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Science Agency

Communities in Transition

Rockhampton: A Living Transitions Roadmap



The economic development
unit of Rockhampton
Regional Council

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Summary: A Living Transitions Roadmap for Rockhampton

This document is a living roadmap for Rockhampton Region's transition to a more prosperous, low emissions and sustainable future by 2030. It is drawn from deep community conversations and supported by desk-top study. It has been developed as part of the Communities in Transition (CiT) project through active participation of the Rockhampton Regional Council and its community members. Support has been provided by a consortium from James Cook University, the University of Southern Queensland, the Ecoefficiency Group and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). A three-stage process was implemented in this project (Figure 1):

1. Assessing current state, risks, challenges and opportunities for the Region and identifying broad pathways for the future.
2. Rapid evaluation of innovative ideas and options that enable implementation of the broad pathways identified.
3. Embedding these pathway options and into a roadmap for transition and developing a business case proposal on a priority pathway.

Community conversations revealed key regional challenges in relation to: a) major economic opportunities and challenges; b) extreme weather events including cyclones, floods, fires and heatwaves; c) changing environmental and climate risks and increasing legislative, financial and insurance requirements; d) supply chain, consumer and shareholder pressures; e) low numbers of local businesses and slow business growth rates; f) lower than national average education, employment, health characteristics; and g) difficulties associated with retaining youth, community leadership and capacity.

Key strengths and opportunities of the Region are: a) coastal sub-tropical climate with mild winters; b) great natural assets for diverse economic activities such as a steady water supply, substantial mineral deposits, abundant solar energy, good agricultural land; c) high ecological values within dynamic and varied landscapes; d) emerging effective waste management and recycling opportunities; e) outdoor lifestyles, including agricultural, mining work and sports and recreation; f) laid back relaxed lifestyle and unique rural character;

g) a strong "sense of place" and "sense of community"; h) a strong Indigenous culture and rich Indigenous and non-Indigenous history; and i) strong governance associated with catchment and landscape planning.

The community previously articulated and has reviewed its values and vision and its aspirations and goals for the future of the Region as a great place to live, work, play, learn and invest, both now and in the future. This includes empowering community, protecting, maintaining and enhancing the natural environment, and building sustainable industry and infrastructure. It identified several broad pathways, and defined an initial set of proposed priority interventions, mechanisms and outcomes, through which the vision and goals could be achieved. These are:

- **Flood Resilience:** A major new focus on floodplain management and reef ecosystems.
- **Outward Bound:** Major new supply chain opportunity through airport internationalisation.
- **Making Water Work:** Preparing the ground for low impact agriculture, including biofuels.
- **Aquacultural Boom:** Towards a zero emissions aquaculture sector.
- **New Circular Economy:** Turbo-charging support for dynamic business and eco-efficiencies.
- **Tourism and Recreation Revival:** Environmental, river, historic and Indigenous.

These pathways are complementary and have aspects and phases that maintain, modify and transform parts of the Region to achieve the community's vision and goals. To enable these pathways, additional and key cross-cutting interventions are required, including:

1. Building digital inclusion.
2. Reliable, secure forms of energy including renewable energy.
3. Effective waste management and recycling.

An initial stage business case is proposed to set the roadmap in motion. This priority business case is on *Making Water Work for Rockhampton – Delivering greater benefit from new agricultural water, supply chains and value chains.*

This document outlines the detail of the roadmap process and represents the initial step in developing a dynamic and living roadmap for the Rockhampton Region. Its ongoing implementation will require further work in testing and developing viable options and in collating detailed

information. It will also require a continuous monitoring and regular reviews at least every two years to ensure it is updated and aligned with community vision and goals, and responds to changes in global and domestic drivers.

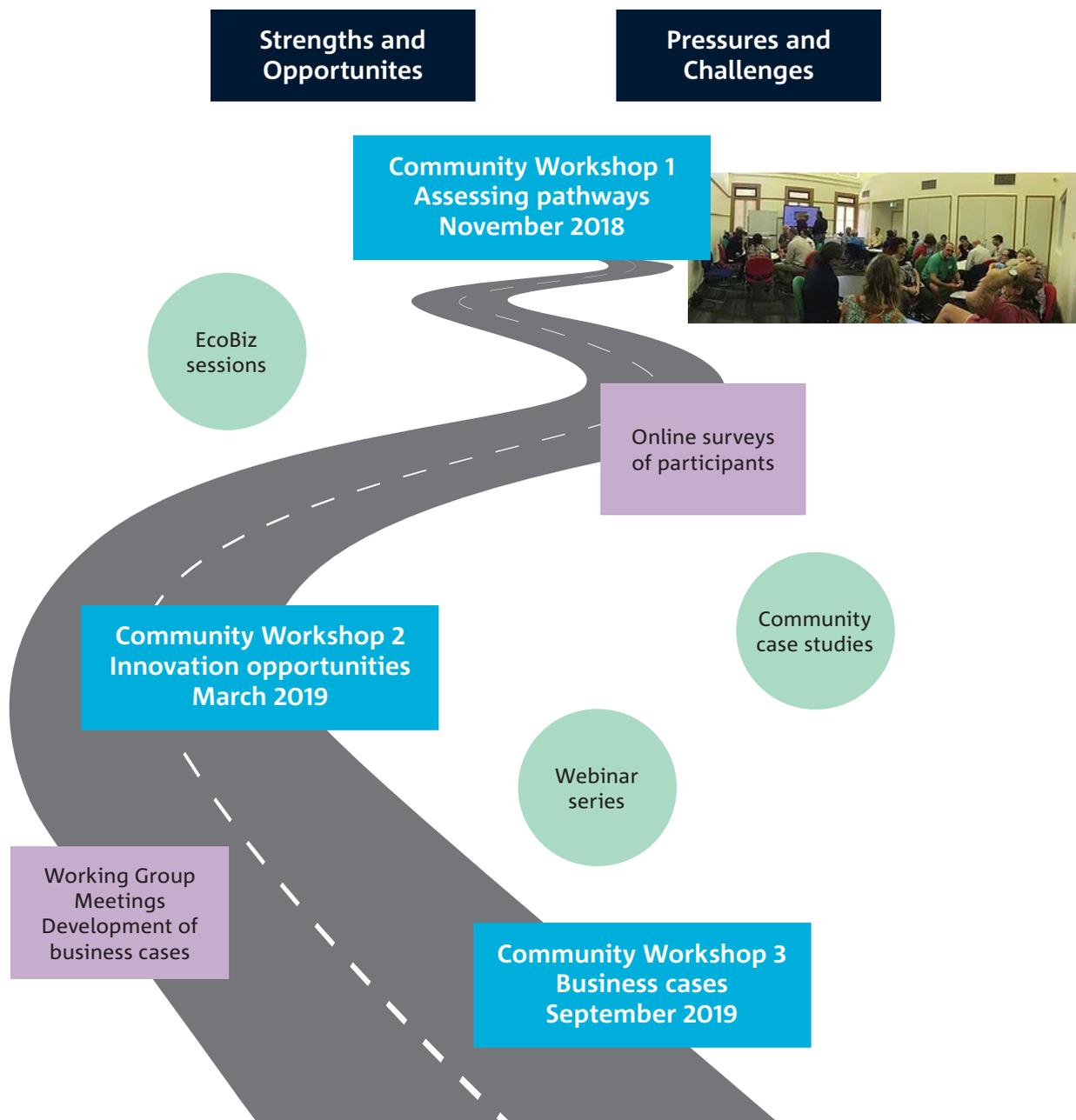


Figure 1. The three stages of the pilot program, leading to the roadmap and business cases.

Background to the project

In partnership with Rockhampton Regional Council, a team from JCU, USQ, CSIRO and The EcoEfficiency Group developed a consortium (the Clean Growth Choices Consortium) to design a program of work in response to a Queensland Government program for the delivery of a pathways approach to its Queensland Climate Transition Strategy 'Pathways to a clean growth economy' (QDEHP 2017). The Statewide strategy focuses on risks associated with environmental, social and economic changes in Queensland's regions. The Queensland Government anticipates that the economy will need to keep adjusting to stay in step with a strongly changing global economy. It assumes, however, that Queensland has a competitive advantage that will assist with the transition, and while the transition will likely occur over decades, it should start immediately to be most cost-effective. The state government has said that it will assist and guide these processes by:

- creating an environment for investment shift and innovation
- facilitating existing Queensland industries to transition
- working with Queensland's regional communities to support transition (QDEHP 2017).

The dynamics of transition are complex and challenging. Transition needs to be led by the communities themselves in ways that are socially acceptable and build collective agency in shaping the future. This document focuses on the development of a transition roadmap for the Rockhampton Region as part of the Communities in Transition (CiT) pilot program. The program is an active community capacity building process for strengthening regional leadership and resilience in dealing with economic, social and environmental change. It is helping Queensland regional communities to organise and process what is involved in transitioning over the intermediate to long term to achieve a more sustainable economy by:

- referring to values, visions and plans to guide each community
- drawing on existing networks, knowledge, skills and capabilities
- canvassing current pressures, opportunities and future scenarios and visions
- identifying broad pathways and options for transitioning and achieving sustainability goals
- developing dynamic and future-focused roadmaps
- identifying an initial set of business cases that set the roadmap in motion.

With advice from Council, the project team worked closely with community members to develop an initial transition roadmap and business case proposals. With more detailed work, a fully developed roadmap will assist the community with navigating future uncertainties and changes.

1 Developing transition roadmaps

Communities in Transition (CiT) provides a framework for communities to create future transition roadmaps, set their own directions, navigate their own pathways, and design interventions conceived and implemented by the participants themselves. The roadmap development process was informed by the Resilience Adaptation Pathways and Transformation Approach (RAPTA) (version 1) (O’Connell et al. 2016). This is a design approach to bring best practice in the formulation of programs, projects and other interventions so that they have the desired outcomes. It was modified to suit this context (Maru et al. 2018) and summarised in a three-stage process (Figure 2).

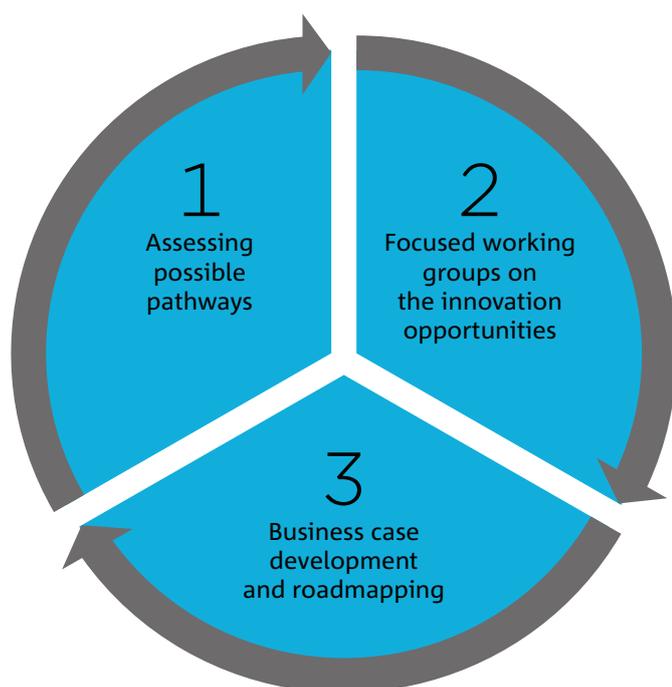


Figure 2. The three stages of the transition planning process.

Stage 1: (Sept – Dec 2018) Assessing broad pathways to the future

The process started with an assessment of the Region’s current state, reflecting on community values, heritage and aspirations, and tabling future opportunities and risks. This phase ended with the Broad Pathways Workshop which discussed the Region’s past, present and future. Participants examined the regional profile as well as key challenges and opportunities prepared by the project team and explored and identified preferred and possible broad pathways forward.

Stage 2: (Jan – June 2019) Focused working groups for innovative ideas and options

Working groups were formed around the domains of focus and broad pathways identified in Stage 1. As part of this stage, the consortium helped the groups to evaluate the real potential of the ideas as well as the enablers needed to overcome barriers and increase chances of success. They then scoped a range of new ideas, settled on the ones that are most likely to be successful, and planned a staged implementation (a ‘pathway’) including actions to address related enablers and barriers.

Stage 3: (June – November 2019) Road mapping the transition and building business cases

Results from Stage 2 were brought together into a single regional community ‘roadmap’ of steps/projects. The consortium helped to identify pathways of interdependent actions, plan the timing of these actions, scope short term priorities and prepare initial business cases to set the roadmap in motion. These were reflected upon in a final workshop.

2 Rockhampton regional profile

Current state of the Region

The Rockhampton Local Government Area (LGA) covers 6,570.3 km² which is dominated economically by beef grazing and coal mining. The area includes a small section of coast adjacent to Keppel Bay in the Great Barrier Reef World Heritage Area. To the north of the Region is the Livingstone Shire Council; the Gladstone Regional Council

and the Banana Shire are south of the Rockhampton LGA, and the Central Highlands Region lies to the west. The city of Rockhampton, the Region's capital, lies on the Tropic of Capricorn beside the Fitzroy River, about 600km north of Brisbane, and is the economic, cultural and administrative hub for Central Queensland.

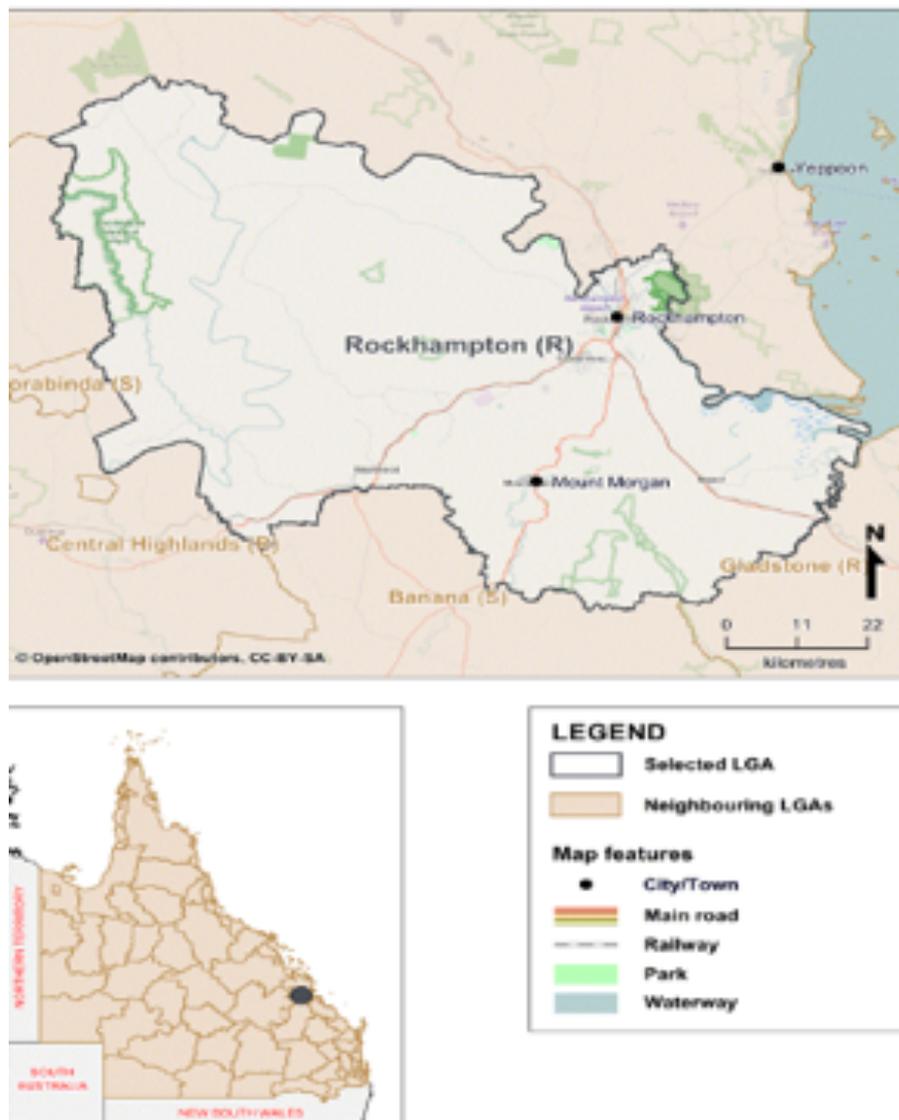


Figure 3. Rockhampton Region (Source: QGSO 2019).

Population composition and dynamics

The 2018 estimated resident population for the Rockhampton LGA was 81,067, with a population density of 0.12 persons per hectare. Average annual population growth declined in the preceding five years, at a rate of -0.2%, but averaged 0.6% over the past decade (QGSO 2019). The population is projected to increase to 104,153 by 2041, at a rate of 1% per year (QGSO 2019). More than 7% of the Region's population is Indigenous (QGSO 2019; FBA 2018). In June 2017, 14.7% of the population was aged 65+, compared with 15.0% for Queensland overall, while 64.2% were in the working age population (15-64), compared with 65.3% for the State (QGSO 2019). In the 2016 census, Australia was the birthplace for 82.7% of the population (QGSO 2019).

Landscapes and livelihoods

The Region's climate is sub-tropical, characterized by hot, moist summers and warm, dry winters. The Region has an average daily temperature range of 16.4°C to 28.0°C and an average annual rainfall of 790mm. Because the Region's annual average potential evaporation is more than twice the annual average rainfall, the area's soils are quite dry (QDEHP 2016). Rockhampton has the reputation of being Australia's 'beef capital', and is a logistics and forward deployment base for the Shoalwater Bay Military Training Area, to the city's north-east. Rockhampton is also known as a major hub for education, health and transport. In 2018, the gross regional product (GRP) was estimated to be approximately \$4.83B in the year ending June 2018, supporting around 42,674 jobs, but declining -0.5% since 2017 (NIEIR 2018). Unemployment was 7.4% at the end of the March 2019 quarter (QGSO 2019). In 2016, the top five industries for employment were: Health care and social assistance (15.1%), Retail trade (10.6%), Education and Training (9.8%), Construction (7.2%), and Accommodation and food services (7.2%) (QGSO 2019). The median total personal income for the Rockhampton Local Government Area was \$626 per week (QGSO 2019).

Challenges and opportunities

Governance, social, and economic challenges

The Rockhampton Region faces a number of fundamental challenges which underpin the ability to respond to other pressures and opportunities. It is afflicted by social and health issues including obesity and drug use in some areas. A lack of facilities and support for community organisations, including multi-cultural groups, has also been cited. Unemployment is high compared to the state average and the workforce has below average skills levels – 52.6% hold a post-school qualification, whereas 59% do for Qld overall (QGSO, 2019). By one assessment, the Region has below average numbers of local businesses and SMEs, slow business formation and growth rates, and lacks community leaders (RPS Australia East 2016). On the other hand, its overall economic performance may be explained in part by slower, but consistent growth as opposed to the boom-bust cycles evident in other regional centres. Youth tend to leave the Region for study and employment opportunities. To overcome these challenges, the Region (mainly through the Council) is applying a number of economic enablers including prudent policy and planning to strengthen partnerships and to take advantage of new opportunities; investing in infrastructure and local skills development to stimulate economic activity; and promoting the Region's strengths, lifestyle and opportunities to attract investment and people (Empower Economics 2016). The Council also plans to provide a new focus on future-oriented jobs through innovation and improved community services (RRC 2018a).

An expanding urban population means habitat loss, pressure on infrastructure, changing community character, and lack of land for affordable urban development. Emphasis tends to be on jobs and growth, with the environment a lower priority. Residents of the Region note 'imposed regulations' from metropolitan centres in the south. Meanwhile, they also cite infrastructure deficiencies such as poor road conditions (i.e. flood prone) beyond highways, and limited air links. Competition with other Central Queensland regions and towns is high, resulting in patch protection; therefore, improved collaboration is required between local councils, government agencies and industry.

Climate and extreme weather events

In recent years Queensland summers have brought an increase in severe storms and floods, droughts, heatwaves and bushfires across the State. Climate change is likely to exacerbate the frequency and severity of these events (QDEHP 2016). In 2015, the Region was battered by Tropical Cyclone Marcia, passing Yeppoon as a Category 4 system, and traversing over Rockhampton as a Category 2 system on the same day, ultimately causing at least \$750M in damage (CGCC 2019).

In coming years, it is predicted that the Rockhampton Region will experience more severe storms; more intense downpours; higher average temperatures; higher risk of fire; more risk of drought; and more frequent floods (RRC 2018b; QDEHP 2016). Extreme events affect ecosystem health, industries and settlements, disrupting their access to water, sewerage, storm water, transport and communications services. Evidence suggests that climate stresses can impact on physical and mental wellbeing, and strain limited social support services and key infrastructure in regional, rural and remote Australia (Hossain et al. 2014). The cost of personal and household insurance may also increase as a result (QDEHP 2016).

As evaporation rates increase with increasing annual temperatures, there will be higher rates of soil moisture depletion, reduced ground cover and lower livestock carrying capacity. On the other hand, a changing climate presents some opportunities for the Region's agricultural sector. Warmer wet seasons may (a) increase pasture growth and allow more frequent use of prescribed burning to control woody weeds; and (b) increase soil fertility by increasing plant decomposition and nitrogen availability. Additionally, higher levels of atmospheric carbon dioxide will increase pasture water efficiency and nitrogen uptake, although this could be off-set by an overall reduction in pasture quality (lower protein and low digestibility) (QDEHP 2016).

Tourism and recreation

The Region has about 30% of its original vegetation still intact, and includes extensive wetlands, creeks and river systems (RRC 2018b), enabling recreational activities such as barramundi fishing and river cruises. National Parks including Mt. Archer, and access to the coast and islands are also attractions. Several events draw local residents and tourists to the Region. The Rockhampton River Festival celebrates the Fitzroy River and promotes the areas' arts, culture, entertainment and food (RRC 2018c). The Dreamtime Cultural Centre is built around reconstructed sandstone caves containing the traditional "ceremonial rings" of the Darambul Tribe and also houses a retail outlet; storage for valuable and sacred material; training facilities; office space; conference facilities; art gallery; and a cultural museum (RCC & CQACCA 2018). The Tropicana gardening and sustainable living expo is an annual 'eco-do-fest' held at the Rockhampton Botanic Gardens (RRC 2018d). Another event of note is Talisman Saber, the Commonwealth Department of Defence's biennial military training activity between Australian and United States air, land and maritime forces, at the Shoalwater Bay Military Training Area. The Exercise is the largest combined military exercise undertaken by the Australian Defence Force (ADF) and in 2017 it involved over 30,000 Australian and US participants (RRC 2017b).

Communications and technology

New telecommunications services emerging across Australia provide access to services previously unavailable to rural and remote communities. For example, telehealth can assist in the long-distance diagnosis, treatment and prevention of disease and injuries by providing clinical support and improve health outcomes by connecting patients and clinicians who are not in the same physical location (Bradford, Caffery & Smith, 2015). However, communication technologies rely on certain levels of infrastructure and equipment such as the internet, computer and videoconferencing systems, and these can be expensive and poorly maintained in remote locations. Rockhampton is emerging as a 'Smart Regional Centre' using real-time data to help improve public services, grow employment, and improve community vitality (RRC 2018a). In March 2018, Telstra announced \$18M in telecommunications projects for Central Queensland to deliver new or improved mobile coverage for Central Queensland communities. Funded projects include an extension of the Internet of Things (IoT) capabilities, connecting devices and apps to new and innovative technology. For example, new projects will enable agriculture apps to access IoT sensors that let farmers measure soil moisture for crops and trees (Mesner 2018).

Consumer pressures

Cattle grazing dominates the agricultural industry in the Rockhampton Region where there is renewed interest in buying local beef. The Region's terrain, however, is suited to breeding rather than fattening, resulting in tougher meat that can be rejected by domestic and overseas consumers. Most cattle from Central Queensland are sent to feedlots elsewhere, then the beef is sent to Brisbane and mostly exported. In recent years, the problem of retaining local beef has been resolved by one grazing family who now grow barley sprout, which they feed to their cattle in small feedlots, resulting in satisfied local customers. Another issue is the sale of local beef to local restaurants, which is much easier for large-scale suppliers, because they can sell secondary cuts to other buyers as mince or sausages. A few Rockhampton restaurants are now buying locally-produced beef which is high-quality organic meat and is proving to be very popular (Terzon 2018). Because it was financially difficult to expand their beef business, one central Queensland farming couple discovered aquaculture. They use waste water from their barramundi tanks to irrigate grazing pasture, improving cattle stocking rates. Electricity, liquid oxygen and feed are the three main costs but it is profitable due to high turnover rates and high consumer demand for barramundi in Brisbane and Sydney. The couple plan to expand the aquaculture business over the coming years, and depending on demand may diversify into other species (McCosker 2016).

Energy

Fundamental changes occurring in the energy sector make solar energy increasingly relevant to the Region, given its favourable climate. Currently there is a proposal from Fitzroy River Water for a small-scale solar farm to be built on vacant land next to the Glenmore Water Treatment Plant at a cost of about \$3M. The aim is for the farm to generate enough power to run the treatment plant and deliver a full capital return within a year, as well as an additional 15% offset (Bulloch 2017). In 2015 Teys Australia's abattoir in Rockhampton installed a Wastewater Treatment Plant (WWTP) with a Covered Anaerobic Lagoon (CAL) which treats all liquid waste from the Plant & captures methane rich biogas, which is then used in site boilers replacing natural gas and coal. In this way, the abattoir has offset 20% of coal consumption required for steam demand (Tey Australia 2015). The WWTP recently won the Premier's Business Eco efficiency Award for outstanding performance in improving its operational efficiency by applying environmentally beneficial processes; and the Premier's Energy and Sustainability Award for forward thinking on good energy practices and sustainability (Tey Australia 2015).

Rockhampton City Council participates in a number of other initiatives to reduce carbon emissions including the Queensland Climate Resilient Councils Program and the Rockhampton Region Planning Scheme amendments to review advice, science & policy on climate change adaptation and renewable energy provision. A number of investigations into the feasibility of energy efficiency and renewable energy initiatives are in place, as well as reducing CO₂ emissions through the use of diesel and hybrid powered vehicles, and an energy-efficient water pumping and treatment project (RRC 2017a).

Water

The Fitzroy River, which empties into the Great Barrier Reef lagoon, is the largest river catchment flowing to the east coast of Australia (RRC 2018b). The River, together with numerous smaller rivers and creeks, feature prominently in the Region's landscape, and are a reliable source of water for domestic use, agriculture and other industries. The environmental impacts of these industries pose a major challenge, however, as sediment, pesticide, and herbicide levels in the coastal waterways and ultimately in the lagoon affect the distribution and abundance of coral and other marine organisms (Marsden Jacob Associates 2013). Future pollutant loads could increase, given the agricultural intensification outlined in the Queensland government's plans to double the value of agricultural production in the State by 2040. These plans have identified the Fitzroy River Agricultural Corridor for intensive agriculture development, with water supplied from the new Rookwood weir (RDAFCW 2018). The new weir will also enable a back-up supply of water for Gladstone, Rockhampton and the Livingstone Shire (RDAFCW 2018). New infrastructure is also planned to improve flood mitigation of the Fitzroy River, as periodic flooding in the Region has led to significant damage to buildings, houses, agricultural production and transport infrastructure (RRC n.d; 2018e).

A number of small-scale measures are in place to encourage increased water efficiency, improve quality and ensure security. Rockhampton Regional Council offers residents a rebate for installing water-efficient products (RRC 2018f). The WWTP at Teys Australia's abattoir uses a Biological Nutrient Removal (BNR) System to significantly improve waste water quality, allowing for a greater number of potential reuse opportunities (Tey Australia 2015). The Glenmore High Lift Water Pump Station has a new diesel generator capable of supplying backup power to the entire water treatment plant site, and new pumps to enable a continuous and reliable supply of water to the whole community in times of extreme weather and other emergencies (Dickers 2016).

Waste

Rockhampton Regional Council has a Waste Reduction and Recycling Plan which provides a framework for the collection, treatment and disposal of waste generated within the Region; sets long term targets to minimise landfill; sets out a strategy to maximise the recovery and reuse of waste; and ensures ongoing compliance with legislation. Within the Region there are two landfill areas; four waste transfer stations; nine roadside bin stations; and the Central Queensland Material Recovery Facility which also serves neighbouring councils (RRC 2016).

3 Vision

Aspirations and goals

The goal is to build a Region that is a great place to live, work, play, learn and invest, both now and in the future. This includes empowering community, protecting, maintaining and enhancing natural environment, and sustainable industry and infrastructure.

Values

Values were discussed in groups at the first workshop, not in terms of assets but what people valued about Rockhampton. There was a clear consensus on values such as diversity of the economy, liveability, collaborative willingness, relative safety, relationships and connections, social and cultural diversity, resilience and pragmatism, a sense of belonging, and a sense of Rockhampton being neither too big nor too small. This echoed the values articulated in the Rockhampton Regional Council's Corporate Plan 2017-2022.

Plausible scenarios

Participants discussed key current and future challenges and opportunities facing Rockhampton as summarised in Table 1.

Table 1. Challenges and opportunities.

CHALLENGES	OPPORTUNITIES
Climate/extreme weather conditions – floods, heat, cyclones	Coastal sub-tropical climate with mild winters
Changing environmental risks, including climate risk, changing government policies and consumer and shareholder pressures	Great natural assets for diverse economic activities – steady water supply, important mineral deposits, abundant solar energy, good agricultural land
International trading hampered by political and/or practical barriers affecting trade	High ecological values with varied landscapes
Below average numbers of local businesses, slow business formation and growth rates.	Outdoor lifestyle – agricultural, mining, sports and recreation
Population with lower than national average educational, employment and health characteristics	Diversifying from traditional focus on beef, exploring new products and industries
Perceptions by some of 'imposed regulations' from metropolitan centres in the south.	Strong governance associated with catchment and landscape planning
Always a challenge to maintain community leadership and capacity	Container Refund Scheme (CRS) – economic opportunities, litter reduction
	Laid back relaxed lifestyle and unique character
	Both Indigenous and Non-Indigenous history adds to 'sense of place'
	Rich Indigenous culture – local Traditional Owners hold key information about country/culture.
	Strong 'sense of community' across the Region.

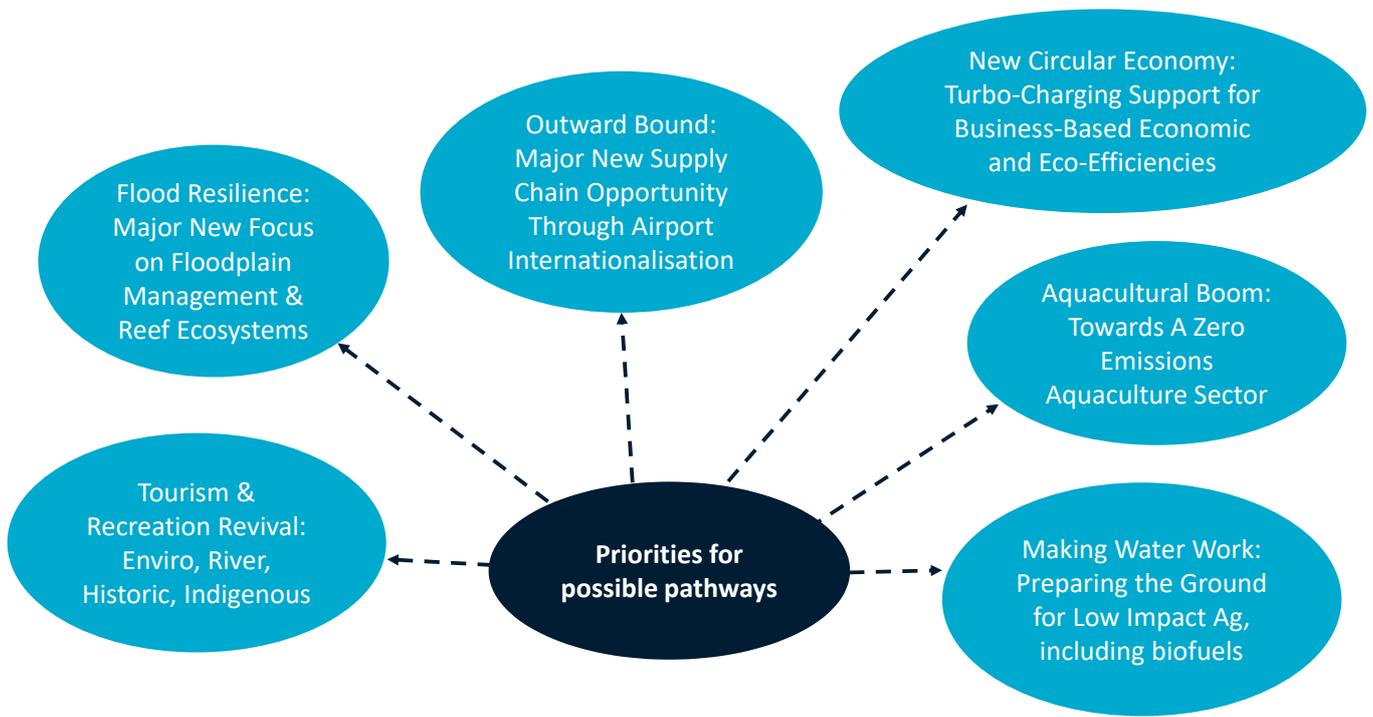


Figure 4. Six priority pathways contributing to broad transition.

4 Priorities and pathways

There is uncertainty about some of these challenges and opportunities: how and when they may unfold, as well as how they will interact. This requires the development of robust and flexible pathways to building a region strong on livability, jobs, leisure, learning and investment.

Priorities

Workshop participants identified priority pathways that were considered and discussed including:

- **Outward Bound:** Major new supply chain opportunity through airport internationalisation.
- **Making Water Work:** Preparing the ground for low impact Ag, including biofuels.
- **Aquaculture Boom:** Building in the new aquaculture opportunity.
- **New Circular Economy:** Turbo-charging support for dynamic business and eco-efficiencies;
- **Tourism & Recreation Revival:** Enviro, River, Historic, Indigenous.
- **Flood Resilience:** A major new focus on floodplain management and GBR ecosystems.
- Telecommunications.
- Ecosystem services.
- Waste management.

This list of nine priority areas were further refined to six shown in Figure 4 that might contribute to pathways for building a resilient regional economy emerged, taking into account some of the risks and uncertainties identified earlier:

- **Flood Resilience:** A major new focus on floodplain management and reef ecosystems.
- **Outward Bound:** Major new supply chain opportunity through airport internationalisation.
- **Making Water Work:** Preparing the ground for low impact agriculture, including biofuels.
- **Aquacultural Boom:** Towards a zero emissions aquaculture sector.
- **New Circular Economy:** Turbo-charging support for dynamic business and eco-efficiencies.
- **Tourism and Recreation Revival:** Environmental, river, historic and Indigenous.

5 Dynamic roadmap for the future

Types of change pathways

Each of the identified three broad pathways will build and enhance existing resource use and livelihood systems in the Region in the short term; modifying some aspects gradually and even transforming other aspects by radically changing and/or adding some significant new components

into the Regional economy. Therefore, it is possible to envisage each proposed pathway as having different stages or aspects to maintain, modify and transform the Region (Figure 5). Each requires different types of interventions.

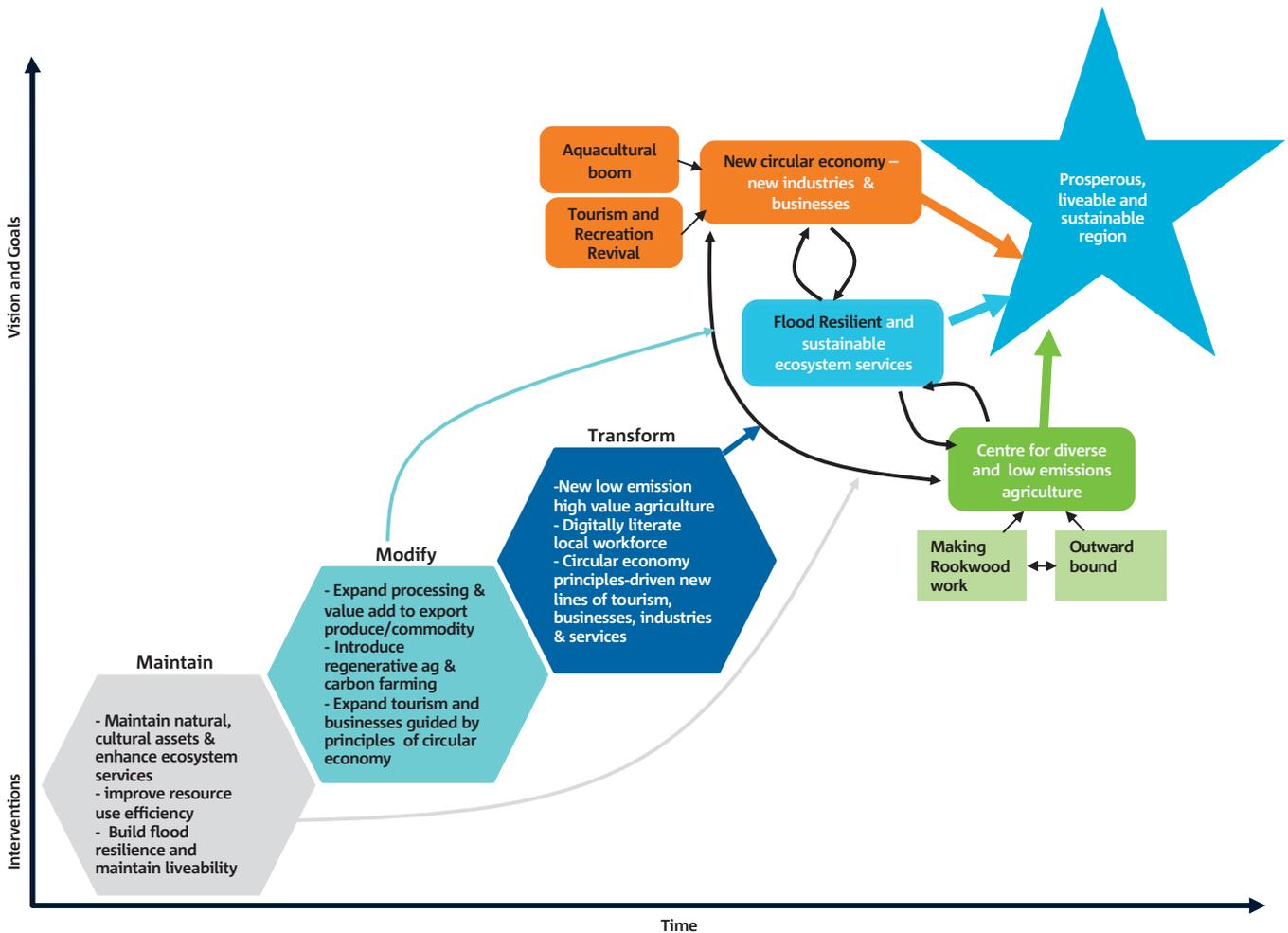


Figure 5. Key strategic activities intended to maintain, modify and transform aspects of the region to achieve vision and goals.

Table 2 below is a summary of a suggested primary focus of each stage, without precluding work that could be initiated for the other stages as part of the broad and dynamic road map.

To enhance visualisation of the broad pathways, Figure 6 shows strategic interventions that will maintain, modify and transform aspects of the Rockhampton Region to realise the vision and goals.

Further, there are three cross cutting interventions identified in workshops and discussions that could enable the realisation of the six broad pathways identified. These are:

1. **Digital connectivity:** Digital technology is expected to offer significant opportunities in improving efficiencies in existing businesses, industries and services as well as supporting emergence of new ones. Digital innovation will also replace low skill and repetitive jobs. This will require preparing and building digitally literate workforce and businesses. All six transition pathways will require greater connectivity.

2. **Renewable energy:** Low impact agriculture and the other pathways will require expansion of affordable and renewable energy from different sources and across the Region. This will be important for the Region and the different industries to contribute to emissions reductions. The construction and maintenance of these energy resources will need development of local skills and will provide employment opportunities. A large solar farm, for example, is now being built on a 700ha site on the outskirts of Rockhampton, which would provide power for about 60 000 homes (Gately 2017).
3. **Integrated waste management:** Waste management still poses a problem for the Region, as it does elsewhere. For example, the major landfill site is located next to the Fitzroy River, the second largest waterway in Australia. During large flood events there is the potential for contamination of the river water by waste dumped at the site.

Table 2. ‘Maintain’, ‘modify’ and ‘transform’ aspect/phases of the three Broad pathways.

BROAD PATHWAY	MAINTAIN	MODIFY	TRANSFORM
Rockhampton as a centre for low impact agriculture through Making Rockwood Work and Outward Bound and Airport internationalisation	Maintain and expand existing livestock and crop industry and rural lifestyle Maintain existing road, rail and air transport. Maintain Security of water access. Maintain respect to one another and liveability in the region. Local values.	Focus on processing Value ad high quality produce/commodity where possible instead of direct export of everything. Expand and diversify transport networks. Water security and trading functionality, Efficiency of land use.	Low emission and circular agriculture. New high value horticultural products and food value chains New and well networked supply and distribution hub. A region with integrated renewable energy, smart water uses and food production/ processing and waste recycling.
Protection, maintenance and enhancement of ecosystem services starting with ensuring Flood Resilience	Build flood resilience. Reduce waste and emissions from businesses and industries.	Expand and diversify existing biodiversity stewardship services and Carbon farming. Adopt better environmental conservation goals.	Identify and generate new business in ecosystems services.
New circular economy starting with Tourism and Recreation revival and Aquaculture Boom	Promote circularity in existing industries, businesses and services to improve efficiencies in water, energy and other input starting in tourism.	Provide incentive for reducing input use, material, energy re use recycling and money recirculation in the region.	Establish new businesses and industries such as aquaculture to enable large scale circularity of the economy to "meeting the needs of the present without compromising the ability of future generations to meet theirs".

Intervention options

Legend:

Green set = maintain Blue set=modify Orange set=transform

In black font = priority area of focus

Dotted line –early stage hard line –established

No intervention

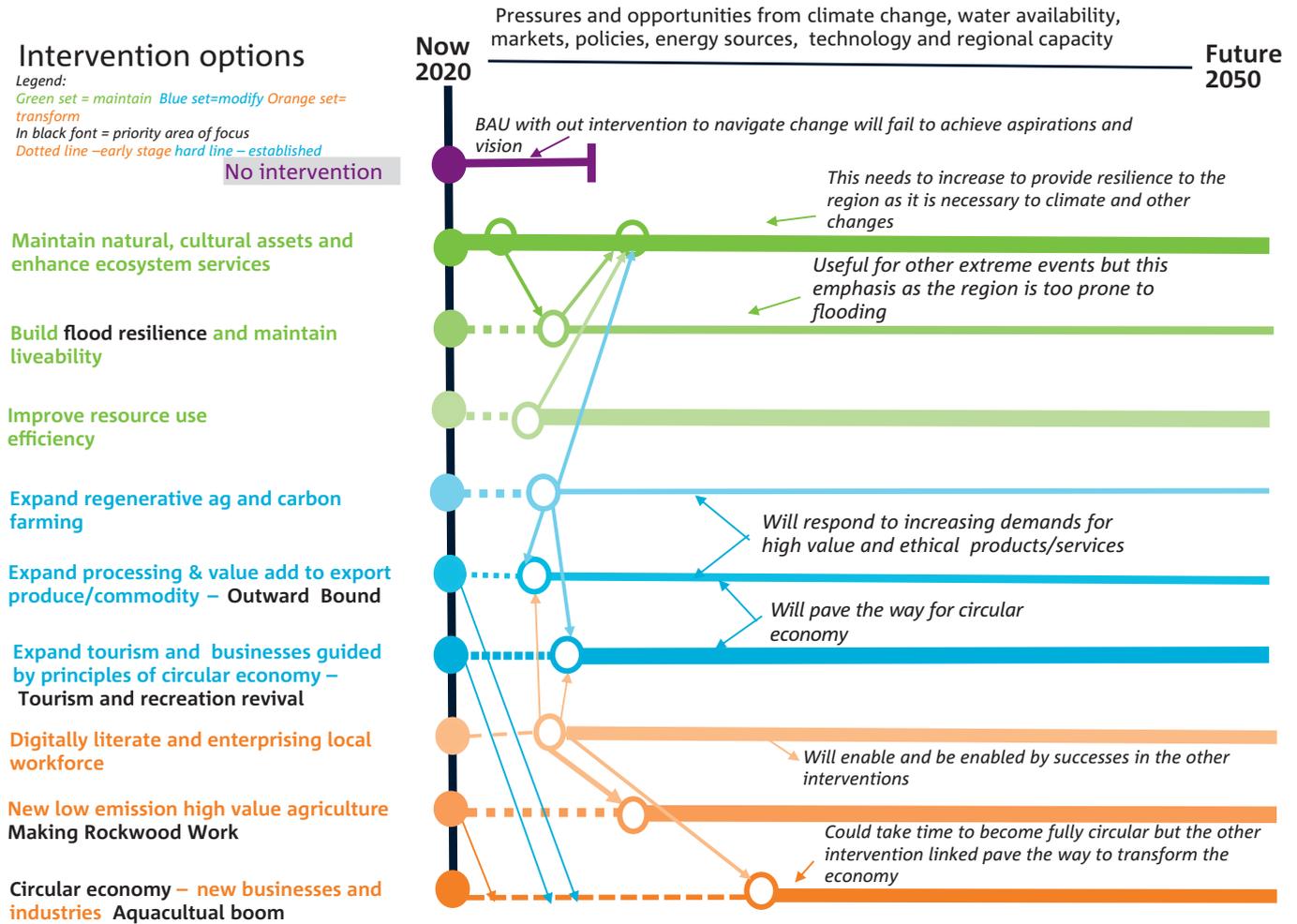


Figure 6. Sets of intervention options to ‘maintain’, ‘modify’ and ‘transform’ aspects of the region and their interdependencies.

6 Towards a business case for the priority pathway

Implementing the Priority Pathway

Each of the six pathways require feasible and effective sets of interventions options (investment, policies, programs, projects, and practice change) that need to be prioritised, sequenced, combined and implemented to transition from the current state of the Region into the vision. The Pathways can be complementary or alternative to allow flexibility in addressing uncertainty in how the challenges and opportunities may unfold in the future.

The Making Water Work pathway was identified as the priority pathway to be progressed within the resources currently available through the CiT Program. To progress this pathway to a business case involved further community conversations, and an online survey of stakeholders to elicit their preferences for key components of options within the prioritised pathway. The prioritisation was completed via a second workshop which listed options for further investigation (See Table 3.)

The Making Water Work Pathway

A business case has now been developed, focusing on identifying studies and interventions that could lead to Rockhampton as a low impact agriculture centre. In this sector, Rockhampton has many advantages over numerous regions across Australia. One of the most critical is that it has the largest freshwater river catchment on the eastern seaboard of Australia (the Fitzroy River catchment), combined with suitable soils for irrigation. It is also well positioned to service significant growth in new agricultural commodities into near northern markets. At the same time, increasing water prices and declining water availability are driving renewed interest from other irrigation regions in northern Australian development opportunities. Recent related supply chain analysis further north in Townsville suggests significant unmet demand for typical agricultural products across key markets including South East Asia, China and the Middle East. Of relevance to Rockhampton, that work identified five priority products, including intensive beef cattle, on-shore aquaculture, pulses and avocado, with nearly \$3B of currently unmet demand in global markets.

Table 3. Prioritised initial set of options for progressing the Making Water Work pathway.

OPTIONS AND PROJECT IDEAS	NO. OF RESPONSES
New Forms of Local, Secure, Affordable, Dispatchable and Low Carbon Energy to Drive Agricultural Growth	8
Visionary Land Use and Infrastructure Planning to Reduce Costs and Impacts and Strengthen Supply Chains	8
Next Generation Skills for a Circular Economy	5
Best Management Practices and Regional Composting in Nutrient Management and Monitoring	4
More Effective Water Trading and Local Management	4
New Protected Cropping Systems and Agricultural Engineering and Enabling Substantive Recycling	3
New Forms of Zero Emission Aquaculture and Macro Algae Use As Ameliorants	1
Water infrastructure development	1
Environmental credential systems	1
Stronger Digital Data Hubs and Value Chain Resilience and Innovation	0

In a strong sign of the Region's capacity to service these markets, and to further harness the economic opportunities from this water source, the Federal Government and Queensland State Government have collectively agreed to fund \$352 million towards the construction of the Rookwood Weir on the Fitzroy River. Rookwood Weir will deliver up to 42,000ML of water to help generate agricultural industry development along with supporting urban and industrial growth and water security (76,000 ML in total). This will be in addition to the existing storages found between the Barrage and Rookwood Weir (Barrage 60,150 ML and Eden Bann Weir 26,260 ML). This will enable the transition of land use towards the production of priority demand-led products.

The Fitzroy Agricultural Corridor is the first major new irrigation development in Queensland for a generation, and achieving economic, social and environmental resilience will mean making every drop of work hard for the Rockhampton community. The new development has the potential to herald internationally ground-breaking opportunities for the expansion of the next generation of value-rich horticultural, cropping and livestock developments. This new approach is needed as agricultural development comes with a series of previously silent challenges. New State regulations for water run-off from farms seeks to achieve no net decline in GBR water quality. There are higher infrastructure costs, higher energy costs and higher general farming input costs. Consumer markets demand increasingly high product standards.

Consequently, the most significant challenge for the development of agriculture will be effective management of water allocations to enable higher value and much more efficient, low impact agricultural ventures and supply chains. The Making Water Work pathway explores, scopes and maps:

- agricultural supply chain visions and potential production system models
- visionary land use and infrastructure planning that can deliver on this promise, including innovative road, airport, port and communications solutions
- integration with reliable, affordable and low-carbon energy options
- catering for protected cropping, smaller scale farming and farm services innovation
- next generation production system practices that meet the new GBR regulations.

Combined with new supply chain, value chain and waste reduction and energy sector thinking, the opportunity exists for the Region to lead the way in new and exciting developments in these approaches. New thinking and technologies present great opportunities to shift towards a more circularised economy and more integrated and value-rich supply chains in the agricultural sector. These include new techniques in the design and management of new agricultural lands, nutrient extraction in aquaculture, and the potential for greater integration of feed production, soil enhancement and nutrient reuse between sectors. This Making Water Work pathway will focus a combined government, community and industry effort on identifying the opportunities, constraints and strategies to achieve this outcome.

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Contact us

1300 363 400

+61 3 9545 2176

csiroenquiries@csiro.au

csiro.au

For further information

Land and Water

Dr Yiheyis T Maru

Principal Research Scientist

+61 2 6246 4171

yiheyis.maru@csiro.au

research.csiro.au/eap