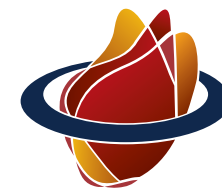# Research Priority Plan

mriwa

Minerals Research Institute
of Western Australia

MRIWA Revised Research Priority Plan

MRIWA

The Minerals Research Institute of Western Australia's (MRIWA) vision is for minerals research to advance WA.

To achieve this we:

- have an **IMPACTFUL RESEARCH** program where applied research creates capability and delivers economic and social benefit for Western Australia;

- provide **COLLABORATIVE RESEARCH LEADERSHIP** so industry, academic and government relationships can activate innovation and research networks attracting investment in high value activities;

- enable **KNOWLEDGE TRANSFER** so minerals research outcomes are implemented to deliver value for the State.

MRIWA is a statutory body established by the Western Australian Government in 2013 under the *Minerals Research Institute of Western Australia Act 2013* (the Act).

RESEARCH PRIORITY PLAN

The Research Priority Plan describes the medium to long term knowledge and technology needs of the State's minerals industry to ensure it can deliver an economic and social benefit for Western Australia.

Priorities included in the Plan are intended to be those issues industry, the research sector and the MRIWA Board agree present real and significant challenges inhibiting Western Australians from benefiting from the minerals sector to its fullest extent and where resolution of these will create opportunities and deliver value.

Some priorities are specific to parts of the mining value chain, while others apply across the spectrum with an integrated approach required to achieve the intended outcomes outlined in the plan.

The MRIWA's **Knowledge Transfer** program will seek to identify existing research being undertaken across all industry sectors in the priority areas covered by the Plan and promote this to the Western Australian minerals community for adaption and adoption.

This Plan is used by MRIWA to identify the key areas where investments will be made into high impact research and development. Those seeking to work with MRIWA on our **Impactful Research** program will need to demonstrate alignment with the priorities outlined in the Plan and how their proposals deliver economic and social benefit for Western Australia.

Addressing the research priorities identified for the Western Australian minerals industry will require a coordinated and combined response. Through our **Collaborative Research Leadership** program, MRIWA will seek to work with all relevant parties across the research eco-system to focus research efforts on those areas most likely to deliver the intended outcomes.

Western Australian Minerals Industry Research Priorities Overview

FIND MORE VIABLE RESOURCES

EXPAND THE MINING ENVELOPE

INCREASE RECOVERED VALUE THROUGH PROCESSING

INFRASTRUCTURE AND LOGISTICS

NEW PRODUCTS AND MARKETS

REMEDIATION AND MINE CLOSURE

- ▶ Mineral Systems
- ▶ Detection Technology

- ▶ Deep and Complex Extraction Systems
- ▶ Engineering in Highly Stressed and Complex Rock Masses
- ▶ Mining Technology

- ▶ Processing Technology

- ▶ Communications and Positioning Technology

- ▶ Strategic Foresight
- ▶ Downstream Processing Technology

- ▶ Acid Mine Drainage and Treatment of Tailings
- ▶ Sustainable Land Use Post-mining

- ▶ **DATA DRIVEN DECISIONS**
- ▶ **ENERGY UTILISATION**
- ▶ **REGULATORY TOOLS AND PROCESSES**
- ▶ **SAFETY, SOCIAL AND ENVIRONMENTAL SUSTAINABILITY**
- ▶ **WORKFORCE OF THE FUTURE**

Program 1 – Find More Viable Resources

The vast majority of Western Australia's easily found and economically viable mineral deposits near to the surface have already been discovered and are being exploited at a greater rate than which they are being replenished by new discoveries.

To meet the challenge of finding significant new discoveries, and building on *Uncover Australia*[1], and the Western Australian Government's *Exploration Incentive Scheme*, the research priority areas in Program 1 are intended to systematically advance knowledge and capability to improve mineral exploration productivity through both detection, exploration technology and prediction performance.

In doing so, the research will inform the pre-competitive geological, geochemical and geophysical knowledge base and create exploration capability to:

- position Western Australia as a global leader in exploration technology;
- facilitate private sector investment in existing and newly identified Western Australian mineral provinces to develop the State's rich natural resources.

Theme	Intended Outcome
Mineral Systems	Better prediction and targeting of orebodies using the mineral systems approach including, but not limited to: • characterising cover [1] • investigating Western Australia's lithospheric architecture [1] • resolving the 4D geodynamic and metallogenic evolution of Western Australia [1] • characterising and detecting the distal footprints of ore deposits[1]

Theme	Intended Outcome
Detection Technology	Tools which optimise the efficient collection and accurate processing of data, enabling exploration for concealed mineral systems in areas of deep cover
Data Driven Decisions	New datasets and new analysis of existing geological, environmental and geophysical knowledge enabling enhanced geological and mineralogical modelling to: • improve consideration of ore-body and in-situ geological features in mine planning; • optimise processing and minimise waste, footprint and costs
Regulatory Tools and Processes	Evidence based tools to increase confidence and provide certainty and efficiency in regulatory processes including: • reporting standards enabling real time resource and reserve updating; • reporting formats enabling data mining and machine learning techniques for prediction of mineral systems and exploration targets
Safety, Social and Environmental Sustainability	Processes which eliminate exposure to hazards, improve social wellbeing and reduce the environmental footprint of exploration
Workforce of the Future	An agile, adaptable and skilled workforce capable of leading and implementing exploration technological changes into the future

[1] https://www.uncoveraustralia.org.au/wp-content/uploads/2019/02/UNCOVER-Roadmap-Unlocking-Australias-Hidden-Potential.pdf accessed 14 June 2019

Program 2 – Expand The Mining Envelope

A significant proportion of the future Western Australian resource base is likely to reside in deep and complex geotechnical environments. Additionally most major open-cut and underground operations are known to have extensions to the mineralisation, albeit at possibly lower grade. Mining methods have to adapt to allow economic and safe extraction of resources.

The research priority areas in Program 2 are intended to systematically advance knowledge and capability toward solutions for mining more ore from challenging deposits.

In doing so, the research will create engineering capability and demonstrate technical feasibility of mining more selectively and deeper to:

- position Western Australia as a global leader in extraction technologies;
- decrease the capital and operating costs associated with mining;
- allow for safer and increased productivity from existing mines and a new generation of deposits to be brought into production.

Theme	Intended Outcome
Deep and complex extraction systems	Systems engineering approaches to enable mining in deep and complex conditions
Engineering in highly stressed and complex rock masses	Understanding and quantification of seismic hazard, including the dynamic behaviour of ground support elements design and systems, mine design and rock mass conditioning

Theme	Intended Outcome
Mining Technology	Equipment and processes utilising artificial intelligence and machine learning to: • enable automation and alternative methods of extraction, concentration and/or precision mining to extend the life of mine; • optimise recovery and economic extraction from low-grade ores both for underground and surface mining
Data Driven Decisions	Reporting standards to deliver clarity on data needs, facilitating the development of risk-based design and decision-making frameworks, and common information management platforms with real-time data collection, for better mine planning and whole of site interoperability
Energy Utilisation	Lower overall energy costs, reduced carbon footprint and removal of hazards from mining operations through adoption of alternative energy sources
Regulatory Tools and Processes	Evidence based tools to increase confidence and provide certainty and efficiency in regulatory processes
Safety, Social and Environmental Sustainability	New processes and novel technologies which eliminate exposure to hazards, improve social wellbeing, reduce the environmental footprint and impact of mining including the reuse and disposal of processed mine waste
Workforce of the Future	An agile, adaptable and skilled workforce capable of leading and implementing mining technological changes into the future

Program 3 – Increase Recovered Value Through Processing

More complex and lower grade orebodies, combined with higher energy costs and the need for a lower environmental footprint, are driving the development of advanced methods of processing to transform low value deposits to be economic.

The research priority areas in Program 3 are intended to systematically advance knowledge and capability toward solutions for increasing yield and throughput and optimising use of raw materials by breaking down operational silos.

In doing so, the research will create mineral processing capability and accelerate the development, testing, piloting, scale-up and other technical de-risking activities associated with new processing technologies to:

- position Western Australia as a global leader in mineral processing;
- decrease the capital and operating costs associated with mineral processing;
- allow for safer and increased productivity from processes and a new generation of processing technologies to be deployed.

Theme	Intended Outcome
Processing Technology	New processes and novel technologies and testing scale-up to optimise processing which utilise artificial technology and machine learning to: • enable co-extraction of multiple commodities where possible minimising waste; • increase recovery values from low grade ores, tailings, slag and residue

Theme	Intended Outcome
Data Driven Decisions	Advanced predictive mineral processing models and simulation techniques which connect easily measurable data with processing performance leading to: • reduced timeframes and costs of deployment of new processing technologies; • common information management platforms providing access to real-time data, increasing efficiency; • improved asset integrity by analysing and predicting failures
Energy Utilisation	Lower overall energy costs and reduced carbon footprint from mineral processing through adoption of alternative energy sources
Regulatory Tools and Processes	Evidence based tools to increase confidence and provide certainty and efficiency in regulatory processes
Safety, Social and Environmental Sustainability	Processes which eliminate exposure to hazards, improve social wellbeing and reduce the footprint of mineral processing and improve environmental outcomes
Workforce of the Future	An agile, adaptable and skilled workforce capable of leading and implementing mining technological changes into the future
Interoperability	Development and testing of standards and protocols to support interoperability in digital platforms used in mineral processing, including interoperability between control systems, analytics tools, instrumentation, historian and business intelligence platforms

Program 4 – Infrastructure And Logistics

Western Australia's export-oriented mining projects place heavy demands on regional infrastructure requiring long term planning and a high level of capital investment by both government and industry. As the sector moves to adopt automated technologies, greater demand will be placed on network bandwidths.

The research priority areas in Program 4 are intended to systematically advance knowledge and capability to:

- optimise supply chain infrastructure usage, haulage and export logistics;
- enable enhanced networks and accurate geo-positioning;
- decrease the capital and operating costs associated with getting commodities to market.

In doing so, the research will inform Infrastructure WA regarding aggregated needs of the mining sector.

Theme	Intended Outcome
Communications and Positioning Technology	New or alternative technologies to: • improve methods for transfer data to/from the field; • reduce bandwidth requirements resulting from automation; • increase the availability and accuracy of positioning and communication technologies throughout the State
Data Driven Decisions	Scalable coordinate and mapping datasets and software platforms for multiple use and modelling on a regional scale leading to optimal utilisation of common use infrastructure
Energy Utilisation	Lower overall energy costs and reduced carbon footprint through adoption of alternative energy sources
Safety, Social and Environmental Sustainability	Processes which eliminate exposure to hazards, improve social wellbeing through consideration of post mine land use in infrastructure planning, reduce the environmental footprint and improve environmental outcomes

Program 5 – New Products And Markets

Rapid adoption of new high-tech products and manufacturing processes is changing the demand for high value, low volume minerals and creating opportunity for the re-use and recycling of by-products and waste.

Increasing emphasis is being placed on those critical minerals which are subject to high risks of supply, but are irreplaceable inputs for technological and industrial advancements, especially renewable energy systems, electric vehicles, rechargeable batteries, consumer electronics, telecommunications, specialty alloys, and defence technologies.

Given Western Australia is well positioned with its significant reserves of a broad variety of minerals now required globally, the research priority areas in Program 5 are intended to systematically advance knowledge and capability which:

- create new industries;
- result in increased demand for one or more minerals found in this State;
- develop and demonstrate ethical and sustainable production of minerals, metals and chemicals;
- create premium products which can be marketed and sold to new generations of customers.

In doing so, the research will create new niche markets for minerals and position Western Australia as a global supplier of critical minerals while also creating opportunity for progressive downstream processing activity in the State.

Theme	Intended Outcome
Strategic Foresight	A view of potential future uses of Western Australian minerals and clarity on the enablers and inhibitors to diversifying mineral production and increasing the scale of domestic processing activities
Downstream Processing Technology	New processes and novel technologies, and testing scale-up, to: • add higher value to low volume minerals; • convert mine waste to economic new products
Data Driven Decisions	Assessment of supply and demand side drivers to develop a more informed understanding of uncertainty in future markets
Energy Efficiency	Lower overall energy costs and reduced carbon footprint from downstream processing through adoption of alternative energy sources
Regulatory Tools and Processes	Evidence based tools to increase confidence and provide certainty and efficiency in regulatory processes for emerging industries
Safety, Social and Environmental Sustainability	Processes which eliminate exposure to hazards, improve social wellbeing and reduce the environmental footprint resulting from Western Australian minerals
Workforce of the Future	An agile, adaptable and skilled workforce capable of leading and creating new markets for Western Australian raw materials

Program 6 – Remediation And Mine Closure

An increasing number of Western Australian mining operations are edging closer towards mine closure, with a lack of certainty in the process for relinquishment of rehabilitated land to the State and the potential for trailing liabilities.

To meet the challenge of mine closure and to support the Western Australian Biodiversity Science Institute's Research Priorities[2] and other work happening across government, the research priority areas in Program 6 are intended to systematically advance knowledge and capability toward developing new technologies and approaches for mine remediation and alternative land use, while filling knowledge gaps to ensure a sustainable positive legacy for the industry and surrounding communities.
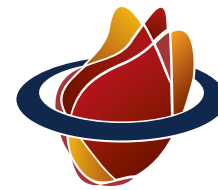
In doing so, the research will:

- position Western Australia as a global leader in mine closure;
- decrease the capital and operating costs associated with remediation and mine closure;
- allow for evidence based decision making.

Theme	Intended Outcome
Acid mine drainage and treatment of tailings	Removal of contaminants from tailings and prevention of acid mine drainage
Sustainable land use post-mining	Planning and delivery of novel post-mining land uses which provide a sustainable positive legacy for the industry, environment and surrounding communities
Data Driven Decisions	Improved information management platforms to facilitate aggregation, interpretation and access to data, to build predictive capability, more effective costing and increase understanding of the cumulative environmental impacts of an action on a region over time[2]
Regulatory Tools and Processes	Evidence based tools to increase confidence and provide certainty and efficiency in regulatory processes for mine closure and relinquishment
Safety, Social and Environmental Sustainability	Processes across the 'Life of Mine' which eliminate exposure to hazards, improve social wellbeing and reduce the environmental footprint resulting from mine closure and optimise environmental outcomes post mine

[2] https://wabsi.org.au/wp-content/uploads/2018/05/WABSI-Research-Priorities-2018.pdf accessed 14 June 2019

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