



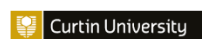
**WA Agricultural  
Research  
Collaboration**  
Innovation • Transformation • Growth



# Mineland to Farmland

January 2026

**agdots**



# Table of contents

---

1. Who are WAARC and CRC TiME? .....	3
2. Who is agdots? .....	3
3. Workshop Executive Summary .....	4
4. Workshop Process .....	5
5. Co-creating ideas – small group workshops .....	7
Governance and Tenure .....	7
Economic and Social Integration .....	9
Applied Agricultural R&D .....	11
Baseline Assessment .....	13
Agricultural Restoration .....	17
Agricultural Infrastructure .....	18
Environmental Safety .....	19
Indigenous Engagement .....	20
6. Ideas for projects – small group workshops .....	22
Priority 1: Integrated regional planning supported by policy and investment .....	22
Priority 2: Indigenous co-designed land-use framework .....	25
Priority 3: Soil and water engineering and amelioration .....	25
Priority 4: Mapping and modelling land use viability .....	27
Priority 5: Pilot demo sites and community acceptance .....	28
Priority 6: Long-term environmental monitoring system .....	29
Priority 7: Agtech and mining tech synergies .....	30
7. Mapping workshop priorities to WAARC and CRC TiME vision and priorities .....	32



**WA Agricultural  
Research  
Collaboration**  
Innovation • Transformation • Growth

# 1. Who are WAARC and CRC TiME?

---

## WA Agricultural Research Collaboration (WAARC)

WAARC brings together leading agricultural research organisations to deliver innovation for Western Australia's farming systems. Its priorities include soil health, water management, sustainable agriculture and Indigenous engagement. WAARC sees this workshop as an opportunity to align its applied research and development (R&D) expertise with CRC TiME's post-mine land restoration strategies, enabling collaborative solutions that integrate agricultural productivity with environmental and social outcomes. Beyond the workshop, WAARC aims to develop pilot projects, decision-support tools and business models that make rehabilitated land viable for farming and community benefit.

## Cooperative Research Centre for Transformations in Mining Economies (CRC TiME)

CRC TiME is a national research collaboration working with diverse partners to support positive social, economic and environmental post-mine transitions. Beneficial post-mine land and asset use is central to post-mine transitions.

Its work spans economic diversification, post-mine land, infrastructure, water and waste use, Indigenous and regional partnerships and collaboration. CRC TiME's interest in this workshop lies in exploring and identifying ways of working together on research and projects that can be applied to agricultural transformation, including on soil, water, land rehabilitation and aspects creating pathways for productive post-mine use and regional resilience.

# 2. Who is **agdots**?

---

agdots (Workshop Facilitator) knows regional, rural and remote Australia. agdots Directors and staff live, work, operate businesses and are active participants and leaders in regional communities and industries. This lived experience and 'skin in the game' drives their culture of accountability and quality, both for their clients and for the communities and industries their clients' impact and serve.

agdots helps to design sustainable business models and fund new projects, products or innovations for their clients. They facilitate processes that capture the voice, intent and appetite of stakeholders, with particular focus on agricultural industries and rural and remote communities.

agdots is passionate about elevating communities, industries and organisations to a place of shared power and influence over their future.

### 3. Workshop Executive Summary

---

The WA Agricultural Research Collaboration (WAARC) and Cooperative Research Centre for Transformations in Mining Economies (CRC TiME) identified the opportunity to collaborate to better inform and enable post-mine transitions into agriculture.

In December 2025, WAARC and CRC TiME delivered a workshop which brought together more than 60 stakeholders across the mining, agriculture, horticulture, aquaculture, ecological restoration, water, First Nations and regional NRM sectors.

Collectively, workshop participants built a shared understanding of the key priorities that would guide and enable focused effort and investment, to deliver the greatest impact for post-mining transition into productive agricultural land in Western Australia. The group co-developed seven priorities that now need broader testing and refinement.

#### Mineland to Farmland Priorities

<b>Integrated regional planning</b>	Develop a regional integrated plan that integrates an expected mine closure schedule with potential agricultural and other economic development opportunities, including land and asset re-use. The planning would include policy requirements, regulatory gaps, tenure mapping, decision frameworks and cost-benefit analysis, including trade-offs and multi-land use planning required for a successful transition.
<b>Indigenous co-designed land use framework</b>	Develop a framework to incorporate Indigenous knowledge and values as a foundation for land use plans, including cultural indicators for agriculture and spatial prioritisation for transition to overcome permitting challenges, improve cross-agency coordination, strengthen social licence and provide clear and culturally informed guidelines for land transitions.
<b>Soil and water engineering for agricultural transition</b>	Model and conduct pilot trials on how to integrate climate, engineered soils, water integration and infrastructure, to create viable agricultural transition opportunities.
<b>Agro-Eco-Geographic modelling and opportunity matching system</b>	Opportunity matching/brokering by assessing agro-ecological ability, and social-economic viability assessment and potential investors for all mining sites.
<b>Pilot demonstration sites (South West and Pilbara)</b>	Identify and implement demonstration sites to establish community confidence, capture mining industry buy-in, inform regulators, demonstrate capacity to manage risk and test real-world feasibility.
<b>Long-term environmental monitoring system</b>	Establish baseline conditions and capture key information across the mine life-cycle for each mine. This would underpin condition understanding for transition and is essential for safety, compliance, ESG and credibility.
<b>Ag and mine tech synergies</b>	Merge capabilities from each industry to solve the key problems in transition and leverage technology and thinking across platforms (e.g. rethinking soil restructure and leveraging mine soil moving equipment).

To facilitate change for post-mine land transformation into agriculture, further developing strategic partnerships and alliances - and, where needed, fostering new ones - across government, mining, agriculture, and allied sectors will be critical. These have been identified during the workshop and captured under the seven priorities. Workshop participants also identified funding streams for projects that align with these collaborative priorities.

Next steps will involve co-development of shared research and development (R&D) priorities, pilot ideas and funding pathways to advance the Mineland to Farmland transition opportunities.

## 4. Workshop Process

---

To identify the priorities, the group considered a Discussion Roadmap (Attachment 1) which was circulated pre-workshop to catalyse thinking. The Roadmap acted as a draft strategic framework for better transforming post-mine land into productive agricultural landscapes, combining CRC TiME’s research achievements and future priorities with WAARC’s applied agricultural R&D lens.

The Roadmap emphasised eight key themes:

Baseline assessment focuses on soil and water diagnostics along with risk quantification, which will provide the foundations for decision-support tools to evaluate land capability.	Land restoration addresses soil reconstruction, revegetation, and innovative soil amendments.	Environmental safety prioritises contaminant mitigation, Acid Mine Drainage (AMD) and Neutral Metalliferous Drainage (NMD) management and real-time monitoring systems to ensure safe agricultural reuse.
Agricultural infrastructure explores irrigation systems, renewable energy integration, and cost-effective logistics for farming on repurposed land.	Governance and tenure highlight frameworks for secure and responsible land access, mechanisms to ensure the transfer of assets while managing risk, and collaborative models for working with Traditional Owners and other regional and community partners.	Indigenous engagement promotes co-design of agroecological trials, cultural indicators for land health, and pathways for Indigenous participation in agri-business.
Applied R&D opportunities include demonstration farms, regenerative agriculture models, and opportunities to integrate low emissions agriculture.		Economic and social integration focuses on market analysis, industry and community engagement strategies, and knowledge-sharing platforms to inform and support regional transitions.

### Key insights from WAARC and CRC TiME

The WAARC and CRC TiME collaboration represents a new targeted strategic alliance to support the transformation of post-mine landscapes into productive, sustainable assets that deliver economic, environmental, and cultural benefits for Western Australia. As mining operations approach closure, large-scale land transitions are inevitable, with rehabilitation obligations estimated at \$78 billion nationally. Agriculture offers a scalable option for repurposing these lands, creating opportunities for regional economies and building long-term resilience. Both organisations

emphasise First Nations inclusion, seeking to ensure that their work emphasises co-design and cultural stewardship to help support future opportunity.

The Roadmap presented at the workshop focused on three priority areas:

- **Foundations for Agricultural Transition** – soil and water assessments, environmental safety measures, and governance models for shared land use with Traditional Owners, mining and agriculture operations.
- **Building Productive Landscapes** – soil restoration, revegetation protocols, infrastructure solutions such as irrigation and renewable energy, and Indigenous engagement in agri-business.
- **Driving Innovation and Integration** – applied R&D for crop systems, carbon accounting, market development, and frameworks for regional economic transition.

These priorities aimed to define research needs, identify high-value opportunities and align investment for scalable outcomes.

CRC TiME has focused on developing innovative solutions that connect regional economic development and post-mine transition, including delivery of new frameworks and tools that enable collaborative planning, regional cumulative effects assessment and management, economic development and transition capacity, and production-based post-mine land use. CRC TiME has achieved significant milestones in its journey to develop the foundations for mining transitions, including piloting Natural Capital Accounting at multiple sites, working to develop microbial solutions to address challenges associated with Acid Mine Drainage, launching a national native seed trial network and delivering the Restoring Country pilot.

CRC TiME has also created educational resources like a Mass Open Online Course on mine closure and sustainable transitions and they are working with government and other partners to develop a national mine closure and transition policy framework. This framework is informed by global reviews of mine closure guidance, residual risk management, post-mine transition tenure frameworks, incentivising innovative post-mining land use outcomes and regulatory pathway mapping for closure and post-mine transitions.

CRC TiME's major initiatives include:

- **National Pit Lakes Initiative** – a \$5 million investment to manage pit lakes and enable beneficial water reuse.
- **Post-Mine Opportunity Atlas development including an Australian Water Atlas (AWARE)** - a spatial tool mapping water sources and reuse opportunities.
- **Renewable Energy Atlas** - a digital atlas of opportunities to repurpose and use mines and land for renewable energy projects.
- **Post-Mine Land Use Business Case Evaluation Model** - supporting transparent decision-making for post-mine land use options.
- **Algae-based technology development** - for carbon capture and water treatment.

Establishing a new collaboration between WAARC and CRC TiME represents a significant opportunity to support the transformation of rehabilitation liabilities into productive, climate-resilient landscapes that deliver lasting value for communities, industry and the environment. By integrating science, technology, policy and cultural knowledge, WAARC and CRC TiME aim to create enduring economic, environmental and social benefits for Western Australia and beyond.

## 5. Co-creating ideas – small group workshops

Each of the eight theme areas from the Roadmap were workshoped to develop:

- Challenges
- Opportunities
- R&D ideas

The results from the eight theme areas are presented, with high priority ideas highlighted.

### Governance and Tenure

#### Group discussion:

- Overlapping and conflicting tenure layers (Native Title, Commonwealth land, pastoral leases, freehold, mining tenements, water rights) need to be considered further as part of regional planning. Current legislation operates through separate systems across mining, water and planning, but strengthening connections between these frameworks offers government a clear opportunity to improve efficiency and support more integrated land transition outcomes. Crown land residual liability usually remains with the State, creating major hurdles to relinquishment.
- Opportunity for regional-level, integrated policy settings, with potential to learn from similar US regional transition legislation.
- Lack of clarity on liability transfer for agricultural use, particularly freehold vs leasehold.
- Government agencies are constrained due to capacity and other challenges, making it difficult to consider a wider range of opportunities via planning, tenure and closure.
- There appears to be a need for mapping regulatory gaps and building bridging frameworks.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Policy level - current mine closure plans don't support transition</li> <li>• Currently EP mandated</li> <li>• Can only transfer risks that are known</li> <li>• Currently fragmented – silos of process and information</li> <li>• Understanding resources – industry, communities – complex, comprehensive, opaque</li> <li>• Poor facilitation of transfer of risk and liability – currently unrealistic</li> <li>• Lack of transparency – governance decision-making, community engagement/visibility</li> <li>• Start planning process too late</li> <li>• Competing priorities – growth vs closure</li> <li>• Political cycle – policy alignment</li> </ul>	<ul style="list-style-type: none"> <li>• Systems thinking, decision-making tool (5 votes)</li> <li>• Regional land use planning (6 votes)</li> <li>• Facilitate risk/liability transfer – similar to trust fund, who does this well? (3 votes, 2 cross-cutting theme)</li> <li>• Community needs</li> <li>• Not 'closure' but the next phase for the asset/region (diversified economy, transparent future),</li> </ul>

- Engaging with different levels/departments, silos vs holistic, who is the right level for different elements of transition?
- Public perception
- Fragmented/inconsistent tenures – legislation silos
- Risk exposure – new applicants
- No transition case study (ag)
- Mining to EP regulations, EPA doesn't regulate for social/economic activity
- Renewables as land use – tenure problems (no clear process for transition)
- Resolving RIWA – water rights, MA – mining rights, LAA – pastoral/freehold, NIA – Native title
- Liability transfer – no residual liability agreement
- How to partition risks – not supported by legislation
- Transactional nature of mine closure
- Understanding residual risks and their impact on potential and specific land use
- Pastoral vs freehold legislation

- public perception (1 vote)
- SW WA - especially due to freehold
- Legislation reform – especially land administration, diversification leases
- Regional plans for long-term land use
- Bridging legislation for transitioning land use, fit for purpose, long-term reform
- Development Commissions – role?

### Research and Development Ideas

- Case studies/good transition policy/process models. Who does this well? (1 vote)
- Developing bridging policies (4 votes)
- Practical tools
- Integrated regional planning supported by policy and dollars (5 votes, 12 cross-cutting theme)
- Regulatory requirements review – bridging legislation and multiparty stewardship - closing the regulatory gap (6 votes, 2 cross-cutting theme)
- Atlas of Mining Infrastructure supported by agency – e.g. Development Commissions – what is being used, what can be repurposed (alternative uses), what tenure can support it, what residual risks exist, infrastructure retention plans? (7 votes, 3 cross-cutting theme)
- Strategic agricultural targets identified
- Diversification in freehold – liabilities, regulation (2 votes, 1 cross-cutting theme)

### High Priorities

1. Integrated regional planning supported by policy and dollars (5 votes, 12 cross-cutting theme)
2. Regulatory requirements review – bridging legislation and multiparty stewardship – closing the regulatory gap (6 votes, 2 cross-cutting theme)
3. Atlas of Mining Infrastructure supported by agency – e.g. Development Commissions - what is being used, what can be repurposed (alternative uses), what tenure can support it, what residual risks exist, infrastructure retention plans? (7 votes, 3 cross-cutting theme)

# Economic and Social Integration

## Group discussion:

- Land transition will only succeed with community acceptance – transition must be undertaken with communities and opportunities should be co-designed where possible.
- Workforce issues (pay scales, skills, competition) between mining and agriculture require coordinated planning.
- Major opportunity to leverage mining supply chains, logistics, ports, roads, cargo, and water infrastructure.
- 80 per cent of agricultural land exists on pastoral leases that overlap mining - major crossover area.
- Demonstration sites are critical for trust-building.
- Need to understand consumer acceptance of food grown on former mine sites.
- Exploration of multi-use land (agriculture, conservation, tourism, carbon, biodiversity).

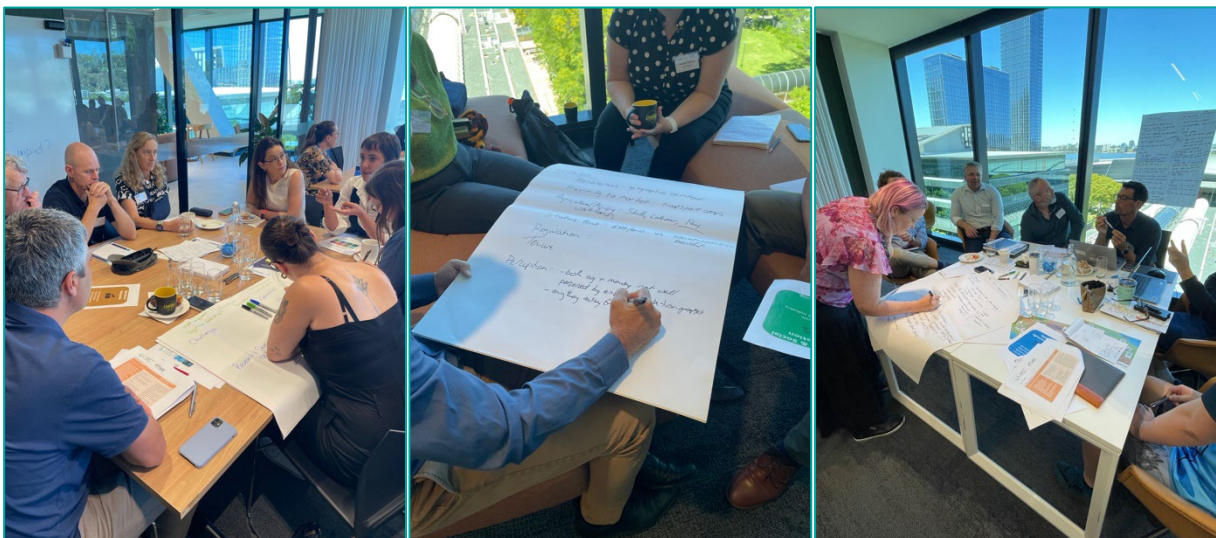
Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Remoteness – geographic context</li> <li>• Proximity to market – transport costs</li> <li>• Agriculture/mining – skills, labour, pay, workforces</li> <li>• Status quo – EPA/environment vs socio-economic benefit</li> <li>• Regulation – many barriers</li> <li>• Tenure – underlying tenure holder, diversification lease?</li> <li>• Perception – both ag and mining are not well perceived by environment and conservation groups</li> <li>• Narrative – value add, desensitise talking about closure</li> <li>• Lack of strategy and shared vision – needs long-term planning, needs the “pull”</li> <li>• Knowing what land and assets are available and its capability</li> <li>• Do we know community vision for agriculture?</li> <li>• Do we have the right community infrastructure?</li> <li>• Will it be viable when mining finishes?</li> <li>• What is the transition plan?</li> </ul>	<ul style="list-style-type: none"> <li>• Export – Dampier as a cargo back-fill on boats – economic assessment (1 vote)</li> <li>• Seed production built on to pastoral – evaluation of hubs/models</li> <li>• Novel ways of brainstorming PMLU – characterisation / what can we publish? / think tank (3 cross-cutting, 1 vote)</li> <li>• Establish pilot / demonstration sites – PMLU evaluation – case studies and workshops (16 votes, 6 cross-cutting theme)</li> <li>• Industry development planning with evaluation of procurement models (1 vote)</li> <li>• Consumer perception study to test acceptance</li> <li>• Lowering carbon footprint of local supply in big mining regions (2 votes, 1 cross-cutting theme)</li> <li>• Community planning – next clear next land user and pull from them (3 votes, 1 cross-cutting theme)</li> <li>• Map and model the land available and its suitability and capability</li> <li>• Community planning/visioning – needs identification of community, community building (6 votes)</li> <li>• Study of mining industry buying ag land/industry</li> </ul>

- Are we creating environmental impacts?
- What is the social acceptance of this?
- Community perceptions and understanding of mine closure
- Liveability and secure jobs
- Industry collaboration – value proposition, aligning with company targets (2 votes)
- What is the existing skills base and community assets/skills?
- 18 per cent of ag land is owned by mining companies

- Research to demonstrate value to industry of collaboration (1 vote), risk reduction (2 votes), value generation
- Skills training that connects/balances ag training
- Industry viability study with and without active mining – aquaculture, integrated ag, restoration, broadacre, horticulture (4 votes, 2 cross-cutting theme)
- Drought resilience plans – update with mining
- Rangers and cultural stewardship
- National infrastructure case studies – e.g. Strahan, Macquarie Harbour

## High Priorities

1. Establish pilot/demonstration sites – PMLU evaluation – case studies and workshops (16 votes, 6 cross-cutting theme)
2. Industry viability study with and without active mining – aquaculture, integrated ag, restoration, broadacre, horticulture (4 votes, 2 cross-cutting theme).



*Small groups workshoped each of the eight theme areas from the Roadmap to develop challenges, opportunities and R&D ideas. Photos: CRC TiME.*

# Applied Agricultural R&D

## Group discussion:

- Pre-closure planning is essential – trials and baseline data must start five to 10 years before closure.
- Opportunities include short-rotation woody perennials, integrated biodiversity/agriculture, soil amelioration, nitrogen-fixing legumes and biomass-for-energy interim systems.
- Uncertainty around livestock as an early land-use option – requires targeted research.
- Strong need for engineered soil blends, soil conditioners and biologically active topsoil replacements.
- Mapping water, soil, slope, climate and infrastructure layers enables opportunity matching.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Limited climate data for remote opportunities</li> <li>• Not much known about native fauna, saline algae – e.g. regionally specific</li> <li>• New ecological systems restoration – need systems approach to remediation</li> <li>• Staged remediation approach</li> <li>• Ensure investment commitment</li> <li>• Build in timeframe for transition – state agreements?</li> <li>• Mines want certainty on remediation requirements up front</li> <li>• What is a “good” end result? – e.g. restoration</li> <li>• What alternatives are possible for a site?</li> <li>• Need information on water quality, soil health – microbiome, composition, chemistry profile and contaminants</li> <li>• Research opportunities to understand possible land uses (post mining)</li> </ul>	<ul style="list-style-type: none"> <li>• Weather station focus – collect data, modelling future weather</li> <li>• Pilbara has lots of sunlight – seawater – based marine algae</li> <li>• Baseline bioprospecting of saline algae – cultivating and harvesting of high-value product or animal feed production</li> <li>• Biorefinery – needs engineering deployment in remote locations (2 votes)</li> <li>• Automation of algal systems</li> <li>• Water quality – need pre-knowledge (1 vote)</li> <li>• Understanding opportunities – location specific</li> <li>• Opportunity assessment – spatial and temporal assessment, weather including future (1 vote)</li> <li>• Funding IIF (Innovative Industries of the Future) – funding opportunities, regional grants, opportunity for SW funding</li> <li>• Interim steps:             <ul style="list-style-type: none"> <li>○ High throughput forestry – tree species important, carbon sequestration, continuous canopy</li> <li>○ Phosphorous – forestry</li> <li>○ Soil remediation – chemical requirements</li> <li>○ Biomass to energy</li> <li>○ Economic viability</li> <li>○ Vertically integrated value chain</li> <li>○ Integrated trees and other crops</li> </ul> </li> <li>• Long-term lead in</li> <li>• Demonstration of innovative ideas</li> <li>• First Nations knowledge</li> <li>• Soil remediation</li> </ul>

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Is there already knowledge about type of soils or regional agricultural uses?</li> <li>• Understanding toxin/heavy metal profile to understand remediation requirements</li> <li>• Graded/staged approach to regen of soil (from mining to agriculture)</li> <li>• Cycles of cropping etc., first activity to begin cycle</li> <li>• Succession of pasture/crop species, pioneer crops – e.g. legumes</li> <li>• Green manuring, crop rotation to improve soil quality</li> <li>• Pioneer species to assist soil regen – mix of species, see what grows</li> <li>• Food safety aspects – heavy metals, contaminants</li> </ul> | <ul style="list-style-type: none"> <li>○ Nutrient cycling via plants</li> <li>○ Soil amelioration – what is best to use?</li> <li>○ Pasture system – but care with animal products</li> <li>• Ag trials <ul style="list-style-type: none"> <li>○ Longer term – 10-plus year timeframe</li> <li>○ While still mining (1 vote, 1 cross-cutting theme)</li> <li>○ Don't wait for mines to close</li> <li>○ Top-soil available</li> </ul> </li> <li>• Map and analyse what is there <ul style="list-style-type: none"> <li>○ Infrastructure</li> <li>○ Early data sharing, soil history, endemic species that existed before mining</li> <li>○ Consider option of biodiversity/conservation/nature reserves</li> <li>○ Consider carbon sequestration opportunities</li> <li>○ Complementary land use</li> <li>○ Sustainable</li> <li>○ Water assets</li> <li>○ Opportunities for renewable energy sites</li> </ul> </li> <li>• Prioritise land for different uses <ul style="list-style-type: none"> <li>○ Look at proximity to other assets – e.g. towns (2 votes)</li> <li>○ Consider future jobs/economic opportunities</li> </ul> </li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Research and Development Ideas

- Agtech and mine tech opportunities – automation (15 votes, 6 cross-cutting theme)
- Evaluation of pasture and crops for certain soil types, climate and site species matching for most productivity (depends on what soil issues are existing)
- Nutritive value of plants – contaminant profile, analysis pre-grazing
- Multi-species pastures/crops
- Soil re-engineering and mitigating/amelioration – biochar OM, fines, biosolids, fungi, microbiome restoration, earth worms (9 votes, 3 cross-cutting theme).
- Understand soil constraints
- Potassium trials
- Plant breeding program/adaption – willow, poplars – e.g. pioneering species, short rotation woody perennials
- Systems modelling – design system early in mine life
- Consider water/other aspects for new agriculture opportunities – e.g. horticulture
- Mineral sand mining – more amenable to ag transition
- Logistics backfill opportunities during mining opportunities
- Future agtech electrification and automation opportunities
- Understand utilisation of existing assets – e.g. power

- Shared logistics management
- Baseline bioprospecting (algae) in saline environments (4 votes)
- Cultivating and harvesting high-value crops – e.g. hemp (1 vote, 2 cross-cutting theme)
- Biorefineries (containerised) engineering and deployment in remote locations (2 votes, 2 cross-cutting themes)
- Consider innovative opportunities ag/biomass/energy
- Assessment of opportunities that match the service providers, conduct economic analysis – water, land, soil, proximity to towns/transport; model and map sustainable intensification (algae/seaweed), biomass to energy etc (16 votes, 8 cross-cutting theme)
- Pre-closure – data sharing and information (data imaging), soil info and GIS, landscape, infrastructure, water (1 vote, 2 cross-cutting theme)
- Trials:
  - Carbon and biodiversity opportunities to integrate – e.g. trees
  - Commence while mining (10-year timeframe)
  - Stepped remediation – e.g. tagasaste (5 votes)
  - Soil amelioration – test and optimise
  - Multiple plant species – see what grows – economic analysis, productivity
  - How to speed up/optimize this process?
  - Type of varieties that work best
  - Breeding/selection of adapted plant species
- Mining closure
  - Transition to viable agriculture
  - Deployment at scale
  - Agtech and mining tech opportunities (15 votes, 6 cross-cutting theme)

### High Priorities

1. Assessment of opportunities that match the service providers, conduct economic analysis – water, land, soil, proximity to towns/transport; model and map sustainable intensification (algae/seaweed), biomass to energy etc (16 votes, 8 cross-cutting theme)
2. Agtech and mine tech opportunities – automation (15 votes, 6 cross-cutting theme)
3. Soil re-engineering and mitigating/amelioration (9 votes, 3 cross-cutting theme)

## Baseline Assessment

### Group discussion:

- Major data gaps for agricultural transition – agronomic soil metrics, heavy metals, groundwater behaviour and climate-change projections.
- Mining data is strong but not aligned to agricultural needs.
- Opportunities for remote sensing (UAVs, LiDAR, multispectral, in-situ sensors).
- Need standardised templates and checklists for pre-closure and transition-phase assessment.
- AI-driven predictive modelling can forecast long-term capability under changed climate.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Baseline opportunity of understanding population.</li> <li>• Pit lakes – what is useable water?</li> <li>• Agricultural understanding of baseline data</li> <li>• Bounce back of water tables</li> <li>• How to effectively treat contaminants/heavy metals – how does this affect root uptake of nutrients</li> <li>• Biological challenges – e.g. algae as every site is different</li> <li>• Seasonality on salinity levels</li> <li>• How to continue ongoing cultural practises</li> <li>• Remote environment</li> <li>• Data management and capacity</li> <li>• Limited resourcing</li> <li>• Time constraints/availability/seasonality</li> <li>• Safety logistical challenges</li> <li>• Lack of understanding from historical land use, environmental guidelines/changing, carbon accounting, auditing – e.g. PFAS</li> <li>• Soil/subsoil constraints</li> <li>• Seeking permission to work on land</li> <li>• Soil constraints – water holding capacity etc.</li> <li>• Indigenous knowledge about fire safety/controlled burning</li> <li>• Socio-cultural changes – who does it affect in the town? Are there Indigenous exclusion zones?</li> <li>• Climate – lightning/cyclonic activity – what does this look like for the future?</li> <li>• Cost/budget restraints</li> <li>• Lab sourcing challenges</li> <li>• Testing availability/requirements – e.g. quarterly/post natural disaster etc.</li> <li>• Climate challenges</li> <li>• Weather stations – how close are they?</li> </ul>	<ul style="list-style-type: none"> <li>• Building the economy of the town</li> <li>• CZ score – database of geological bodies</li> <li>• Geological museum – creation of a hub</li> <li>• Understanding characteristics and how to use it most effectively (2 votes)</li> <li>• Generalise approach per region, greater understanding of potential ag opportunities</li> <li>• How to maximise natural resources?</li> <li>• Real time monitoring for an ag sense</li> <li>• Better understanding heritage sites</li> <li>• Leveraging a living knowledge hub (2 votes)</li> <li>• Using ranger network to spread knowledge respectfully (2 votes)</li> <li>• Development of technologies – e.g. drones/ UAVs for tailings/safety challenges</li> <li>• Real time monitoring – e.g. water quality</li> <li>• Remediation, opportunities to trigger values clean up - sequestration opportunities – algae, legumes (2 votes)</li> <li>• AI technology to manage data use and analysis</li> <li>• Historical forecasting for budgets</li> <li>• GIS mapping/surveying/effective storing of the data/spatial data farms – integrated data management, predictive modelling – e.g. some climate, same landform, usage? (3 votes)</li> <li>• Collaborative approaches to environmental guidelines</li> <li>• Underground power for climate challenges</li> <li>• More testing for cyclonic challenges</li> <li>• How is the mine currently reacting, what is the water table, climate, salinity, what was landform previously?</li> <li>• Effective tree management</li> <li>• Water movement – opportunity for farmland</li> <li>• Baseline assessment</li> </ul>

## Research and Development Ideas

- Better understand cultural areas and incorporate traditional knowledge
- Integrating local knowledge better (2 votes)
- Better collaboration with generations – e.g. learning from Elders
- Building a living knowledge base – creating an experience (5 votes)
- Demonstration projects and examples
- Aquaculture – e.g. prawns, algae, sea sponges, sea cucumbers (2 votes, 1 cross-cutting)
- Development of assessment of technologies to integrate crop/forestry requirements – multifaceted technologies, GPS tracking, predictive modelling simplified outputs with tangible outcomes, geospatial tools (4 votes, 3 cross-cutting theme)
- Integration/AI/predictive modelling – soil understanding, weed management, native fauna, mixed-use options – e.g. solar panels and ag products (5 votes)
- Air quality dust – what are the regulations like, how does this vary (1 cross-cutting theme)
- Develop assessment techniques – is there a way to make it universal and standardised?
- Forecasting models – carbon models, hydrological models
- Temporary land uses – what does the mosaic look like? Long-term strategy?
- Create a simplified checklist of what is required in mining/ag, heritage and cultural values and understanding the baseline

## High Priorities

1. Integration/AI/predictive modelling – soil understanding, weed management, native fauna, mixed-use options – e.g. solar panels and ag products (5 votes)
2. Development of assessment of technologies to integrate crop/forestry requirements – multifaceted technologies, GPS tracking, predictive modelling simplified outputs with tangible outcomes, geospatial tools (4 votes, 3 cross-cutting theme)



*High priority ideas from the eight theme areas were highlighted. Photos: WAARC.*



# Agricultural Restoration

## Group discussion:

- Mining soils often low in organics, structurally poor, compacted, saline/alkaline, or contaminated.
- Mine machinery can reshape landforms for agricultural use (terracing, drainage, slope correction).
- Saline water offers opportunities for algae, halophytes and alternative energy systems.
- Using mine-derived waste (woody waste, food waste) for soil organic reconstruction.
- Controlled-environment systems (greenhouses, hydroponics, vertical farms) offer bypass to soil constraints, possibly on compacted areas.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Topsoil quality and potential to make soil for agricultural purposes</li> <li>• Water quality issue</li> <li>• Topography of the land and climate available for agriculture now and in future</li> <li>• Where is the land (mining area) we want to do agriculture?</li> <li>• Restrictions to use machinery equipment</li> <li>• Settlement and soil compaction</li> <li>• Returning agricultural productivity</li> </ul>	<ul style="list-style-type: none"> <li>• To make suitable soil for agricultural purposes – particle size, minerals, microbes, organics</li> <li>• Ability to use saline water and non-arable land for algae production</li> <li>• Capitalise on socio-economic factors to facilitate quick wins – e.g. coastal Pilbara and South West have opportunities</li> <li>• Link the project with Innovative Industries of the Future Conference SW 2026</li> <li>• Utilise the organic waste coming from mining – e.g. woody waste, food waste</li> <li>• Greenhouses or vertical agriculture infrastructures can be used on compacted soil areas</li> <li>• Access the heavy machine to change the topography for agricultural purposes</li> <li>• Different mine demands</li> <li>• Starting early and use the opportunities coming from mining structures</li> <li>• Pre-planning and strategic approaches to enable us to use the resources coming from mining (one vote, one cross-cutting theme)</li> </ul>

## Research and Development Ideas

- Engineer devices and methods to make soil from mine waste and limited topsoil (8 votes, 2 cross-cutting theme)
- Mapping and modelling viability assessment (12 votes, 2 cross-cutting theme)
- Turn the land to algae production (1 cross-cutting theme)
- Developing the technologies to increase water quality (4 votes)
- Develop engineer tools and technologies for improving water and soil quality (10 votes, 1 cross-cutting theme)
- Utilise the organic material coming from mining (1 vote)
- Experimental trial before mining closes (1 cross-cutting theme)

## High Priorities

1. Mapping and modelling viability assessment (12 votes, 2 cross-cutting theme)
2. Develop engineer tools and technologies for improving water and soil quality (10 votes, 1 cross-cutting theme)
3. Engineer devices and methods to make soil from mine waste and limited topsoil (8 votes, 2 cross-cutting theme)

## Agricultural Infrastructure

### Group discussion:

- Significant opportunities may be present from repurposing powerlines, pipelines, roads, airstrips, water treatment systems.
- Need early evaluation of what mining infrastructure can be retained, repurposed or expanded.
- Port infrastructure mismatch (bulk minerals vs horticulture) may need redesign or new equipment.
- Integrated planning needed to maintain local economic activity across transition phases.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Climate changes</li> <li>• Identifying the opportunities, site specific feasibility – what are the local constraints – existing infrastructure (maintenance and asset life span and capacity to maintain), tenure, community capacity, resource base mining, quality and quantity</li> <li>• Scale, compatibility and adaptability</li> <li>• Tyranny of distance/isolation</li> <li>• Tenure limits/policy</li> <li>• Market access</li> <li>• Cost of electricity – e.g. input cost production</li> <li>• Labour shortages</li> <li>• Competition with mining</li> <li>• Local government – zoning policy, inconsistent decision-making</li> <li>• Charismatic/influential influencer for buy-in</li> <li>• Culturally sensitive</li> </ul>	<ul style="list-style-type: none"> <li>• Leveraging existing climate adaptation knowledge in the ag space</li> <li>• Re-purposing of existing infrastructure – e.g. using powerlines to supply renewable energy to a market</li> <li>• Surplus – power, water and land – local manufacture – e.g. fertiliser</li> <li>• Water for manufacturing, irrigation – aquaculture, pastures, horticulture, cropping, recreation, tourism</li> <li>• Transport routes – roads, airports, rail</li> <li>• Market access, processing – supply chain access e.g. storage, bulk handling</li> <li>• Land – ag, housing, industrial</li> <li>• Water – settling ponds, water infrastructure</li> <li>• Adjacent compatible land use – e.g. rangelands fodder</li> <li>• Power, roads and airports, markets in high population locations</li> <li>• On-farm diversification – e.g. tourism</li> <li>• Leveraging existing crops</li> <li>• Building relationships through consultation and Indigenous partnership, where mutually agreed</li> </ul>

## Research and Development Ideas

- Gap analysis and match opportunities to constraints and site specifics (8 votes, 3 cross-cutting)
- Timing of infrastructure requirements – decadal scale planning and projected economic map and demand over time. Timelines developed with climate adaptation considerations (1 vote)
- Managed handover
- Applied experimentation – demonstrating use-case scenarios
- Integrated approaches to capitalising on opportunities – e.g. more than one use transition
- High-value productions - destination human experiences, innovative tourism – e.g. jet boats, symphony under the stars, golf course, accommodation
- Integrated, early fruiting, bush foods
- Food logistics – economic modelling (1 vote)
- Specialised fresh vegies – watermelon, capsicum
- Tourism economic modelling
- Integrated pilot/showcase/demo
- Hub – e.g. Desert Knowledge Hub
- Aquaculture ideas (1 vote)

## Environmental Safety

### Group discussion:

- Key risks: acidity, alkalinity, metals, radioisotopes, PFAS, buried waste, contamination exposure pathways.
- Novel remediation technologies emerging (bioremediation, phytoremediation, biocrusts, engineered microbial communities).
- Potential opportunity to recover minerals and resources from waste streams, reducing waste areas.
- Long-term environmental monitoring required for contaminants, groundwater movement, erosion and biodiversity changes.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Economic viability of trails, testing and end result value chain</li> <li>• Achieving productivity levels of normal ag land – compaction</li> <li>• Funding for research</li> <li>• Timescales for leaching in dystrophic soils</li> <li>• Novel tailings materials (trailings, not soil)</li> <li>• Unidentified contaminants</li> <li>• Water quality – acids, salts, metals and other contaminants</li> <li>• AMC and other soil challenges</li> <li>• High alkalinity challenges</li> </ul>	<ul style="list-style-type: none"> <li>• New technologies to remove contaminants</li> <li>• New technology to monitor and track</li> <li>• Improvement to regulation for waste disposal</li> <li>• Transforming mining areas to liveable areas</li> </ul>

- Technology for data monitoring
- Erosion
- Changing climate and extreme weather events
- Inability to remove certain chemicals/contaminants
- Timescales to reduce toxins
- Toxicity to organisms
- Knowing what chemicals have been used where - particularly if mine is in care and maintenance
- Buried waste at mine sites - tyres, landfill and processing chemicals, etc.

- Re-use or recovery of elements from waste – bioleaching/bioprecipitation (critical minerals, radioisotopes)
- Increasing biodiversity and connectivity to adjacent bushland
- Novel dust suppression and soil stabilisation methods – biocrust

### Research and Development Ideas

- Long-term study across all areas (soil and water) baseline, during and post mining, and smart monitoring (14 votes, 4 cross-cutting theme)
- Bench scale testing of novel technology to recover value from waste – pilot scale (also contaminant removal) (9 votes, 1 cross-cutting theme)
- Improving knowledge of contaminants - are there unknown contaminants – e.g. next PFAS, are there other uses for contaminants to turn them into beneficial products (5 votes)
- Develop and test novel monitoring tools for contaminants
- Create best practice guidance to improve the regulatory framework
- Long-term environmental monitoring – e.g. groundwater, standard set of environmental parameters

### High Priorities

1. Long-term study across all areas (soil and water) baseline, during and post mining, and smart monitoring (14 votes, 4 cross-cutting theme)
2. Bench scale testing of novel technology to recover value from waste – pilot scale (also contaminant removal) (9 votes, 1 cross-cutting theme)

## Indigenous Engagement

### Group discussion:

- Engagement must begin early and co-design is non-negotiable.
- Cultural values must be embedded in land-use decision frameworks.
- Need to account for grief, loss and intergenerational experience associated with mining.
- Many communities may not want agriculture immediately – need to respect alternative cultural land uses.
- Opportunities: mineral-uptake traditional knowledge, shared land management, training pathways from school to employment.
- Shift from engagement to partnership, knowledge-sharing and co-investment.

Challenges	Opportunities
<ul style="list-style-type: none"> <li>• Engagement fatigue</li> <li>• Free, prior, and informed consent</li> <li>• Temporal justice – time for communities to go through decision-making process</li> <li>• Relationship development</li> <li>• Transitional land-use could lead to change in native title - reopen the right to claim</li> <li>• What is the attraction of ag compared to other land-use activities</li> <li>• Engaging on what is most important to Mob, which may be land and food security and associated cultural, social and economic benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Early and meaningful engagement, support to develop capacity to engage, relationship development (5 dots, 2 cross-cutting theme)</li> <li>• Ag as another opportunity post-mining land use</li> <li>• What diversification in ag can TO's contribute to? – e.g. bush foods that may lead to health (1 vote)</li> <li>• Small-scale diversified industries</li> <li>• Ag business and food business as an alternative to be discussed with Indigenous groups</li> <li>• Acknowledge that the PBCs and TOs are right holders not only stakeholders</li> <li>• Understand the underpinning knowledge of a group and what matters to them</li> <li>• Pick a ready-to-hear group to present a water-based ag business (clean water is a key issue)</li> <li>• Discuss ownership</li> </ul>
<h3>Research and Development Ideas</h3>	
<ul style="list-style-type: none"> <li>• Examination of diversified industries – e.g. sandalwood, bush foods (9 votes)</li> <li>• Learnings from mining – ag transition (lessons learnt) (2 votes, 1 cross-cutting theme)</li> <li>• How do we co-design transition – benefit to community, overcome permitting challenges, export interest for overseas markets (9 votes, 6 cross-cutting theme)</li> <li>• How to scale up traditional food (cottage industry)</li> <li>• Indigenous knowledge for future diversification</li> <li>• Mining to ag/restoration, apply Indigenous knowledge to improve soil/water health – e.g. grazing management, pollinators (6 votes, 1 cross-cutting theme)</li> </ul>	
<h3>High Priorities</h3>	
<ol style="list-style-type: none"> <li>1. Co-design land-use framework as a foundation for land-use plans and spatial prioritisation with training opportunities and culturally appropriate indicators for agriculture and mine restoration (15 votes, 8 cross-cutting theme)</li> <li>2. How do we co-design transition? – benefit to community, overcome permitting challenges, export interest for overseas markets (9 votes, 6 cross-cutting theme)</li> <li>3. Examination of diversified industries – e.g. sandalwood, bush foods (9 votes)</li> <li>4. Early and meaningful engagement, support to develop capacity to engage, relationship development (5 dots, 2 cross-cutting theme)</li> </ol>	

## 6. Ideas for projects – small group workshops

---

The workshop voted in the key R&D ideas developed under each theme of the Roadmap.

Participants were given 10 overall votes for the R&D ideas they wanted to prioritise based on the criteria listed below:

- Investor appetite – fundable, WAARC and CRC TIME have interest.
- Ideas that are leverage points – critical to be done to enable other ideas to occur.
- Gaps – where something is required to progress the agenda, and filling this gap has real impact.

Participants were also given three cross-cutting theme votes to indicate they felt an idea cut across more than one Roadmap theme.

Each priority was developed into a project plan by a small group for development and implementation.

### Priority 1: Integrated regional planning supported by policy and investment

#### Purpose and rationale

- Mining, agriculture, conservation and community development currently operate under disconnected policy and legislative frameworks, leading to fragmented land-use decisions.
- Mine closure processes rarely evaluate different post-mining agricultural options and their potential contribution to regional economic diversification or cultural land-use aspirations.
- Without integrated regional planning, land transitions occur piecemeal, increasing risk of community pushback, regulatory conflict and poor long-term outcomes.

#### Key components

- Regional transition plans that integrate mine closure schedules, agricultural potential, conservation priorities, tourism opportunities and infrastructure reuse.
- Policy-bridging instruments, similar to US transition legislation to align tenure, planning, mining and agricultural laws.
- Tenure reform options, including clarity on residual liability, risk partitioning and pathways for transferring land for agricultural use.
- Decision frameworks that embed cultural values, community aspirations and multi-use land choices.
- Cost–benefit analysis, including trade-offs between agriculture, conservation, tourism, carbon, biodiversity and cultural land use, noting that not all post-mine land uses will be desirable, feasible or viable.
- Worked case studies for the South-West and Pilbara regions as demonstration exemplars.
- Identification of policy barriers and recommended reforms (e.g. elements of the Land Administration Act, Mining Act, Water Acts, Planning Acts).

- Regional development integration, ensuring the RDCs and local governments have defined roles in transition planning.

### Key risks and issues

- Tenure complexity.
- Uncertain liabilities.
- Policy misalignment.
- Limited regional planning capacity.
- Variable expectations across community and Traditional Owner groups.

<p><b>What is the project?</b></p>	<ul style="list-style-type: none"> <li>• Pilot testing agriculture transitions through WA policy analysis.</li> <li>• Case study – regional transition plan that integrates mine closure, ag and regional development, including business case analysis that considers the trade-offs, cost/benefit to community, identification of policy barriers and proportional analysis agriculture-conservation-tourism-other (offsets/urban)</li> <li>• Case studies – aquaculture, horticulture, terraced ag</li> <li>• Map tenure – who controls and owns?, identify bottlenecks, work through regulatory structures</li> <li>• PMLU options analysis – including ag</li> </ul>
<p><b>Who should be involved?</b></p>	<ul style="list-style-type: none"> <li>• Department of Local Government, Industry Regulation and Safety (LGIRS)</li> <li>• Department of Mines, Petroleum and Exploration (DMPE)</li> <li>• Department of Biodiversity, Conservation and Attractions (DBCA)</li> <li>• Department of Water and Environmental Regulation (DWER)</li> <li>• Western Australian Environmental Protection Authority (EPA)</li> <li>• Department of Primary Industries and Regional Development (DPIRD)</li> <li>• Local Government</li> <li>• Department of the Premier and Cabinet</li> <li>• Department of Planning, Lands and Heritage (DPLH)</li> <li>• Natural Resource Management (NRM) organisations</li> <li>• Local landholders</li> <li>• Mining companies</li> <li>• The University of Western Australia (UWA) – agricultural and resource economics</li> <li>• Traditional Owners</li> <li>• Affected communities for social licence</li> </ul>

<p><b>Potential funding?</b></p>	<ul style="list-style-type: none"> <li>• Zero Net Emissions Agriculture Cooperative Research Centre (ZNE CRC)</li> <li>• Research Development Corporations (RDCs)</li> <li>• Hort Innovation</li> <li>• CRC TIME</li> <li>• WAARC</li> </ul>
<p><b>Is there a best location?</b></p>	<ul style="list-style-type: none"> <li>• South West</li> <li>• Pilbara</li> <li>• Lake Kepwari – needed?</li> <li>• Heidleberg SCP</li> <li>• Collie</li> </ul>
<p><b>What other disciplines will we need?</b></p>	<ul style="list-style-type: none"> <li>• Socioeconomics</li> <li>• Conservation planning</li> <li>• Agriculture</li> <li>• Land-use planning</li> <li>• Geography – spatial optimisation</li> <li>• Geographic Information System (GIS)</li> <li>• Human geographers</li> <li>• Impact assessment</li> <li>• Business development</li> <li>• Policy experts</li> <li>• Legal/mining approvals experts</li> </ul>



*Participants were given 10 overall votes for the R&D ideas they wanted to prioritise. Each priority was developed into a project plan by a small group for development and implementation. Photos: CRC TIME.*

## Priority 2: Indigenous co-designed land-use framework

<b>What is the project?</b>	Indigenous-led co-designed land-use framework incorporating Indigenous knowledge and values as a foundation for land-use plans, including cultural indicators for agriculture, and spatial prioritisation for transition overcoming permitting challenges
<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Local Prescribed Bodies Corporates (PBCs)/rightsholders</li> <li>• Ranger groups</li> <li>• Industry representatives</li> <li>• Universities</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• North Australian Indigenous Land and Sea Management Alliance (NAILSMA)</li> <li>• National Indigenous Australians Agency (NIAA)</li> <li>• DPIRD</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• Gascoyne</li> <li>• Pilbara</li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Environmental science</li> <li>• Hydrology</li> <li>• Soil science/topography</li> <li>• Agriculture</li> <li>• What we have (expertise) - planning, cultural values, social science</li> </ul>

## Priority 3: Soil and water engineering and amelioration

### Purpose and rationale

- Mining soils often lack structure, nutrients, organic matter and microbial diversity, or contain elevated contaminants.
- Without soil engineering and amelioration, agricultural transition is not viable – this is the most critical technical barrier.

### Key components

- Baseline characterisation of soils (texture, compaction, chemistry, contaminants, organics, biological activity).
- Soil reconstruction approaches:
  - Engineered soil blends using waste streams (woody waste, biosolids, compost, food waste).
  - Amendment trials (gypsum, lime, clay, biochar, microbial inoculants).
  - Rebuilding soil physical structure and water-holding capacity.
  - Topography and landscape recontouring using mining machinery to create agriculturally suitable landforms.
- Salinity management solutions, including halophyte systems and algae-based production.

- Water integration, including:
  - Reuse of mine dewatering systems.
  - Opportunities for irrigated agriculture in high-water-availability post-mining sites.
- Pilot amelioration trials to determine economic thresholds, inputs and timeframes.
- Soil health indicators to determine readiness for different agricultural systems.
- Risk analysis for contaminants, including pathways, remediation options and regulatory thresholds.

### Key risks and issues

- High cost.
- Scientific uncertainty.
- Variation across sites.
- Potential community concerns about contaminants.

<b>What is the project?</b>	<ul style="list-style-type: none"> <li>• Characterising water and soil – e.g. materials</li> <li>• Context – climate, rainfall zone, accessibility of soil and water, infrastructure</li> <li>• Identifying opportunities for agriculture and aquaculture</li> <li>• Identify gaps/activities/technology to support the opportunities – e.g. saline water</li> <li>• Test the mitigation options/technology with experiments</li> </ul>
<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Mining companies</li> <li>• Research lead and research teams</li> <li>• Land use/agronomy expert to translate research outputs to practical use</li> <li>• Self-Managed Investments (SMI) expert</li> <li>• Water treatment expert</li> <li>• Soil amelioration expert</li> <li>• Ag/agtech/aquatech</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• Government</li> <li>• Industry</li> <li>• Mining company balance sheets</li> <li>• CRCs and RDCs</li> <li>• Start-up ventures</li> <li>• Regional Development Commissions</li> <li>• Marscape pilot project (SpaceX)</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• Where there is a collaborative mining company           <ul style="list-style-type: none"> <li>◦ Data sharing and degree of contamination</li> <li>◦ Easy win could be mineral sands company</li> </ul> </li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Soil science</li> <li>• Water science</li> <li>• Ag science/agtech</li> </ul>

	<ul style="list-style-type: none"> <li>• Biotechnology</li> <li>• Engineering</li> <li>• Chemistry</li> <li>• Material science</li> <li>• Farmers/aquaculturists</li> <li>• Traditional Owners</li> <li>• Industry up/downstream (inputs/uptake of outputs) – e.g. fertiliser manufacturer, mineralogy</li> </ul>
--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## Priority 4: Mapping and modelling land use viability

### Purpose and rationale

- Decisions about land use require a spatially robust, science-backed platform that links what is possible with who could invest.
- Prevents misaligned investments and supports coordinated state planning.

### Key components

- Eco-geographic mapping of soil, water, climate, slope, contaminants, infrastructure and cultural values.
- Agricultural suitability models, not only assessing capability but setting target land capability thresholds for transition.
- Opportunity identification, such as:
  - Perennial crops
  - Horticulture
  - Fodder
  - Biomass
  - Carbon and biodiversity
- Investor-matching layer enabling RDCs, private investors, mining companies and government to see ready opportunities.
- Economic modelling for each agricultural option, including water needs, labour, logistics and ESG performance.
- Integration with Indigenous co-design frameworks, so cultural priorities influence suitability outputs.
- Decision-making dashboards for government, industry and community.

### Key risks and issues

- Requires high-quality data.
- Need for transparent governance.
- Risk of oversimplifying cultural values or environmental constraints.

<b>What is the project?</b>	Opportunity matching/brokering (agri-eco geographic model) that assesses agri-ecological ability, socio-economic viability assessment in mining areas
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Universities</li> <li>• DPIRD</li> <li>• DWER</li> <li>• Minerals Research Institute of Western Australia (MRIWA)</li> <li>• UWA Centre for Exploration Targeting</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• Mining (user, beneficiary)</li> <li>• Agriculture (knowledge holder, beneficiary)</li> <li>• Government (user, beneficiary)</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• South West</li> <li>• Pilbara</li> <li>• Where there are links to Indigenous co-design</li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Geology</li> <li>• Mineralogy</li> <li>• Climate</li> <li>• Water</li> <li>• Cultural</li> <li>• Infrastructure</li> <li>• Biodiversity</li> <li>• Agroeconomics</li> <li>• Agriculture</li> </ul>

## Priority 5: Pilot demo sites and community acceptance

### Purpose and rationale

- Community acceptance is impossible to achieve through desktop work – people need to see what post-mining agriculture looks like.
- Demonstration sites de-risk investment, create community confidence, inform regulators, attract industry interest and test real-world feasibility.

### Key components

- Selection of two to three demonstration sites – South West, Pilbara and one optional inland site.
- Establishment of small-scale trials across a range of agricultural systems: horticulture, grains, fodder, perennials, woody crops, algae, controlled environment growing.
- Side-by-side comparisons: untreated mining soil vs treated vs engineered soil.
- Community engagement hubs located at the demonstration site for training, field days and knowledge-sharing.
- Integration with mining companies, showing viability and building trust around relinquishment.
- Evaluation frameworks – agronomic success, economics, environmental performance, cultural appropriateness.
- Showcase opportunities, enabling early wins and visibility for government.

## Key risks and issues

- Cost and complexity of establishing sites.
- Community perceptions of contamination.
- Governance of land access.

<b>What is the project?</b>	<ul style="list-style-type: none"> <li>• Establish demonstration sites:             <ul style="list-style-type: none"> <li>○ Base trials on best modelled land uses</li> <li>○ Who do we need to prove/derisk success to?</li> <li>○ Prove financials, marketing, operations, biological, scale, etc.</li> <li>○ Can we set up a way to invite strong projects?</li> <li>○ Is this a framework for deciding on funding towards transition?</li> <li>○ Utilise previous or new projects to be converted to demonstrate low-hanging fruit to community and mining companies looking to get into it</li> </ul> </li> </ul>
<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Industry</li> <li>• Communities</li> <li>• Ag entities</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• Joint from all stakeholder groups</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• South West is low-hanging fruit</li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Modelling</li> <li>• Financials</li> <li>• Marketing</li> <li>• Trials</li> </ul>

## Priority 6: Long-term environmental monitoring system

### Purpose and rationale

- Long-term environmental data is essential for safe transition, ESG assurance, regulatory decision making and community trust.
- Mine sites often have decades of legacy contamination and changing water systems, plus agriculture adds its own pressures.

### Key components

- Baseline and ongoing monitoring of soil, water, contaminants, biodiversity and climate.
- Smart sensor networks across sites, including in-situ contaminant probes, water quality systems, soil health sensors.
- Remote sensing (UAVs, satellite, LiDAR) to detect change in vegetation, erosion, water movement.
- AI-driven predictive models for contaminant movement, groundwater shifts and climate impacts.

- Longitudinal trials comparing rehabilitation-only areas vs agriculture-transition areas.
- Standardised environmental parameters, enabling comparability between sites and regions.
- Biodiversity and ecosystem-service indicators, integrated with agricultural productivity metrics.
- Global benchmarking (link to EU, US, Canada long-term monitoring frameworks).

### Key risks and issues

- Monitoring must be ongoing – risk of funding drop-off, data governance must be clear and ethical.

<b>What is the project?</b>	<ul style="list-style-type: none"> <li>• Environmental impact - prospecting and exploration</li> <li>• Long-term database of new and existing environmental and mine information</li> <li>• Information about contaminants</li> <li>• Mine life cycle to include agriculture, collecting data through permanent sources and remote sensing (GIS, Satellite, AI)</li> </ul>
<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Department of Energy and Economic Diversification (DEED)</li> <li>• DBCA</li> <li>• DMPE</li> <li>• DPIRD</li> <li>• MRIWA</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• Mining companies</li> <li>• European Union</li> <li>• Forest Research Foundation</li> <li>• Universities</li> <li>• Mindaroo Foundation - focus on natural ecosystems</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• Mine site where there are areas of high biodiversity <ul style="list-style-type: none"> <li>○ Pilbara</li> <li>○ South West</li> </ul> </li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Hydrology</li> <li>• Geology</li> <li>• Meteorology</li> <li>• Pedagogy</li> <li>• Biology/Botany</li> <li>• Agriculture</li> </ul>

## Priority 7: Agtech and mining tech synergies

### Purpose and rationale

- Mining and agriculture use similar technologies but for different purposes - enormous opportunities exist to merge capabilities.

- Soil compaction is a major post-mining challenge – automation and new machinery platforms can reduce disturbance and reshape landforms with precision.

### Key components

- Automation platforms for low-compaction machinery, precision recontouring and soil disturbance minimisation.
- Cross-sector sensor systems including contamination sensors, soil moisture probes, environmental monitors.
- Digital twins for post-mining landscapes to simulate agricultural potential.
- Robotics for hazardous sites, enabling early trials before land is fully safe for human operators.
- R&D partnerships with global original equipment manufacturers (OEMs) – mining and agricultural machinery manufacturers.
- Exploration of hybrid machines suitable for both mining rehabilitation and agricultural establishment.
- Integration with agtech ecosystems (data platforms, farm management systems, automation software).
- Shared workforce training, bridging mining technology skills into agricultural applications.

### Key risks and issues

- High cost of capital.
- Recognition that technology transfer is uneven across regions.
- Workforce upskilling required.

<b>What is the project?</b>	<ul style="list-style-type: none"> <li>• Rethinking soil restructuring to reduce compaction – e.g. profiling top two metres from side</li> <li>• Leverage mining soil moving equipment</li> <li>• Automation through cross-linked platforms</li> </ul>
<b>Who should be involved?</b>	<ul style="list-style-type: none"> <li>• Iluka Resources</li> <li>• UWA</li> <li>• DPIRD</li> <li>• OEMs</li> </ul>
<b>Potential funding?</b>	<ul style="list-style-type: none"> <li>• Cotton Research and Development Corporation (CRDC)</li> <li>• Mining companies</li> <li>• CRC ZNE</li> <li>• OEMs</li> <li>• WAARC</li> </ul>
<b>Is there a best location?</b>	<ul style="list-style-type: none"> <li>• Where partnerships develop</li> </ul>
<b>What other disciplines will we need?</b>	<ul style="list-style-type: none"> <li>• Soil scientists</li> <li>• Agronomists</li> <li>• Engineers</li> <li>• Geologists</li> </ul>

## 7. Mapping workshop priorities to WAARC and CRC TiME vision and priorities

Priority	Description	WAARC Objectives	CRC TiME Priorities	Alignment
<b>1. Integrated Regional Planning</b>	Regional transition plans integrating mine closure, agriculture, conservation, tourism and infrastructure reuse	Decision-support tools and business models for viable agricultural land use	Governance and tenure reform, policy frameworks, residual liability management that enables viable, feasible and desirable post-mine land use	Create a unified planning framework that embeds agriculture in post-mine transition strategies, reducing risk and enabling regional economic diversification
<b>2. Indigenous Co-Designed Land-Use Framework</b>	Embedding Indigenous knowledge and cultural indicators in land-use planning	Commitment to Indigenous engagement and co-design in agricultural science	First Nations inclusion and cultural stewardship in post-mine transitions	Build trust and cultural legitimacy, ensuring land-use decisions deliver social and economic benefits for Indigenous communities
<b>3. Soil and Water Engineering &amp; Amelioration</b>	Engineering soil blends, water reuse and salinity management for agricultural viability	Soil health and water management for sustainable agriculture	Soil reconstruction and innovative remediation technologies	Overcome the most critical technical barriers to transition, enabling productive and safe agricultural systems on rehabilitated land

<b>4. Mapping &amp; Modelling Land-Use Viability</b>	Spatial tools for agro-ecological and socio-economic viability assessment	Applied R&D for crop systems and regional planning	Geospatial modelling and economic diversification pathways	Provide a transparent, science-backed platform for investment decisions, aligning cultural, environmental and economic priorities
<b>5. Pilot Demonstration Sites &amp; Community Acceptance</b>	Real-world trials to build trust, derisk investment and showcase feasibility	Demonstrates sustainable agriculture models and tests farming systems	Social licence and community engagement through visible success stories	Create proof-of-concept sites that attract investment, build community confidence and inform policy reform
<b>6. Long-Term Environmental Monitoring System</b>	Smart sensor networks, remote sensing and AI-driven predictive models for soil, water and biodiversity	Baseline and ongoing data for agricultural R&D and ESG compliance	Environmental safety and contaminant monitoring across mine life cycles, with potential to generate new economic opportunities	Ensure credibility and compliance for both sectors, enabling safe and sustainable land-use transitions
<b>7. Agtech &amp; Mining Tech Synergies</b>	Cross-sector technology transfer for automation, soil re-engineering and precision landform management	Innovation and low-emission farming systems	Mining technology expertise for cross-sector solutions	Accelerate innovation by merging capabilities, reducing costs and creating scalable solutions for land rehabilitation and agriculture



## WA Agricultural Research Collaboration

Innovation • Transformation • Growth

[waarc.org.au](http://waarc.org.au)

| [info@waarc.org.au](mailto:info@waarc.org.au)

