects will generated $142.2 million** in benefits over the ten years from 2018-19 to 2027-28 in real (2017-18) dollars. The research program case studies provide evidence that the MRIWA has been effective in delivering its statutory objective regarding delivery of benefits to the Western Australian minerals industry (**Figure 5.2**).

Stakeholders noted the MRIWA's **benefits extended to intangibles** such as fostering collaboration and assisting to create linkages between stakeholders who would otherwise have no means of connecting organically. In addition to this, stakeholders noted in some instances the MRIWA acted as a "clearing house" for research projects, creating linkages and generating ideas for research projects which then proceeded without the MRIWA's direct involvement.

FIGURE 5.2 DIRECT BENEFITS OF MRIWA RESEARCH PROGRAM CASE STUDIES, $M 2017-18 DOLLARS



SOURCE: ACIL ALLEN CONSULTING

An important and consistent point raised by stakeholders regarding the MRIWA's effectiveness was the need for **greater certainty of funding** over the forward estimates period and beyond. Stakeholders from industry and the research community noted without a long term funding commitment it was difficult for them to secure matching funds from internal sources. Stakeholders more directly involved in the management and governance of MRIWA indicated to ACIL Allen that a lack of future funding certainty was beginning to impact upon their ability to source new projects.

Most projects seeking funding have a multi-year time horizon, or are part of a longer term research program which requires a number of projects to achieve the full outcome. ACIL Allen notes that four the six research case studies assessed for the economic impact assessment developed over a series of individual research projects, sometimes stretching over decades. Without funding from MRIWA, these projects would not have commenced and the benefits from them would not have materialised.

There were stakeholders that suggested that more could be done to increase the **awareness of MRIWA**, and its role, objectives and functions. Principally, there was a view the MRIWA was delivering significant value to the State, and as a small statutory authority has an excellent story to tell regarding its effectiveness in delivering on its objectives. It was noted the MRIWA has a good relationship with its responsible Minister and within the Department of Mines, Industry Regulation and Safety, but its visibility within Government outside of these groups was more limited.

Improved awareness would not only help to demonstrate the important role that MRIWA plays in industry, but also open the door to other potential funding opportunities.

In relation to the lifecycle of a MRIWA funded project, a useful suggestion was that after a project is "closed", there is follow up in the subsequent years to **document the progress** of each project and the outcomes and benefits achieved. This would help improve future project selection as the MRIWA would have a consistent view of the relative success of its portfolio in relation to all projects.

KEY FINDING 11 OVERALL ASSESSMENT – EFFECTIVENESS

MRIWA has been effective in meeting its overall objectives as established in its Research Priority Plan and as articulated in its annual reports, notwithstanding it has yet to meet its formal effectiveness KPI regarding funding leverage. The ultimate measure of effectiveness is the delivery of benefits to the WA minerals sector, which ACIL Allen has established both quantitatively and qualitatively. The MRIWA's effectiveness could be improved with greater funding certainty, improved awareness and development of a formal benefits measurement process.

5.3 Does a demonstrable need exist for MRIWA?

ACIL Allen's review has not identified any issues or concerns that require a change to the *Minerals Research Institute Act 2013*. The Act does not constrain the MRIWA in any way, and as demonstrated by the assessments of efficiency and effectiveness the MRIWA has delivered on its statutory objectives.

As to the ongoing need for MRIWA, there was universal endorsement of the important role MRIWA is playing in supporting the minerals industry in Western Australia. This became evident in a number of ways, both quantitative and qualitative, which are discussed below.

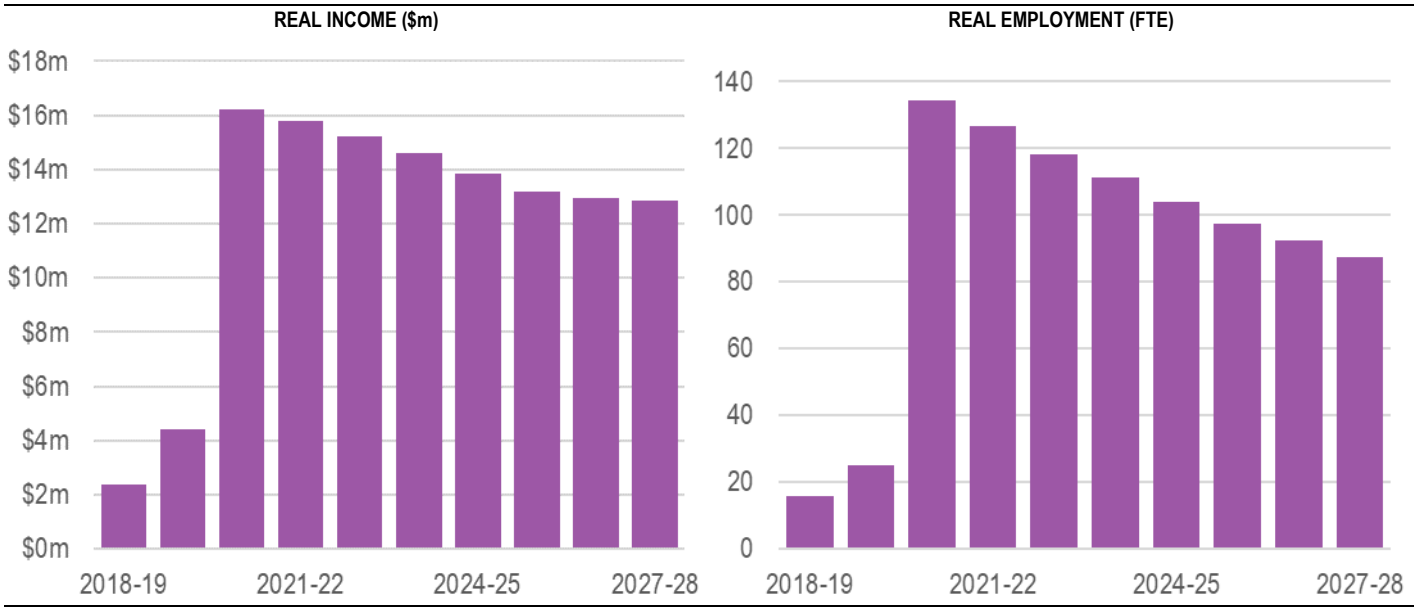
ACIL Allen's economic impact assessment estimates that the funding allocated to MRIWA and its corresponding impact on the mining industry will provide a significant boost to the WA economy over the forecast period from 2018-19 to 2027-28. Based on ACIL Allen's CGE model, *Tasman Global*, it is estimated that the MRIWA funded research into the selected case studies will generate:

- **real incomes** of $121.5 million over the forecast period, averaging $12.1 million per annum;
- **real output** of $166 million over the forecast period, averaging $16.6 million per annum;
- **real consumption** impact of $42.8 million over the forecast period, averaging $4.3 million per annum;
- **government taxation** of $6.6 million over the forecast period, averaging $0.7 million per annum; and

— **employment** generation of 91.3 FTE jobs per annum over the forecast period.

The income and employment benefits are summarised below (**Figure 5.3**).

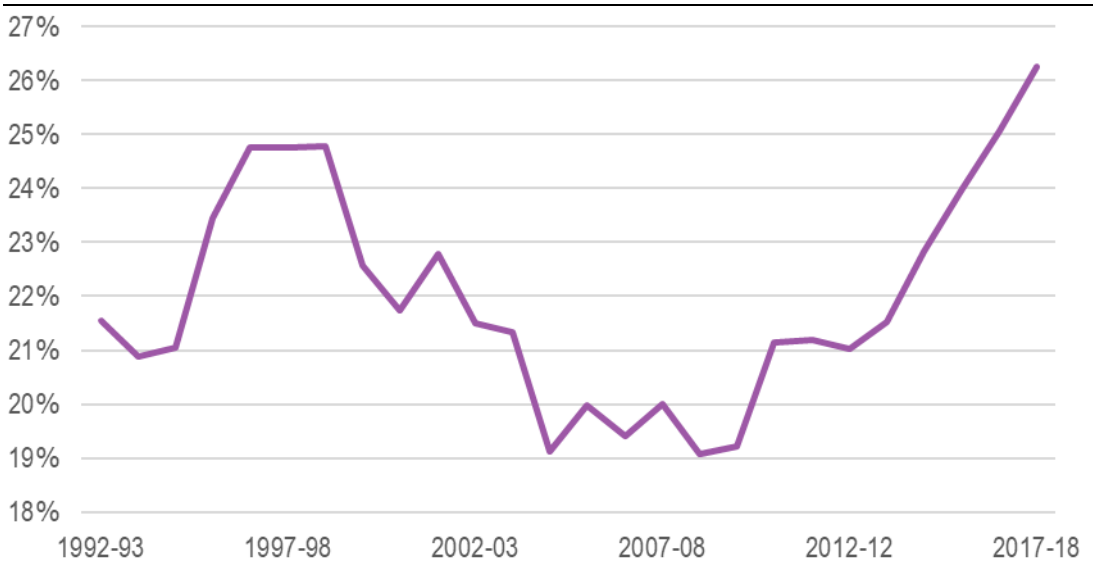
FIGURE 5.3 ECONOMIC IMPACT ASSESSMENT OF MRIWA RESEARCH PROGRAM CASE STUDIES, REAL INCOME ($M, 2017-18) AND EMPLOYMENT (FTE JOB YEARS)



SOURCE: ACIL ALLEN CONSULTING

While WA's mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges. The minerals industry is the most important industry in Western Australia. The mining industry has been the State's largest industry for some time, though its share of activity has increased in recent times on account of the mining boom (**Figure 2.1**).

FIGURE 5.4 WA MINING INDUSTRY SHARE OF WA GROSS VALUE ADDED



SOURCE: ACIL ALLEN CONSULTING, ABS

Given the role of the mining industry in Western Australia's economy, the State should look to ways of helping it address these competitive challenges.

The MRIWA is an important part of this emerging story. While MRIWA has been around for some time, its role is arguably more vital than ever as a catalyst for mining innovation and technology development in Western Australia, as the industry moves evolves beyond the blunt instrument of billions of dollars of new mines and turns to the more specific toolkit enabled by technology and innovation.

It was widely accepted that MRIWA fills a gap in the market between science and application; between industry and academia.

The MRIWA is seen by stakeholders as part of the State's comparative and competitive advantage in the mining and minerals industry. Industry representatives saw part of the MRIWA's role as facilitating collaboration and creating linkages, and not just as a pool of money for research. The MRIWA and its unique model also afforded the State Government a means to act quickly to capture Commonwealth funding opportunities (such as through CRC bids).

There was a consensus view across most stakeholders that if MRIWA did not exist then the level of funded research in WA would diminish, and by extension the application of the research in WA would also diminish.

In relation to the projects that are funded by MRIWA, there was a view by industry stakeholders that there could be a greater share of the funding portfolio dedicated towards technology and supply chain innovation as opposed to minerology and geoscience – addressing the competitive challenges faced by the State's minerals industry. By providing grants targeted at specific, industry-led solutions to problems, the MRIWA has been able to provide tangible opportunities for research to be translated into outcomes for industry, which has been demonstrated in ACIL Allen's economic impact assessment.

Generally speaking, the view was MRIWA could enhance its role in the industry if it were to shift its focus and potentially expand its scope to participate in the funding of projects that were further along the so-called Technology Readiness (TRL) scale – assisting projects that had moved past feasibility and were looking towards commercial trials and more large scale applications in the prototype phase. MRIWA has funded some projects which would fit this type in recent years

Where and how the MRIWA directs its funds is ultimately a decision for MRIWA and its board, in consultation with industry, so it can best achieve its statutory objectives. ACIL Allen suggests the MRIWA consider stakeholder perspectives regarding the direction of funding using the TRL spectrum as a framework to guide discussions and external engagement.

In this vein, the Act requires that the Institute must have regard to its Research Priority Plan, as revised from time to time, when performing its functions. The timing for a review of the RPP is at the discretion of the MRIWA Board.

According to its 2017-18 Annual Report:

The Board's view is that the research fields described in Theme 1 (Find More Resources), Theme 2 (Expand the Mining Envelope), Theme 3 (Increase Recoverable value) and Theme 5 (Develop New Products and Markets) are still entirely relevant and that Theme 4 (Improve Productivity) needs to be amplified to better describe research needs that have emerged in recent years.

The Board is mindful that whilst the RPP must remain contemporary it also needs to provide some continuity for stakeholders.

The Board decided to defer finalising the review of the RPP until there was greater clarity of the consequences of the Minister assigning MRIWA a role in delivering to the Government's election commitment regarding renewable technology manufacturing and work to develop battery technologies, and the transition to the new CEO was completed.

It is recommended that the RPP should be reviewed to ensure that each of the research themes are still contemporary and reflective of current and emerging trends in the industry.

KEY FINDING 12 OVERALL ASSESSMENT – ONGOING NEED FOR MRIWA

The minerals industry is the most important industry in Western Australia. While WA's mining industry is globally competitive, by no means is its competitive advantage enduring. The industry must continually work to become more productive and efficient in the face of growing competitive challenges.

This alone presents a clear and objective need for the MRIWA, which has been quantified by ACIL Allen's economic impact assessment, and reinforced through feedback provided to ACIL Allen during stakeholder consultation.

However, the changing needs of the minerals industry provides an opportune time for the MRIWA to review and revise its Research Priority Plan, to ensure its efforts are directed at the current and emerging challenges of the State's minerals industry. The MRIWA may also consider shifting its focus further up the TRL scale, to target research projects that address specific and identified industry needs as oppose to more base level research – which is funded by a number of other government bodies.

A STAKEHOLDER CONSULTATION GUIDE

The Consultation Guide that was presented to each stakeholder prior to each interview is presented below.

A.1 Background

In May 2018 ACIL Allen Consulting ('ACIL Allen') was engaged by the Minerals Research Institute of Western Australia (MRIWA) to complete two separate but related pieces of work. These are:

- An **economic impact assessment and benefit cost assessment**, centred on the calculation of direct and indirect economic benefits of research funded by the MRIWA and an assessment of whether this delivered a benefit to the State of Western Australia net of the cost of the MRIWA; and,
- An **interim review** of the *Minerals Research Institute of Western Australia Act 2013* ('the Act'), ahead of the statutory requirement that a review of the Act be undertaken by the Minister for Mines and Petroleum prior to the fifth year of the operation of the Act.

These are notionally two separate bodies of work, but are ultimately complementary in that the findings of the economic impact assessment will be central to the interim review of the Act. Central to both pieces of work is a process of stakeholder consultation, with stakeholders that have been involved with, been assisted or affected by the MRIWA to be relied upon to provide critical inputs into and guidance for the research.

The MRIWA has identified you and/or your organisation as a stakeholder who may be able to assist us in our consultation efforts.

This document is ACIL Allen's consultation guide, which will be used as the central frame of reference for stakeholder consultation for both pieces of work. It includes an overarching set of questions (annotated in purple for ease of reference), some of which may not be relevant to how you have interacted with the MRIWA. We would appreciate it if you could familiarise yourself with the document prior to our agreed consultation session.

A.2 About ACIL Allen

ACIL Allen Consulting is the largest independent economics and public policy consulting firm in Australia, with a specialisation in economics, policy and strategy advice. With over 60 consultants across five offices, we have an established reputation for providing sound and independent advice on economic, public policy and organisational issues for all levels of government and business.

Further information about ACIL Allen can be found on our website: www.acilallen.com.au

A.3 About MRIWA

The Minerals Research Institute of Western Australia (MRIWA) is a statutory body established by the Western Australian Government under the *Minerals Research Institute of Western Australia Act 2013* to stimulate minerals research to support investment in, and operation of, a globally competitive minerals industry in Western Australia. The MRIWA's primary function is to provide and administer funding grants to carry out minerals research. The Institute collaborates with research and government entities in Australia and overseas. The MRIWA funds PhD students, and makes funds available for projects, programs and events that promote public awareness of, and interest in, minerals research, and to support related academic activities.

Further information about the MRIWA can be found at its website: www.mriwa.wa.gov.au

A.4 About you

* *Can you please introduce yourself and/or your business/institution? What do you do? And how did you come to be involved with the MRIWA?*

A.5 Benefits of MRIWA research

The centrepiece of ACIL Allen's economic impact assessment is the quantification of attributable benefits arising from the application of research funded by the MRIWA to the Western Australian economy. This is primarily an exercise in valuing benefits, using a series of assumptions informed by our own research and stakeholder information. This section of the consultation guide deals with potential benefits of MRIWA-funded research and how these may have manifested in the WA mining industry. There are two sub-sections: one specifically for researchers, and one for industry participants.

A.5.1 Researchers

The MRIWA provides co-funding for research that has the potential to benefit the Western Australian minerals industries. Guided by its research priority plan, the MRIWA funds research under the expectation that it will ultimately be applied to mining activities in Western Australia for the benefit of the minerals industry. This flows through to benefits for the Western Australian economy, in the form of increased productivity (increasing unit output or reducing unit costs), expansion of the mining envelope (more minerals become accessible) or the creation of new markets.

As a beneficiary of MRIWA funding, we would like to understand your research from your perspective, and understand how it can and/or has been applied to the Western Australian minerals industry.

* *Can you please describe the research you undertook that was co-funded by the MRIWA, with a specific focus on what you were hoping to achieve, what you did achieve, and how the research results could be applied to the Western Australian minerals industry?*
* *Can you please advise of how your research results have been applied by the Western Australian minerals industry? If it is yet to be applied, can you advise how it may be applied in the future?*
* *Can you provide a perspective on how a tangible value associated with your research may be derived? (for example, does your research lead to a percentage reduction in unit costs?)*

While the primary channel of benefit in our study is benefits to the minerals industry, activities associated with your research – expenditure and/or employment – are also benefits.

* *Can you please provide an estimate of the total expenditure of your research activity co-funded by the MRIWA? Can you also provide a broad indication of the share of this which was spent on labour (wages and salaries) versus non-labour (supplies, services) items?*
* *What portion of this expenditure occurred in Western Australia? Can we assume this expenditure was incurred during the full period of the research?*

* *Was MRIWA funding an important factor in deciding to undertake your research activities in Western Australia? If not, what was the primary driver?*

We are also interested in understanding any qualitative (or unquantifiable) benefits that may have arisen due to your research. These are an important means to "tell the story" of the MRIWA.

* *Are there any qualitative (or unquantifiable) benefits of your research that you believe arose during your research or as a result of your research? If so please share these.*

A.5.2 Industry participants

The MRIWA's research projects are geared towards an ultimate objective of producing techniques or knowledge that can be applied to the Western Australian minerals industry. We are led to believe you and/or your firm has been the beneficiary of techniques or knowledge which originated from research funded by the MRIWA.

* *Can you please describe the research you and/or your company applied? How did you first hear about it and access it?*

* *Can you provide a perspective on a the value associated with the application of this research? (for example, does your research lead to a percentage reduction in unit costs?)*

* *If you had not accessed this research, do you think you would have been able to learn or develop this technique or knowledge from an alternative source? If so, where and how? If not, why not?*

The initial technique or knowledge is the primary channel of benefit. However, we are also interested in understanding whether this initial technique or knowledge may have spurred any additional benefits within your business that you can attribute to the initial technique or knowledge.

* *Have you and/or your business extended the initial technique or knowledge gained from the MRIWA funded research? If so, how? And how has this benefitted your business and/or the broader minerals industry?*

We are also interested in understanding industry perceptions of the MRIWA, and how it is benefitting the Western Australian minerals industry in ways which may not be readily quantifiable (for example, enhancing the State's reputation, attracting other researchers and/or start-up companies, conducting basic research which does not have a direct application, but which can lead to direct applications).

* *Are there any other benefits associated with the MRIWA that you consider important for ACIL Allen to consider as part of this economic impact assessment? If so what are these and can you describe them?*

A.6 Review of the Act

Section 74 of the Act stipulates that:

7. The Minister must carry out a review of the operation and effectiveness of this Act as soon as is practicable after the fifth anniversary of the commencement of this section.
8. In the course of the review the Minister must consider and have regard to —
   a) the effectiveness of the operations of the Institute; and
   b) the need for the continuation of the Institute's functions; and
   c) such other matters as appear to the Minister to be relevant to t
   d) e operation and effectiveness of this Act.
9. The Minister must prepare a report based on that review and, as soon as is practicable after the report is prepared, cause it to be laid before each House of Parliament or dealt with under section 73.

ACIL Allen has been engaged by the MRIWA to conduct an Interim Review ('the Review') of the Act, as a means of delivering an independent perspective on the operation and effectiveness of the Act ahead of the formal Review to be conducted in 2019. This is being done in parallel to the economic impact assessment, as the findings of the economic impact assessment are one of the means to measure the effectiveness of the Act.

The scope of the Review is broad, and involves data analysis, benchmarking, desktop research and stakeholder consultation. Consultation is the primary means of gathering feedback on the operations of the Act (and by relation the MRIWA), and the effectiveness of the various processes used to guide the activities of the MRIWA as it carries out its work under the Act.

As a person or organisation who has been involved with the MRIWA we are seeking your feedback on the operations and effectiveness of the Act as a means to gather evidence to allow ACIL Allen to conduct the Review. There are a number of questions, grouped into sub-headings, not all of which may be applicable to you or your organisation.

A.6.1 Effectiveness of the MRIWA

This section of the consultation guide deal with matters relating to the way in which the MRIWA operates. This is mostly a question of the structure, functions and administration of the MRIWA under the Act, and how this has played out since the Act was enacted in 2014.

* *Has the MRIWA received any negative feedback from the Auditor General and/or Department of Treasury? If so has this feedback been acted upon?*
* *Has the MRIWA met its performance targets, as indicated in strategic plans, annual reports or other public materials?*
* *How does the MRIWA's administrative cost per unit of funding disbursed compare to like institutions in the WA public sector?*
* *How do clients perceive the MRIWA?*
* *How do staff perceive the MRIWA?*

A.6.2 The need for the MRIWA

This section of the consultation guide seeks a perspective on the overall effectiveness of the MRIWA in providing a benefit to the Western Australian minerals sector, and whether the MRIWA should continue to exist. This will also examine the appropriateness of the MRIWA as a statutory authority and whether there is a role for government in the provision of funding for minerals research.

* *Has the MRIWA delivered an attributable economic benefit to Western Australia?*
* *Do researchers/industry view the MRIWA as a primary source of funding for mineral research?*
* *Has the MRIWA used the powers conferred to it by the Act, and does it anticipate a need for these powers in the future?*
* *Has the MRIWA been unable to act in a way that would achieve its objectives as a consequence of limitations within the Act?*

The MRIWA has a broader role in the Western Australian mining industry than funding research. These have not been quantitatively considered as part of the economic impact assessment, but are an important factor when considering the ongoing rationale for the MRIWA.

* *Has the MRIWA delivered qualitative benefits to Western Australia, which are backed up by stakeholder feedback and/or industry perceptions?*
* *In what ways has the MRIWA fostered collaboration and assisted in the development of networks amongst researchers, the mining industry and related sectors? Is this something the MRIWA should do more, less or the same of going forward?*
* *Does the MRIWA enhance Western Australia's reputation as a minerals jurisdiction? Does it assist the Western Australian Government unlock other minerals research opportunities (such as CRC funding?)*

A.7 Additional information and other matters

* *Is there any additional information relevant to ACIL Allen's research that you may be able to make available to us?*

* *Is there additional feedback you would like to convey to provide us with an understanding of the role the MRIWA and its impact on the Western Australian economy?*
* *Is there anything related to the MRIWA Act or the MRIWA itself which you believe should be changed as part of the review of the Act?*

A.8 Further Enquiries

If you have any questions in relation to the research, the role of ACIL Allen, and the consultation process that is being undertaken, please contact:

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