Expression of interest reference: A.7.2122007 Visionary land use planning to facilitate development precincts

Making Water Work in the Rockhampton region

Project reference: A.7.2122007 Visionary land use planning to facilitate development precincts

Background

With major economic and social challenges and opportunities shaping the future of Queensland's regional communities, the Rockhampton Regional Council (RRC), the Queensland Government, through its Department of Agriculture and Fisheries (DAF) and the Department of Environment and Science (DES) and the Cooperative Research Centre for Developing Northern Australia (CRCNA) have been working together to maximise the future sustainable development opportunities emerging from available water resources in the Lower Fitzroy Basin.

Early stages of this work culminated in the development of a broad **Making Water Work Business Case** (see Appendix 1). This business case represents the Rockhampton region's wider integrated approach to maximising the economic, social, environmental and cultural value from the new Rookwood Weir development and other available sources of water.

Key stakeholders with an interest in this **Business Case** (Appendix 1) have formalised collaborative governance arrangements through the *Making Water Work Governance Group* that oversees this work, chaired by Advance Rockhampton in partnership with the CRCNA Chief Scientist and DAF. Justification for shared investment between the CRCNA, DAF and RRC in progressing this business case includes:

- The need to deliver high value water security in the region
- The opportunity to unlock significant unmet agriculture export and domestic demands
- The potential to explore many new jobs from new agricultural development, food manufacturing and export of agricultural products and materials
- The existence of important agricultural and pastoral development opportunities in the Rockhampton Regional Council area and the Lower Fitzroy
- A growing policy and consumer pressure for a more circular and value rich agricultural economy, particularly in the Great Barrier Reef lagoon.

Five (5) key scoping Sub Projects have been identified and resourced to help progress this broader **Making Water Work Business Case** within the Rockhampton Regional Council area within the context of the Lower Fitzroy basin**.** These include:

1. Defining a supply chain and development precincts vision
2. **Visionary land use planning to facilitate development precincts**
3. Mobilising strong water governance arrangements

4. Integrating nutrient, waste and energy streams in agricultural development
5. Achieving reef water quality requirements in new agricultural development.

This EOI applies to the **second** of these Sub Projects. It is intended that Sub Projects 1, 2 and 3 will be released first and around the same time, and that successful proponents will communicate with each other during their completion. Sub Projects 1, 2 and 3 will also provide foundational knowledge and data to inform later release of Sub Projects 4 and 5.

The Job

The proponent is required to undertake the following activities:

Visionary Land Use Planning to Facilitate Development Precincts		
1	Opportunities & constraints development for potential and staged agricultural development.	To support the Supply Chain and Development Precincts Vision (Sub Project 1), and building on existing Rockhampton Regional Council data layers, develop the key opportunities and constraints layers to help identify potential staged agricultural (horticulture, cropping and livestock) and aquacultural development, together with associated infrastructure development.
2	Planning instrument analysis.	**Explore the most appropriate planning instruments, planning provisions and planning sequencing options** required to help facilitate development and investment in emerging development precincts (e.g. State Development Areas, Ag Development Precincts, Strategic Assessments under the EPBC Act etc.).
3	Planning foundations report for South Yaamba.	Based on the South Yaamba District (see Appendix 2), provide a Planning Foundations Report for an agricultural precinct, starting with an outline of existing agricultural production and additional areas where commercial cropping and horticulture could be undertaken in line with soil suitability and landholder aspirations. The Planning Foundations Document would include advice on: (i) a proposed water distribution system; (ii) necessary road and transport treatments; (iii) required power/ energy, digital communications, innovation infrastructure and other necessary infrastructure; (iv) waste streams generated; and (v) areas based management of water, sediment and nutrients

Expression of interest reference: A.7.2122007 Visionary land use planning to facilitate development precincts

Eligibility

To be considered eligible, any responses to this EOI must:

- Demonstrate that the lead proponent has strong partnerships in place to deliver on the required activities
- Demonstrate how they will deliver this proposed project within a maximum 12-month timeframe
- Be able to secure cash and in-kind commitments from the lead organisation and research partners to match the requested CRCNA funding - at least 25% cash and 25% in kind of the total project cost
- Have a proven track record across the skills required to achieve the objectives of the EOI.

Selection criteria

- Provide evidence of project management capability, including technical competency in delivery the project and administrative capacity (including appropriate systems) to meet project reporting and financial management obligations to deliver this project on time (12 months) and within budget.
- Provide a clear demonstration of the partnership capacities required to partner with key relevant stakeholders in the Rockhampton and Lower Fitzroy region.

The process

- This is an open EOI process with submissions due **5pm AEST Friday 29 April 2022**
- Responses should be provided by filling in the required EOI form
- EOIs will be evaluated by the *Making Water Work Governance Group*
- Successful proposals will be presented to the CRCNA Board for final approval
- Once approved, successful proponents work with the CRCNA staff and the *Making Water Work Governance Group* to develop a detailed project plan and budget
- This plan forms the basis of the CRCNA participant agreements and contracts which need to be fully executed before projects commence.

How to apply

Proposals are to be submitted on the EOI form**.**

Format for Deliverables

MS Word and PDF documents will be accepted for the draft and overall report.

Key contacts for information relating to this EOI

Strategic EOI Advice	**Administrative Advice**
Allan Dale (CRCNA Chief Scientist)	Carla Keith (CRCNA General Manager)
0418 736 422	0499 330 051
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Expression of interest reference: A.7.2122007 Visionary land use planning to facilitate development precincts

Appendix 1 – Business case

Communities in Transition

Business Case

Making Water Work in the Rockhampton Region

Delivering Greater Regional Benefit from Agricultural Water, Supply and Value Chain Development for the Rockhampton Region



(IMAGE SOURCE: https://www.i-q.net.au/wp-content/uploads/Queensland-18x449-300-ppi-Rookwood-aerial_2-min-3264x1632-855x0-c-default.jpg)

Acknowledgements

Funding for this report was provided by the Queensland Government's Department of Environment and Science (DES), and delivered through the Clean Growth Choices Consortium. The consortium is comprised of experienced practitioners and academics from the University of Southern Queensland (USQ), James Cook University (JCU), CSIRO and The Ecoefficiency Group (TEG). The consortium team would like to acknowledge the strong support we received from DES, especially from Georgine Roodenrys, Matthew Arthur, Sandra Avendano and Rosanna Virzi.

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Executive summary

The Rockhampton Region's community is building on its economic, social and environmental assets to create a stronger economy. On the back of a broad options assessment, the Region has agreed a priority development pathway that will focus on growing, transitioning and intensifying the irrigated agricultural sector. This focus will deliver greater economic, social and environmental benefit from every additional megalitre of water brought on line for agriculture in the Region. In this sector, Rockhampton has many advantages over many Australian regions. One of the most critical is that it has the largest freshwater river catchment on the eastern seaboard, the Fitzroy River catchment, and soils suited to 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 a decline in water availability are driving renewed interest from other irrigation regions in Northern Australian. Recent related supply chain analysis further north in Townsville suggests that there is 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 avocados, accounting for nearly $3 billion of currently unmet global demand.

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 and Queensland State Governments have collectively agreed to fund $352 million towards the construction of Rookwood Weir on the Fitzroy River. Rookwood Weir could deliver up to 42,000ML of water to help generate agricultural industry development along and support urban and industrial growth and water security (76,000 ML in total). This will be in addition to the existing storages between the Barrage and Rookwood Weir (Barrage 60,150 ML and Eden Bann Weir 26,260 ML). This water 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, but achieving economic, social and environmental resilience, will mean making every drop of water work hard for the community.

This 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 activities. 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 Great Barrier Reef (GBR) water quality. We face 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, whether they be they large or small in scale.

To assist in this transition, the Communities in Transition (CiT) Program, funded by the Department of Environment and Science (DES) and supported by CSIRO, James Cook University (JCU), the University of Southern Queensland (USQ) and The Ecoefficiency Group (TEG), have been working with Rockhampton Regional Council's economic group Advance Rockhampton and the Region's wider stakeholders to create and implement this *Making Water Work* initiative. The initiative will explore, scope and map:

- The required agricultural supply chain visions and potential production system models

- Visionary land use and infrastructure planning that can deliver this promise, optimising effort; including innovative road, airport, port and communications solutions
- Integration with reliable, affordable and low-carbon energy/waste management 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 and more efficient supply chain, value chain, waste reduction and energy sector thinking, the opportunity exists for the Region to lead the way with exciting developments in these approaches. New thinking and technologies present great opportunities to shift towards a more circular economy and more integrated and value-rich supply chains in the agricultural sector. These include new techniques in the design and management of 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* business case will focus a combined government, community and industry effort on identifying the opportunities, constraints and strategies to achieve this outcome.

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SECTION ONE – STRATEGIC CONTEXT

Options analysis

The *Making Water Work* initiative evolved from the *CIT* Program, an active community development and capacity building process for strengthening regional resilience in dealing with economic, social and environmental change. The first stage of the program included the development of a *Community Resilience Framework* from which a community profile was created. Next came a series of deeper community conversations, asking stakeholders to describe pressures and opportunities facing their community. A desk-top study, together with information provided by the community conversations, led to broader consensus on a prioritised set of transition pathways and options for the future of the Region. These are listed in the third column of Table 1.

Table 1: Linking regional pressures and opportunities with plausible pathways

Current pressures & future challenges	Current strengths & opportunities for the future	Some options/ideas for broad pathways
• Climate/ extreme weather conditions – floods, heat, cyclones • Changing investment risks, including climate risk, changing government policies and consumer and shareholder pressures. • International trading hampered by political and/or practical barriers affecting trade partnerships • Below av numbers of local businesses, slow business formation & growth rates • Population with lower than national average educational, employment and health characteristics. • Perceptions by some of 'imposed regulations' from metropolitan centres in the south • Always a challenge to maintain community leadership and capacity (RPS Australia East 2016).	• Coastal sub-tropical climate with mild winters • Great natural assets for diverse economic activities - steady water supply, important mineral deposits, abundant solar energy, good agricultural land • High ecological values with varied landscapes • Outdoor lifestyle –agricultural, mining, sports and recreation • Diversifying from traditional focus on beef, exploring new products and industries. • Strong governance associated with catchment and landscape planning • Container Refund Scheme (CRS) - economic opportunities, litter reduction (Boomerang Alliance 2018). • 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	**Making water work:** preparing the ground for low impact agriculture **Aquaculture boom:** Towards a zero emissions aquaculture sector **Flood Resilience:** Major new focus on floodplain management & Great Barrier Reef ecosystems **Focus on Ecosystem Services** **Outward bound:** Major new supply chain opportunity through airport internationalisation. **Tourism & recreation revival: enviro, river, historic, indigenous** **Effective waste management** **Communications & big data** **New circular economy:** turbo-charging support for business-based economic and eco-efficiencies

Because of its potential for significant economic progress and value-intense industry, one clear priority pathway, *Making Water Work* became apparent through workshop discussions of several potential pathways, based on regional pressures, challenges and opportunities for the future. Agreement on this pathway was based on a number of considerations including:

- The recent announcement of the construction of Rookwood Weir
- Shared government identification of the Fitzroy River Agricultural Corridor for intensive agriculture development, with water supplied from the new weir
- Opportunities to shift towards a more circular economy in the wider agricultural sector (e.g. exploration of new techniques in the design and management of new agricultural lands)
- Combined with new value rich supply chain thinking, the opportunity exists for Rockhampton to lead the way in new and exciting global developments
- The need to meet particular obligations to protect the Great Barrier Reef (GBR) and to achieve "no net decline" in GBR water quality under prosed new regulatory arrangements
- Identification of Aquaculture Development Areas at Bajool and Raglan by the State Government.

The second stage of the program involved an online survey of stakeholders to elicit their preferences and priorities for options within the *Making Water Work* pathway. The option prioritisation was completed through a second set of workshop discussions, based on options and criteria shown in Appendix A. Further discussions with the Rockhampton City Council and other key stakeholders have resulted in the key concept and components within the *Making Water Work* initiative (Figure 1).

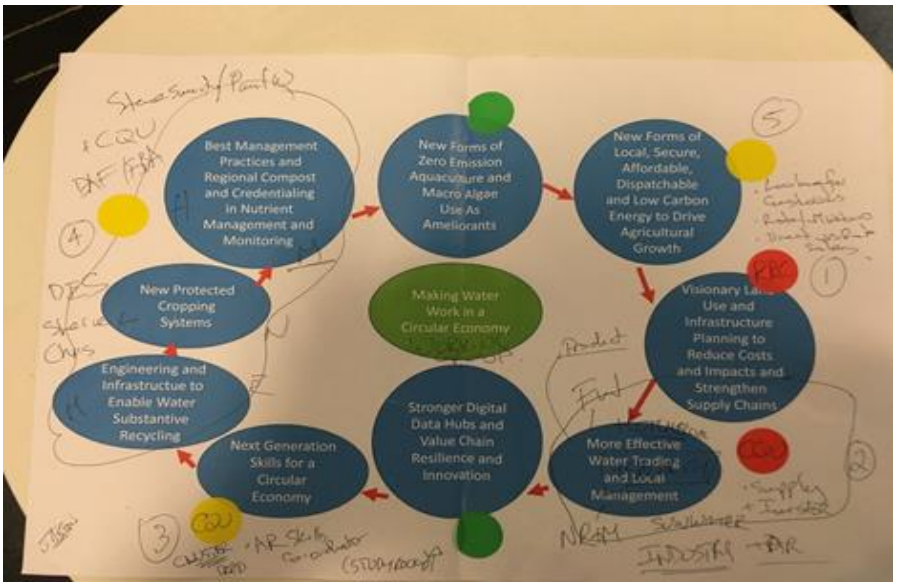


Figure 1: Prioritisation of pathways options: The green circle in the middle is the preferred pathway, blue circles represent potential options, red dots represent foundational options, yellow dots essential options and green dots represent desirable options that maybe realised in the future

The key concept

The Fitzroy River Catchment, located in the Rockhampton Region, is the largest freshwater river catchment on the eastern seaboard (RRC 2018). However, it is experiencing increasing water demands from continued urban and industrial growth, mining development, agricultural activities and other issues in the Region. The Central Queensland Regional Water Supply Strategy (CQRWSS) (DNRW 2006), identified that further infrastructure on the lower Fitzroy River is required to meet short, medium and long-term demands for high priority water (Sunwater & GAWB 2015). Recent and related supply chain analysis further north in Townsville suggests that there is significant unmet demand for typical agricultural products across key markets including South East Asia, China and the Middle East (KPMG 2019). To further harness the economic opportunities from the catchment, the Federal and Queensland State Governments have collectively agreed to fund $352 million towards the construction of Rookwood Weir on the Fitzroy River. The new weir could deliver 42,000ML of water which could boost the Fitzroy River Agricultural Corridor's production by up to $1 billion, supply extra water for urban and industrial growth, and improve water security (76,000 ML in total) (RDAFCW 2018; QDSDMIP 2019).

These opportunities collectively present the chance for the Region to grow, transition and intensify its agricultural sector. Implementing this business case will enable the Region to unlock currently unrealized economic value from unmet demand in markets for agricultural and food products in the

Asia Pacific Region. The Fitzroy River Agricultural Corridor is the first major new irrigation development in Queensland for a generation, but achieving economic, social and environmental resilience will mean making every drop of water work hard for the community. The development of the Fitzroy River Agricultural Corridor has the potential to herald internationally groundbreaking opportunities for the expansion of the next generation of value-rich horticultural, cropping and livestock production. However, a new approach is needed as today's agricultural development comes with a series of previously silent challenges.

The Fitzroy River and its tributaries contribute to sediment, pesticide, and herbicide levels in coastal waterways and further out into the Great Barrier Reef (GBR) lagoon, affecting the distribution and abundance of coral and other marine organisms (Marsden Jacob Associates 2013). Proposed new State regulations for water run-off from farms seeks to achieve no net decline in reef water quality (Queensland Parliament 2019). Further, there are increasing infrastructure, energy and general farming input costs, whilst consumers demand increasingly high product standards. Consequently, the most significant challenge for the development of agriculture in the Fitzroy River Agricultural Corridor will be the effective management of water allocations to enable higher value and much more efficient, low impact agricultural ventures; whether large or small.

Combined with new supply chain 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 circular 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. Embedded within this overall opportunity is the need to facilitate much more intensive investment and development in a traditional grazing area, with changing land ownership patterns and intents.

To create and implement this *Making Water Work* pathway and initiative, the CiT pilot program has been working with Rockhampton Regional Council's economic group *Advance Rockhampton* and the Region's wider stakeholders. The pilot program is funded by the Department of Environment and Science (DES) and supported by CSIRO, James Cook University (JCU), the University of Southern Queensland (USQ) and The Ecoefficiency Group (TEG). In effect, the vision for the concept was that new agricultural develop word/phrase missing deliver next generational agricultural development, with significant environmental efficiencies, highly efficient supply chains, and increasingly integrated and high-worth value chains that deliver social and economic resilience. It was considered that the key components needed to drive this vision include:

- Defining supply chain visions and potential productions system models
- Visionary land use planning, footprint development and design
- Connected water infrastructure, ownership and water products
- Integrated infrastructure, communications, services planning and coordination
- Integrated, reliable, affordable and low impact energy and waste management
- Next generation practices to achieve GBR outcomes.

These are detailed in Section 2 of this business case.

Justification and risks mitigated

There are multiple major justifications that underpin the *Making Water Work* initiative, unpacking the significant benefits from and risks to be mitigated by taking such an approach. The following key factors underpin the logic for progression of this business case for the approach.

1. Unlocking unmet agriculture export and domestic demand

Recent supply chain analysis in North Queensland suggests that demand for products typical of those produced in Central Queensland exists across the usual 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 and pulses, accounting nearly $3 billion of currently unmet global demand. In the Northern Queensland case, transitioning land use to the priority products was estimated to provide a positive benefit of between $26.5 and $271.1 million NPV and to generate numerous jobs, and we consider that similar trajectories are possible in the Rockhampton Region (KPMG 2019).

In 2015/16, the total value of agricultural output in the Rockhampton Region was already $74m. The largest commodity produced was processed livestock, which accounted for 84.9% of the Region's total agricultural output (RRC 2016). The Region presently concentrates on the production and processing of beef which is exported to markets throughout the world, but particularly China, Japan, United States and Korea. Other crops which are currently grown and which have the potential to increase further are cotton, wheat, sorghum, table grapes, hay, macadamia nuts, citrus, mangos and avocados. Construction of Rookwood Weir has the possibility of significantly expanding the range of crops which are grown in the Rockhampton Region and within 5km of the Fitzroy River. Many of these crops are not presently grown in Central Queensland, but can be well aligned to identified demand-led gaps in particular agricultural markets.

Risks of Doing Nothing

The risks of not preparing for greater involvement in this sector means the Region would effectively perform poorly in the most significant and resilience growth opportunities available. If these significant opportunities are to be realized however, the major climatic and environmental constraints for agricultural development need to be overcome; though these are small compared with other factors such as those associated with finances and investment planning, land tenure and property rights, management, skills, and supply chains (Ash & Watson 2018).

2. Taking intensive advantage of new and existing water resources

The Commonwealth Government's North Queensland Water Infrastructure Authority (NQWIA) was established in March 2019 to progress the development of water resource projects in northern and central Queensland through strategic planning and the coordination of information sharing among relevant regulatory authorities and stakeholders (Commonwealth of Australia 2019). Current planning includes a focus on building weir-based water infrastructure; with the Federal and Queensland Governments collectively agreeing to fund $352M towards the construction of Rookwood Weir on the Fitzroy River. The new weir could deliver up to 42,000ML of water which could boost agricultural production by up to $1B in the Fitzroy River Agricultural Corridor, supply extra water for urban and industrial growth, and improve water security (76,000 ML in total) (RDAFCW 2018; QDSDMIP 2019). This will be in addition to the existing storage located between the Barrage and Rookwood Weirs (Barrage 60,150 ML and Eden Bann Weir 26,260 ML), enabling the transition of land use towards the production of priority demand-led products. More work is required on planning for:

- Water products and costs, with the National Water Initiative requiring any water pricing subsidy to be fully transparent in water pricing
- A staged approach to water availability, e.g. what is the current latent capacity in the system? Availability of water held in the barrage and Eden Bann? What are some options if the planned Rookwood weir is reduced in size?
- Upgrades to the road network to handle freight and tourism traffic
- Value added economic development opportunities in food processing
- Export opportunities of fresh and processed foods
- The exploration of airport connections to South East Asia and southern Australian cities
- Long-term water security for the Rockhampton Region
- Socio-economic development of the communities around the development
- Associated recreational (fishing, water sports) and other activities.

Risks of Doing Nothing

Without effective planning behind the development of new water assets, the uptake and use of water may be slower than desirable from an infrastructure, commercial and economic perspective. Significant effort will be required to promote and attract investment and facilitate development that migrates from current land uses. Potential risks associated with the project that could be better managed through this *Making Water Work* initiative include:

- Increasing the cost effectiveness of development attracted to the Region as a result of the weir development and other available water resources
- Reducing the costs of water likely to restrict the viable cropping opportunities
- Increased capacity of existing markets to absorb significant additional horticultural production (SMEC Australia Pty Ltd 2018).

Further de-risking work is needed before new agricultural development proponents could invest confidently, especially given the scale of development and the long term infrastructure investment being made in the Rookwood project. Without this initiative's work to most efficiently match demand to supply and value, there is a risk of creating stranded water assets without an associated gain in environmental values of the catchment. In short, there needs to be a more proactive, sophisticated approach to facilitate development, uptake and use of water. Making time, the value of money and investment more efficient, is a critical part of the financial and economic equation needed to accelerate the benefits arising from new agricultural investment.

3. Unlocking Rockhampton's agricultural potential

The Queensland Government's Agricultural Strategy aims to double the value of Queensland's food production by 2040. However, this can only happen if the level of productivity within the sector increases across the whole supply chain (RDAFCW 2018). Land within 5km of the Fitzroy River has the possibility of being used for intensive animal and horticultural production. Cotton, wheat, sorghum, table grapes, hay, macadamia nuts, citrus, mangos and avocados are crops which are already successfully grown in Central Queensland and have the real possibility of expanding substantially as a result of harvesting water from the Fitzroy River. The construction of Rookwood Weir has the possibility of significantly expanding the range of crops which are grown within 5km of the Fitzroy River.

There are also sufficient land and water resources to adequately support feedlots and intensive livestock and protected agriculture. In 2015-2016 Central Queensland supported 1.9 million head of cattle; 28% of the state's total number (RDAFCW 2018). During the same period, Central Queensland had a total of 2,802 agricultural businesses. 88.2% (2,471 businesses) were beef cattle

farming (RDAFCW 2018). There are two abattoirs in and near Rockhampton: JBS Australia with a daily processing capacity of 696 head of beef and Teys Australia which has a daily capacity of 1,731 head of beef (RDAFCW 2018).

Risks of Doing Nothing

Achieving agricultural development targets based on the quality resources available can only happen if (as envisaged by this *Making Water Work* initiative) the proactive level of analysis and planning for productivity improvements within the sector increases across the whole supply chain (RDAFCW 2018). As such, consequent effort must consider (and where possible draw upon existing data sets held by DAF and DNRME) to determine:

- Spatial limitations and location of the most productive soils in the Region
- The potential for early structural decline in the soil resource base, requiring excellent soil identification and management from the outset
- The potential for integrative links across commodity sectors (such as aquaculture and cropping)
- The most efficient location of infrastructure requirements relative to production areas
- Potential for master planning and refinements to current planning scheme.

4. Benefits from building a more circular and value-rich agricultural economy

A successful circular economy contributes to all three dimensions of sustainable development, encompassing economic, environmental and social values (Korhonen, Honkasalo & Seppälä 2018). In agriculture, these shared values focus on improving growing techniques and strengthening the local cluster of supporting suppliers and other institutions to increase efficiency, yields, product quality, and sustainability (Porter & Kramer 2011). For example, connecting consumer preference to farm profitability is becoming increasingly important in maintaining farmer profitability, as demonstrated by the growing demand for organic food (Perry 2017). Digital technologies have the potential to enable consumers to precisely track food from the field to the pantry, and informing decision-making. At the same time, commodity crop farmers will be able to match consumer demand for products and produce a more valuable crop. In the years to come, the essential connection between agricultural practice and consumer preference will dramatically accelerate the adoption of new sustainable technologies in agriculture (Perry 2017). An emerging local example might be the West Rockhampton Aquaculture Precinct, including protected vertical aquaponics and horticulture (being designed to assist in training, research and small scale commercial opportunities).

Key operational principles/options to create a circular economy (Suárez-Eiroa et al., 2019) include:

1. *Adjusting resource inputs to regeneration rates*
    - Reduce/eliminate non-renewable resources use
    - Substitute non-renewable by renewable inputs (e.g. renewable energy)
    - Adjust extraction rate of renewable resources to be within regeneration rate
2. *Adjusting waste and emission outputs to absorption rates*
    - Promote eco-efficiency and eco-effectiveness to reduce wastage and waste
3. *Closing or slowing material use loops*
    - Promote use of renewable resources (e.g. energy)
    - Connect waste management with resource recovery
    - Design products that are durable, repairable, easy to upgrade, and reuse recycle and/or recover
4. *Shifting production and consumption culture*
    - Shift business perspectives from producing products with rapid obsolescence

- Shift consumer expectations about using disposables and the acquisition of latest products

5. *Coordinating and collaborating*
    - Coordinate adjustments throughout the value chain including inputs and outputs
    - Recover material and energy from waste for recirculation
    - Establish new markets and value chains to facilitate transition to a circular economy; and
    - Enlist significant policy, regulatory and program support from governments
6. *Using digital innovation*
    - Digital technology such as big data, sensors, 3D printing will make reusing and recovering material energy efficient and effective, thus helping to decouple economic growth from natural resource depletion and environmental degradation (Murray et al., 2017).

Key benefits arising for regions through this approach include:

- Building greater efficiency and value within the supply chains
- Increasing the productive segments of the economy
- Increasing the skills and diversity required in the workforce.

In relation to the workforce (see Table 2 below), most of the Region's 643 agricultural full-time work force is currently employed in less differentiated jobs in beef cattle, sheep and grain farming (with 411 people working in this area). According to the 2016 Australian Bureau of Statistics (ABS) Census data for the Region, 78 people were working full-time in horticulture including:

- 31 people working full time in Nursery and Floriculture Production;
- 3 people working full time in Mushroom and Vegetable Growing;
- 23 people working full time in Fruit and Tree Nut Growing; and
- 21 people working full time in Other Crop Growing (ABS 2017).

Taking into account the amount of water that will be available through the development of Rookwood Weir, and the potential for a more value-rich and circular approach to workforce development, there is an opportunity to assist boosting employment and to diversify the agricultural workforce. Initiatives that could assist in the short term to assist diversification could include:

1. *Skilling Queenslanders for Work*: Through the Department of Employment, Small Business and Training the Queensland Government's Skilling Queenslanders for Work initiative funds training and support for unemployed or underemployed people with a focus on young people, Aboriginal and Torres Strait Islander people, people with a disability, mature-age job seekers, women re-entering the workforce, veterans and ex-service personnel, and people from culturally and linguistically diverse backgrounds
2. *Back to Work*: Subject to funding availability, Back to Work supports eligible Queensland employers to hire an eligible unemployed job seeker with payment of up to $20,000
3. *Work Start incentives*: To eligible employers for hiring a new trainee or apprentice who had previously participated in a Skilling Queenslanders for Work project, after a qualifying period. A Youth Boost component of $20,000 is available if the eligible person is aged 15 to 24 years. These incentives are for private sector employers not eligible for a Back to Work payment
4. *CQU/TAFE*: Courses and open days for horticulture and study tours to horticultural centres such as Bundaberg and Mackay.

Table 2: Current agricultural employment in the Rockhampton Region by sector

Employment (Census) by industry sector — export — reset

Rockhampton Regional Council area	2016			2011			Change
Industry (Click rows to view sub-categories)	Number	%	Queensland %	Number	%	Queensland %	2011 to 2016
Agriculture, Forestry and Fishing	643	1.8	2.8	501	1.4	2.7	+142
• Agriculture, nfd	43	0.1	0.2	19	0.1	0.1	+24
• Nursery and Floriculture Production	31	0.1	0.1	25	0.1	0.1	+6
• Mushroom and Vegetable Growing	3	0.0	0.2	3	0.0	0.2	0
• Fruit and Tree Nut Growing	23	0.1	0.4	12	0.0	0.3	+11
• Sheep, Beef Cattle and Grain Farming	411	1.1	1.0	370	1.0	1.1	+41
• Other Crop Growing	21	0.1	0.3	16	0.0	0.3	+5
• Dairy Cattle Farming	11	0.0	0.1	6	0.0	0.1	+5
• Poultry Farming	15	0.0	0.1	13	0.0	0.1	+2
• Deer Farming	0	0.0	0.0	0	0.0	0.0	0
• Other Livestock Farming	14	0.0	0.1	13	0.0	0.1	+1
• Aquaculture	4	0.0	0.0	0	0.0	0.0	+4
• Forestry and Logging	4	0.0	0.0	0	0.0	0.0	+4
• Fishing, Hunting and Trapping, nfd	5	0.0	0.0	0	0.0	0.0	+5
• Fishing	7	0.0	0.0	4	0.0	0.0	+3
• Hunting and Trapping	0	0.0	0.0	0	0.0	0.0	0
• Agriculture, Forestry and Fishing Support Services, nfd	0	0.0	0.0	0	0.0	0.0	0
• Forestry Support Services	0	0.0	0.0	6	0.0	0.0	-6
• Agriculture and Fishing Support Services	39	0.1	0.2	16	0.0	0.2	+23
• Agriculture, Forestry and Fishing, nfd	7	0.0	0.0	0	0.0	0.0	+7

Risks of Doing Nothing

There is significant international evidence to suggest that those economies that adopt more circular approaches to economic development will be become much more resource use efficient and highly competitive economies (Dominish et al., 2017). Not moving in this direction also risks local agriculture not delivering growing market requirements (Kirchherr et al., 2018). While the concept and its benefits are not widely discussed or accessible to practitioners and the wider public (Merli et al., 2018), the opportunity for the Rockhampton Region to take leadership in this area will also mean the services that emerge may increasingly have global value.

5. Planning now to deliver on Great Barrier Reef outcomes

The Northern Australian development agenda seeks to significantly expand agricultural production in northern and central Queensland. However, as much of the State's agricultural land is in GBR catchments, without careful management, agricultural growth and intensification could increase pollutant loads in coastal and marine waterways flowing to the GBR. Activities associated with water pollution in the GBR catchment include suspended sediment from soil erosion, nitrate run-off from fertiliser application on crop lands, and herbicide run-off from various land uses (Brodie et al., 2012).

Legislation for natural resource management is in place across all GBR catchments including the *Queensland Vegetation Management Act 1999*, the *Queensland Water Act 2000*, the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the *Queensland Land Act 1994*, the *Queensland Reef Protection Act 2010*, the *Commonwealth Great Barrier Reef Marine Park Act 1975*, and proposed new regulations in Queensland for land managers to achieve "no net decline" in GBR water quality (Dale et al 2018; Queensland Parliament 2019). Given the critical role of these

legislative instruments in setting limits for resource use, a clear business case for de-risking agricultural expansion will be needed to include explicit consideration of, and costings for, environmental regulations.

Significant investment is already being applied to improve water quality in the Fitzroy Region, (a regulatory requirement under the *GBRMP Act*) and this poses a potentially high risk to the approval of new agricultural activities. By thinking at an area-based level in advance of new agricultural development, serious new thinking can be applied in advance of the approval of individual agricultural activities on farm. This more area-based approach, focused around new water-based agricultural development areas, has the potential to significantly simplify the development approval process and deliver no net decline in water quality discharging into the GBR lagoon. Key activities would need to include:

- New investors thinking through, committing to, and implementing very effective on-farm agricultural practices in advance of new agricultural development
- Exploring new approaches to the treatment of water run-off from farms
- Exploring more sub-catchment based and collaborative approaches to the capture and treatment of agricultural run-off from new agricultural development areas.

Risks of Doing Nothing

Existing regulatory arrangements and the proposed changes to GBR regulations require landholders to move more urgently from traditional agricultural practices to improved practices. Without early and proactive industry-based thinking about how new agricultural development can be best designed and managed to ensure no net decline in GBR water quality, a real risk to new water infrastructure being approved and developed exists, thus disrupting the original intended application to agricultural development. Proactive thinking and planning to address the problem may have the potential to increase profitability in new farming operations as well and maintaining and increasing market access into the future.

SECTION TWO – KEY CONCEPT COMPONENTS AND RETURNS

The following unpacks the key tasks that need to be progressed to secure the best possible outcomes from the *Making Water Work* initiative.

1. Defining supply and value chain vision and production system model

What is the Current Context?

The Rockhampton Region's current agricultural production is focused on beef production and processing, along with some grain (wheat and sorghum). Water from the barrage pondage and Eden Bann Weir has enabled landholders along the Fitzroy River to grow limited crops of hay, macadamia nuts, mangoes and avocados. Despite potential opportunities afforded by the construction of Rookwood Weir and other available water resources, the Region has not yet developed a clear vision of its most viable agricultural supply chain as a basis for planning. This should be a regional priority, regardless of the Rookwood Weir development. A strong model could envision a very clear focus on the development of a particular mix of beef product, the crop-based feedstock required, a particular combination of feedlots, and processing facilitates. These could all be serviced by particular land use and infrastructure/ service needs, including linkage back to feed supplements coming from aquaculture. Attaining broad support for, and consensus about, the supply and value chain vision and model is a crucial foundation in the further steps required to ensure that the Region really makes water work. The approach can be used to encourage and target key sectors for investment and to promote best practice. At the same time, key investment decisions will also be guided by commercial realities of the market.

What Scope is Required?

With significant new water developments coming on line in the Region, the time has now come to ensure that early strategic thinking is in place to deliver new agricultural development that build upon a very clear, demand-driven *Supply and Value Chain Vision and Plan*. New and significant demand-led thinking is now needed to define the most economically and socially lucrative and environmentally responsible vision of the supply chain. Without more visionary clarity about how a more demand-led supply and value chain could function, the proactive development of land use planning, infrastructure and servicing required will not be possible. Consequently, the critical tasks and outcomes required include:

Key Tasks	**Outcomes**
Deeper regional analysis of the most significant and securable agricultural markets. The Queensland's Government's Land use Mapping Program (QLUMP) would be a valuable tool to use.	Regional knowledge to inform proactive land use and infrastructure planning and new agricultural investment.
Based on deeper regional market analysis, building the deep sectoral engagement and collaboration required to forge a shared approach to industry and community-based visioning of the future supply chain possibilities, options and priority strategic directions.	Stronger regional industry and supply chain consensus about priority land use planning and infrastructure investment decision making. Stronger governance arrangements surround critical decision making within the supply chain.
Exploring (quantifying) and envisaging (defining) the potential (demand-led and production enabled) supply and value chains possible to maximize economic and other benefits (from production through to value add and delivery).	Prioritisation of the most viable supply chain options (including transport links for domestic and export markets) and associated production systems, value-add and distribution system needs (land, infrastructure including irrigation distribution and servicing), translating into a very clear *Agricultural Development Model* as a basis for further planning. This vision-based thinking will need to include development of a view of enterprise diversity possible in the *Agricultural Development Model* (i.e. a model based on a reasonable mix between larger corporates and small to medium farming enterprises).
Exploring or identifying the key potential investors (or investor types) to lead investment and development in the sector, and prioritsing future engagement and cooperation with those investors (including the potential for co-investment in development infrastructure). Need to also identify management and ownership structures and the	Key agricultural development investors identified, engaged and supported. Key management and ownership structures identified. Key investment attraction and investment incentives identified and designed (e.g. linkages to concessional loans under the Clean Energy Finance Corporation or CEFC).

potential revenue streams which could get off the ground. May include delivery network options and analysis.	
Exploring potential barriers and enablers in the supply and value chain components - including current under-utilised water and the barriers/drivers.	Key land use planning and infrastructure priorities identified. Steps taken to ensure strong inter-operability between different supply chain options (e.g. between cattle and aquaculture). May lead to brokerage opportunities.

Within the context of this work, serious consideration should also be given to the potential role of more protected forms of agriculture within the Region (i.e. glasshouse-based production). If this is a significant opportunity, it is likely that a more diversified agricultural strategy may be possible, with broader scale agriculture and protected cropping not competing heavily for land and water resources, but potentially complimenting each other in terms of airport/port requirements. It is likely that protected cropping would require flood-free land, good access to transport and water infrastructure and exist within 10 kilometers of reasonable services. Protected cropping approaches also present real opportunities in the progression of more circular forms of integrated cropping, particularly if also linked to more broad-scale cropping opportunities. An example of an innovative Australian company that has invested in protected cropping is shown in the case below.

Case Study: Innovative Sundrop Farms Uses Sunlight and Seawater to Grow Tomatoes*

Sundrop Farms in South Australia uses more than 23,000 mirrors to capture sunlight and direct it to a central receiver at the top of a 127-metre power tower. All the water used for irrigating the crops is piped from the Spencer Gulf and converted into fresh water using a thermal desalination unit. At its peak, it produces 39 megawatts of thermal energy which is used for electricity, heating and making water. The commercial facility cost about $200 million to build, with private equity firm Kohlberg, Kravis and Roberts (KKR) investing $100 million. The facility produces about 17,000 tonnes of truss tomatoes a year and holds a 10 year supply contract with Coles Australia. See https://www.sundropfarms.com/innovation/.



*Information and image source: https: //www.abc.net.au/news/rural/2019-05-15/port-augusta-sundrop-farms- sold-to-investment-fund-morrison-co/11108046

Timeframes, Investment and Costs

The way forward should build strongly on emerging supply chain work currently being progressed through the Collaborative Research Centre on Northern Australia (CRCNA) investment at Central

Queensland University (and also KPMG 2019), explore the particular relevance of that work to the Rockhampton Region, and facilitate a cohesive cross-sectoral vision of the most viable supply and value chains and required strategic actions. Will also include exploration of local, national and international distribution.

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Supply chain visioning and collaboration Building		$150,000	June 2021
Potential Investors	**In Kind**	**Cash**	**Notes**
Possible State Budget bid		$150,000	
CRCNA supply chain			
Council			
CQU/JCU			

Who Needs to Be Involved?
In the Rockhampton Region context, the Council could be the appropriate project lead to ensure that this work is locally coordinated and integrated with other key steps and processes, but it may seek to partner key support from CQU/JCU and the CiT team together with State Government agencies.

Key players that need to be involved in this work include:

- Key participants in agricultural sectors, including growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders
- DAF would be involved as an advocate for agricultural expansion
- TMR would be integral to understanding existing transport infrastructure capacity and where work is needed e.g. road to port, road to airport, rail to port
- Other agencies include DNRME, Sunwater, GAWB, FRW, power companies.

This work should build on the current CQU work on seeking to understand the collaboration building necessary for building agricultural supply chain cooperatives and key price points along each of the key supply chains. This will help identify clear barriers in the supply chain system. Barriers might include trade access, biosecurity and information barriers. The work is also looking to test a viable regional consistency and potential for a Rockhampton brand.

2. Visionary land use planning footprint and design

What is the Current Context?
To encourage high quality and high value agricultural development, a more sophisticated and incentive-focused land use planning and development approval system will need to be developed, designed and implemented. Not having these arrangements in place in advance of the development front will result in sub-optimal outcomes for the Region and for agricultural development investors alike. It will particularly limit value adding investment opportunities such as food processing and waste management (Benyama, Kinnear & Rolfe 2018). Rockhampton Regional Council has already undertaken a preliminary spatial Multi-Criteria Analysis (MCA) across the Region to help identify areas for more intensive investigation. However, more detailed assessment and industry discussion is required. It will be important, for example, to also:

- Not discount dryland agricultural development opportunities in the Region, particularly in relation to feed development (e.g. Kalapa Flats area) and the potential advances in drought tolerant crops (e.g., AgriVentis)
- Explore the potential for the feasibility of rural water distribution schemes to service nearby non-riparian good quality agricultural land (GQAL).

What Scope Is Required?

With a much clearer vision of the future supply and value chain, and a stronger focus on supply chain efficiency, minimizing environmental harm, maximizing the quality of soils farmed, reducing agricultural runoff and reducing agricultural costs (transport, pumping), then a much more refined set of land use planning data layers can be developed, overlaid, analysed and optimized. A good example of the quality of mapping required in this case is already emerging within the Region (see Figure 2 below). However, a stronger agricultural area design is required to significantly achieve higher level supply chain and environmental efficiency.

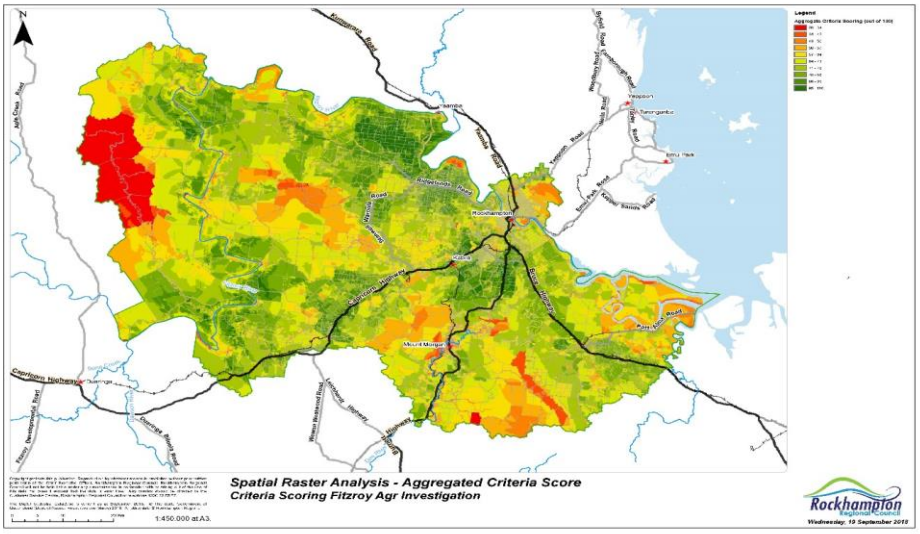


Figure 2: An example of the mapping detail that will be required

Consequently, required tasks and outcomes are:

Key Tasks	Outcomes
Drawing on the *Supply and Production System Vision,* council, DAF, CSIRO and other parties need to further engage in developing the key opportunities and constraints layers for potential and staged agricultural development. Staged infrastructure development is also needed for water distribution scheme.	Clearly identified priority areas for agricultural investment and development, including associated value chain opportunities and associated infrastructure corridors/locations. Sufficient planning flexibility to enable alternative supply chain development models to be accommodated if needed. Sufficient planning flexibility to enable sufficient diversity in the enterprise mix that emerges, enabling an appropriate mix of larger and small/medium enterprises, enabling entrepreneurship. Sufficient planning effort to optimise required infrastructure development corridors.
Exploring the most appropriate planning instruments and provisions required to help facilitate development and investment in these contexts (e.g. State	A planning and development approval framework that facilitates smooth and high quality development investment, appropriate public-private partnerships and identified suitable investment incentive packages.

Development Area, Agriculture Development Precinct, Strategic Assessment under the EPBC Act etc.).	

Timeframes, Investment and Costs
The pathway forward on this particular piece of work should build strongly on the foundations mapping overlay work that already exists within Council. New mapping work can be used to facilitate cohesive cross-sector input into the design of the tightest supply and value chains possible.

Package Item	**Total In Kind**	**Total Cash Cost**	**Completion Timelines**
Mapping overlay development, Efficiency analytics and Plan production			June 2021
Potential Investors	**In Kind**	**Cash**	**Notes**
Possible State Budget bid		$300,000	
Council	Existing mapping layers within Council		
QDAF	Existing data/ products		
CSIRO	Existing data/ products		
FBA	Existing data/ products		
DNRME	Existing data/ products		
Port	Existing data/ products		
TMR	Existing data/ products		
DSDMIP	Existing data/ products		

Who Needs to Be Involved?
The Rockhampton Regional Council could be the appropriate project lead to ensure that this work is coordinated and integrated with other key steps. Key players that need to be involved include:

- Key participants in the agricultural sectors, including government agencies, growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders
- Strong skills in relation to the cost analysis of supply chain logistics (e.g. QUT)

3. Connected water infrastructure, ownership and water products

What is the Current Context?
In relation to water potentially becoming available for agricultural development, there is at this stage, little firm planning in place concerning distribution infrastructure and ownership of water products that will likely be made available, both within and beyond the Fitzroy Corridor. Key components include:

- The consideration of the potential for further use of the current water storage facilities (Eden Bann and the Barrage) and associated agriculture that has been planned historically; Rockhampton Regional Council is the owner and operator of water from the Barrage, however the Council is yet to consider its role in regard to future ownership and management of new water infrastructure
- Overall, new water could deliver up to 5,000 hectares of more intensively farmed land, with

a significant need for coordinated water distribution and management

- In relation to existing water assets, Rockhampton Regional Council has a 50,000 ML allocation (which can only be drawn from Barrage Weir Pool), of which only half is being half used. Its use has also been uncertain because of potential water quality implications
- In the testing of new water products, there may be problems in overcoming the challenge of determining where the water would be best used for the development area and the need to encourage new crop investment trialing (i.e. initial leasing and options to purchase)
- There are now opportunities to consider brokerage options and to work with producers to provide input/insight into the underutilization of current water allocations, including market arrangements (with the potential for unregulated water harvesting entitlements to deliver around 30,000 ML)
- There is also much work to be done to develop water products that will meet the needs of any new supply chain development.

What Scope Is Required?

With Rookwood Weir now planned for construction, much significant effort is needed to define the emerging model of agricultural development, which will in itself define the scope and type of water products that will be needed. Irrigation distribution systems and their ability to contribute to a more circular economy are yet to be determined and designed. Finally, issues of various aspects of scheme ownership, and associated governance are yet to be determined. Consequently, required tasks and outcomes are:

Key Tasks	**Outcomes**
Feasibility of the preferred water products and distribution systems developed and full costings driven by the land use project planning.	A significant interplay between supply chain visioning, innovative land use planning and the final design, costing, funding and delivery of distribution systems. More cohesive distribution systems and innovative investment sharing principles. Opportunities for market arrangements that explore and enhance the potential for using existing under-used water systems/allocations. Exploration of the current Stanwell pipeline as a potential asset that could be utilized (though its future also depends on the future trajectory of the Stanwell Power Station).
Early consideration of the most appropriate governance arrangements and ownership options need to be agreed to between Sunwater, Rockhampton Regional Council, other government agencies and industry.	Once established, there may be potential value in improving the operability of the market. The current market is constrained by the trading rules and needs some refinement. New approaches being explored in the MDIA may be worth exploring and adopting.
Identify and finalise any requirements to update the current Queensland Government Fitzroy Water Management (WMP).	All water allocations scientifically tested and legitimately allocated to ensure security.

Timeframes, Investment and Costs

Given the unfolding process for the construction of Rookwood Weir, and limited consideration of other potentially available water resources, key timeframes and investment includes the following:

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Consideration of water governance, ownership, distribution, water products and market arrangements			
Potential Investors	**In Kind**	**Cash**	**Notes**
Possible State Budget bid		$100,000	
Council			
NRM&E			
FRW			
Sunwater			
Targeted agricultural producer input			
GAWB/Stanwell – leverage existing and future pipelines			

Who Needs to Be Involved?

The Rockhampton Regional Council would be the appropriate project lead to ensure that this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with the current development process being implemented by Sunwater and the Queensland Department of Natural Resources and Mines (QDNR&M). Key players that need to be involved in this work include:

- Key participants in the most prospective agricultural sectors, including government agencies, growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders
- Rockhampton Regional Council, Sunwater and QDNRM&E will need to work closely together in partnership with industry
- Stronger designer-skills in new water product opportunities, power generation in water distribution and market trading skills will be required.

4. Integrated infrastructure, communications and services planning and coordination

What is the Current Context?

To facilitate effective agricultural investment, more cohesive infrastructure and services planning will be required alongside water infrastructure planning and development. With Rookwood Weir coming on line, changes are emerging in the infrastructure and communication systems needed in the Rockhampton Region, and there will be a stronger need to ensure good telecommunications access, and a fresh look at the integrated infrastructure needs of a more intensive/circular agricultural system.

What Scope Is Required?

In the context of the emerging Supply Chain Vision and the proposed new Rookwood development, there is a significant need to update of the *Fitzroy Industry and Infrastructure Study* (which currently runs to 2007). Given the importance of infrastructure in ensuring a tight supply chain, and enabling integrated linkages between sectors (e.g. agriculture and aquaculture), it is essential that innovative

infrastructure design follow through in advance of the development front. In this context, there will be a need for a focus on roads, the airport, port linkages (Gladstone) and communications.

At the same time, this work needs to flag implications for human and commercial service linkages as well, though these will tend to be lagging rather than leading requirements. While there should be a strong focus on telecommunications, it is understood there are no major constraints in the trunk system. As such, service support behind big data management in the supply chain will again tend to be a lagging versus leading part of that thinking, though early approaches to big-data service innovators in the agricultural space will be important within this process to build and strengthen the agricultural support opportunity. Consequently, required tasks and outcomes are:

Key Tasks	**Outcomes**
Reframing if the key infrastructure, communications and services requirements to deliver on the emerging supply chain vision and visionary land use planning. Irrigation precinct master plan.	Strong co-design in establishing a much tighter supply and value chain and greater circular economy opportunities. A clear understanding of the lagging human and commercial service requirements emerging from the proposed development trajectory. Facilitation and brokering of staged workforce development planning and coordinated response.
The coordinated design and production of appropriate, coordinated and staged budgetary and investment response for infrastructure (across Federal, State, Local Governments and private sector requirements).	Timely delivery of infrastructure to secure high quality agricultural investment. Active facilitation of the required big data service supports to keep pace with emerging agricultural development.

Timeframes, Investment and Costs

The way forward should build strongly on foundational mapping and supply chain vision-building and visionary land use planning work undertaken by the Rockhampton Regional Council. This is needed to facilitate a cohesive sector-wide input into the design of the tightest and most effective infrastructure planning and investment priorities possible.

Package Item	**Total In Kind**	**Total Cash Cost**	**Completion Timelines**
Planning and strategic infrastructure, Communications and services for agricultural development			June 2021
Potential Investors	**In Kind**	**Cash**	**Notes**
Core investor		$300,000	
Council			
TMR			
Airport Corp			
Gladstone Port Authority			
NBNCo/Telstra			

Who Needs to Be Involved?

Advance Rockhampton would be the appropriate project lead to ensure that this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with the Queensland Department of Transport and Main Roads (TMR), the port and airport, and the National Broadband Network Company (NBN Co). Key players that need to be involved in this work include:

- Key participants in the agricultural sectors, including government agencies, growers, financials, suppliers, the real estate industry, agricultural service providers, data service providers, CQU and key infrastructure leaders
- Rockhampton Regional Council, TMR, Airport Corporation, Gladstone Port Authority and NBN Co will need to work closely in partnership with industry
- A stronger co-design approach is required to deliver tighter supply and value chain outcomes and stronger circular economy principles.

5. Integrated, reliable, affordable and low impact energy and waste management

What is the Current Context?

Despite policy instability over the last decade, a more stable national and state-wide policy framework is now emerging, seeking to achieve energy security, affordability (via enhanced generation investment) and transition (AER 2018). This means that as a new agriculture development area, the Region has the opportunity to rethink the design of the energy mix to service new agricultural development in ways that achieve significant advances in all three energy-related objectives (security, affordability and transition). Additional energy priorities for Queensland (QDEWS 2017) include:

- Assessment of options for deploying hydro and pumped storage including bulk off-stream storage linked to distribution network
- Increased supply of gas into the Australian market
- Reviewed costs of energy storage and demand management (Arenawire 2019)
- Increased assessment of energy investment trends in Distributed Energy Resources (DER) and Virtual Power Plants (VPPs)
- Strengthening future power systems by addressing technical issues
- Improved access to climate and extreme weather information for the electricity sector
- Tri-sector integration of electricity, gas, and transport in AEMO's co-optimisation model, based on the "zero emission vehicle" roadmap (AEMO 2019).

While these broad settings are emerging, there remains no clear energy planning in advance of new proposed agricultural development. Strategic thinking in this context needs to account for:

- New opportunities for agricultural-based waste to energy technologies that might also contribute significantly to circular economies and tighter supply chains
- New opportunities in remotely generated power and microgrids
- Integration between power generation options and regional waste management
- Emerging opportunities for hydrogen-based power options.

Rockhampton has traditionally benefitted from a stable coal-based power supply located on its doorstep through the Stanwell Power Station. Wider strategic thinking in the context of catering for new agricultural development needs to account for:

- The current planned future life-cycle for the current Stanwell Power Station
- New opportunities for agricultural-based waste to energy technologies that might also significantly contribute to circular economies and tighter supply chains

- Integration between power generation options and regional waste management
- Wider regional plans for the Aldoga solar development west of Gladstone
- Emerging opportunities for hydrogen-based power options.

Similar to energy, the new agricultural development front presents an opportunity to rethink regional and more sustainable and cost effective approaches to waste management. Given several new policy and technology developments, there is a refreshed opportunity to explore the linkages between agriculture and waste management. These include: (i) The recent introduction of the waste levy system; (ii) New thinking about regional organic waste management supporting agricultural production (being undertaken by RDAFNQ&TS, Shark Recyclers and CQU in the Lakeland area); and (iii) the Growcom agricultural waste utilization trial being developed by CSIRO.

With respect to the Lakeland work, there is a focus on testing for a possible 60% reduction in the use of chemical fertilisers, a 35% increase in production, a nine fold increase in organic matter, a 19% saving in energy cost and a 30% reduction in the water consumption of bananas. With respect to the Growcom-based work in the Townsville context, the Food Waste CRC is currently starting a 20 week process for engaging in opportunities for new approaches to food waste processing. In emerging agricultural domains, this might involve the development of a significant value add opportunity for agricultural products. The approach has the potential to be built in a modular style for expansion or duplication. In this context, the Rockhampton Region could have an appropriate horticultural mix all year round (and potentially with strong provenance for the global health and welfare market). This emerging approach suggests that there is significant global investment interest in area-based food manufacturing models (by combining the skills of local entrepreneurs and attracting investors). Early figures show that a factory built at the cost of $22 million could deliver some $66 million revenue with a $45 million return on investment to the community (give or take 30%).

The Rockhampton Regional Council has recently explored the potential for waste to energy opportunities, but these have not yet been integrated into broader thinking about establishing a more circular agriculture development opportunity within the Region. Urban waste streams and feedstock may be a limiting factor, but the Council's strategy could be currently heading towards the beneficial reuse of sewage and residential green waste and organic waste.

Combined with new thinking about the regional organic waste development of agricultural production (being undertaken by Central Queensland University in the Lakeland area), there is a refreshed opportunity to explore the linkages between agriculture and waste management. Related to the regional waste opportunity, is the growing opportunity to link the Region's emerging aquaculture development agenda to an area-based design that applies more circular approaches to new agricultural development, particularly in the GBR catchment context. Pacific Bio and JCU are undertaking detailed work that would see the use of macro-algae to treat water from aquaculture (and potentially also sewage) to develop both innovative stock feeds and soil ameliorants. This raises the potential of the on-site treatment of controlled agricultural runoff. Within all of these opportunities, a third consideration is the potential to take advantage of the emerging Queensland Waste Levy to support the development and operation of innovative solutions.

What Scope Is Required?

With respect to energy's pivotal role in agricultural development, to achieve genuine affordability, security and transition outcomes, a unique opportunity exists to ensure every effort is taken to fully explore and compare the range of locally-based options now available. This will enable regional decisions about the best options possible, and progress planning and implementation. There is a need to explore whether these opportunities can contribute to the design of a more circular

economy in the context of the new agricultural developments at Rookwood and associated future water developments. As such, a structured approach to the conceptualization, comparison and more targeted design of the most effective energy and waste management options should at least include the following tasks and outcomes:

Key Tasks	**Outcomes**
Criteria based assessment and refinement of a range of energy generation and supply options possible, or a combined set of options that deliver significantly improved energy security, affordability and transition in the region in the context of emerging new agricultural developments.	Full exploration of: (i) Property-based solutions (solar or biomass) that additionally feed energy back into the grid; (ii) The potential contribution of innovative hydro-power within or from the distribution system; (iii) A regional approach to biomass powered sub-regional microgrids, resulting in multiple circular economy products (e.g. oil/syngas, biochar); (iv) Potential regional waste to energy options; (v) Potential hydrogen-based solutions (e.g. water plus power to create hydrogen with overflow power to reduce marginal cost); or (vi) An appropriate combination of these and other options.
Criteria based assessment and refinement of the options possible, or a combined set of options that deliver significantly improved waste and pollution reduction, more intense supply chains and improved value chain opportunities.	Full exploration of options that include: (i) Management of municipal waste; (ii) Agricultural waste biomass contributions to energy production; (iii) Regional approaches to organic waste for compost production; (iv) Greater consideration of potential wood waste and other value adding options and processes; and (v) Integrated consideration of biological wastes and nutrient pollution reduction emerging from new agricultural and aquacultural developments. Full review of the potential waste and pollution reduction technologies that could be applied in the agricultural development context and their associated benefits and product streams.
Progression of the most appropriate options into a fully integrated area-based design concept and associated investment strategies for implementation.	Strongly positive and investment ready business cases for regionally agreed solutions.

While energy and waste management security, affordability and transition are the key objectives, additional benefits such as multiple product streams contributing to a more circular system need to be considered, as well as additional value-added products that the Region may be able to grow economically (e.g. power, biochar, etc.).

Timeframes, Investments and Costs

The way forward should build on the foundation supply chain and land use planning work outlined previously.

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Circular integrated energy supply and waste management option comparisons and preliminary designs			June 2021
Potential Investors	**Total In Kind**	**Total Cash Cost**	**Notes**
Proposed State Budget bid		$250,000	
Council			
Energy Queensland			
DES and Queensland Waste Levy			
NRM&E			
Growcom			
Pacific Bio			
Industry partners			
CQU/JCU/CSIRO			

Who Needs to Be Involved?

The *Rockhampton Regional Council* would be the appropriate project lead to ensure that this work is coordinated and integrated with other key steps, but the work would need to be developed in partnership with Energy Queensland, DES and DNR&M. The Council's waste management team would be involved to ensure that this work is coordinated and integrated with other key steps, but the work would also need to be developed in partnership with groups like Pacific Bio, GrowCom and research institutions (JCU, CSIRO and CQU). Linkages would also need to be made to the NQ Regional Organization of Councils Waste Management Strategy. This work would be led by the Council through the integrated governance arrangements, but would need to involve key players that include:

- Key participants in the agricultural sectors, including government agencies, growers, financials, suppliers, the real estate industry, agricultural service providers, and key infrastructure leaders
- Council, Stanwell, Energy Queensland, DES and DNRM&E will need to work together in partnership with industry
- Strong designer-skills in new energy generation, waste management and their integrated contribution to circular economy development opportunities.

6. Achieving regulated water quality outcomes for the Great Barrier Reef

What is the Current Context?

The bilaterally agreed *Reef 2050 Plan* sets a clear strategy for improving water quality outcomes for the GBR World Heritage area. In this context, the Queensland Government introduced a Bill to Parliament in February 2019 to strengthen existing GBR protection regulations. The proposed regulations under the *Environmental Protection (GBR Protection Measures) and Other Legislation Amendment Bill 2019* seeks reduce the water pollution (nutrients and sediment) from agricultural and industrial land uses entering GBR waters while maintaining productivity and profitability through improved land management. The new legislation supports the staged roll-out of strengthened Reef protection regulations to apply to all commercially produced cane, bananas, horticulture, grains and grazing, as well as direct sources of pollution from industrial land uses such as sewage and water treatment plants, aquaculture and intensive animal industries across all GBR regions. This, for the first time, will include requirements to ensure new agricultural development does not contribute further to declines in the quality of water running into the GBR lagoon. This has major significance for any new agricultural development in the Rockhampton Region.

Case Study: Innovative Agritech, Infarm, Goondiwindi

Goondiwindi based company, InFarm, is pioneering the development of ground breaking drone-to-tractor weed identification technology that is enabling large farms in south west Queensland to achieve savings of up to 95% in herbicide use on farm. The process uses drones to capture high definition images of the paddock. The images are uploaded into InFarm's processing platform where a unique weed-identifying algorithm is applied. The result is a file that pinpoints the exact location of the weeds. The file is uploaded into a standard variable rate tractor via a USB and the data is used to control spray nozzles; turning them on and off depending on the presence of weeds. See https://www.infarm.io/.

While there has been major progress in improving existing practices in the Fitzroy Basin, to date there has been no cohesive attempt to conceptualise and design new agricultural development that will meet the no net increase in pollution requirements. This detailed thinking is better managed through an area-based approach, rather than leaving every new farming enterprise to design a no-net-decline approach property by property. Additionally, some actions are actually better planned as at multi-property (e.g. combined water reuse) or sub-catchment scale (sub-catchment monitoring).

What Scope Is Required?

Any planned expansion of agriculture must meet these new regulatory standards. Additionally, however, there is real scope to apply highly innovative and collaborative thinking in advance of the agricultural development curve, improving development approval and new development outcomes. Across the globe, there are examples to be drawn upon. The required tasks and outcomes are:

Key Tasks	Outcomes
Building a strong and evidence-based collaborative alliance between, industry, researchers and FBA to co-design an area-based approach in association with the *Supply Chain Vision Building* and *Visionary Land Use Planning* phases.	All responsibilities for implementation are clearly defined and strong pathways in place to secure the investment required to implement Highly innovative cross-sectoral, area-based approaches are explored and assessed as well as traditional practice-based approaches.
Building strong collaborative governance arrangements to ensure that standards are maintained and continuously improved.	Whole of area monitoring alliances and outcomes established from the outset of the development cycle to minimize investment risk. Targeted concessional finance arrangements identified and linked to new agricultural development meeting scheme requirements.

Timeframes, Investment and Costs

The pathways forward on this particular piece of work should build on the foundational mapping of supply chain vision and visionary land use planning work undertaken by the Council. It should also facilitate cohesive sector wide input into the design of systems that might be able to attract significant concession finances for compliant agricultural development opportunities.

Package Item	Total In Kind	Total Cash	Completion Timelines
Establishing innovative delivery systems to meet no-net-decline water quality outcomes in the GBR			June 2021
Potential Investors	**In Kind**	**Cash**	**Notes**
Potential State Budget bid		$300,000	
GBRF			
OGBR			
Council			
FBA			
Industry partners			
CQU/JCU/CSIRO			
Clean Energy Finance Corporation			

Who Needs to Be Involved?

The Fitzroy Basin Association (FBA), in collaboration with Rockhampton Regional Council, would be the appropriate project lead to ensure that this work is coordinated and integrated with other key steps, but the work would need to be developed in partnership with industry and investors. Key players that need to be involved include:

- Key participants in the agricultural sectors, including government agencies, growers, financials, suppliers, agricultural service providers and data service providers
- Rockhampton Regional Council, GBRMPA, the Fitzroy Basin Association and the water service provider
- A stronger co-design approach at and area scale is required to deliver an area-based and cross-sectoral approach to achieving no-net-decline in water quality.

SECTION THREE – GOVERNANCE, MANAGEMENT AND CAPACITY

Total project costs, return on investment and future leverage

The following outlines the foundational but incomplete return on investment (ROI) case behind the proposed $1.4M State budget investment envisaged over a five year period starting July 2020. Table 3 below outlines the estimated returns and the assumptions underpinning these returns.

Table 3: Estimated ROI for the *Making Water Work* Initiative

Project Impact Category	**Assumptions for Additional Impact**	**Total Investment Return**
Project cash leverage	• TBA following initiative budget finalization	$
Increased regional sector growth or business turnover	• Assume current Gross Regional Product from agriculture is $94 million • Assume the projected growth in agriculture from proposed new water development occurs over 30 years • Assume this investment delivers 25% of the value of the growth in that agricultural GRP over 30 years	$
New consequent and attributable private and public sector investment in Region	• Target of $500,000 Year 1 and $1.5 million in each subsequent year to Year 5	$6,500,000
Total State Investment	**Preliminary Total Investment Return**	**Total ROI**
$1.4M	**$6.5M**	**4.6:1**

Governing for integrated effort and success

Project Governance Arrangements
Strong governance arrangements will be key to the success of this initiative, particularly ones that are locally led, regionally coordinated and State supported. These would include:

- Some form of strong area-based governing structure that is inclusive of key partners
- Strong stable and longer-term initiative leadership based within the RRC
- Strong project-focused delivery coordination (preferably third-party facilitated) involving RRC, CQU, the CiT team, the private sector and the State)
- Ongoing support partnerships with CQU, the original CiT partners and the Regional Economies Centre of Excellence (RECoE)
- Ongoing formal networking across-CiT regions, potentially including strategic consideration, shared appointments and procurement approaches.

Integrated Project Linkages
Key integrated linkages from this initiative and others will need to include:

- Integrated links and cooperation between the wider *Making Water Work* Queensland budget bid (Cooktown, Charters Towers, Rockhampton and Barcaldine)
- Strong linkages to the planning of the recently established Federal NQ Water Infrastructure Development Authority
- Strategic links to key Queensland policy initiatives, including the new Innovation Strategy, Just Transition Strategy, Zero Net Emissions, the Agricultural Strategy Paper, etc.
- Strategic linkages to the Office of the Great Barrier Reef (OGBR), the Great Barrier Reef Foundation (GBRF) and the Great Barrier Reef Marine Park Authority (GBRMPA)
- Key research investments and linkages should be considered and maintained, including the: (i) Advanced Manufacturing Growth Centre; (ii) CRC Northern Australia; (iii) new Future Food Systems CRC and (iv) NESP Tropical Water Quality Hub (RRRC).

Monitoring for Success
A strong monitoring program should be established from the outset of this initiative to ensure that the key outcomes and projected ROI are achieved. This approach sets up the process for key partners to jointly monitor both the health of the partnerships and the progress of implementation. It also establishes a basis for monitoring the achievement of the predicted cost benefits as the project unfolds and becomes a reality.

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Appendix A: Criteria Sheet – Key Options for Making water work

Select **ONE** Option and consider it when you answer the questions in the table.

1. Best Management Practices, Regional Composts, Credentialing in Nutrient Management & Monitoring
2. New Forms of Zero Emission Aquaculture, including macro algae to treat waste water
3. New Forms of Local, Secure, Affordable, Dispatchable and Low Carbon Energy to Drive Agricultural Growth
4. Visionary Land Use and Infrastructure Planning to Reduce Costs and Impacts and Strengthen Supply Chains
5. More Effective Water Trading and Local Management
6. Stronger Digital Data Hubs and Value Chain Resilience and Innovation
7. Next Generation Skills for a Circular Economy
8. New Protected Cropping Systems for Agriculture (e.g. greenhouses, shade structures)
9. Engineering Solutions, New Water Infrastructure and Enabling Substantive Water Recycling

Intervention Option Name:	**Not sure**	**No**	**Yes**	**Comments**
1. Is it essential for the pathway?	N S	N	Y	
2. Is it essential, but difficult to implement - i.e. lots of barriers	N S	N	Y	
3. Might the option foreclose other options?	N S	N	Y	
4. Might it open/benefit other options?	N S	N	Y	
5. Could it lead to irreversible negative changes?	N S	N	Y	
6. Will it be robust? (long-lasting & durable)	N S	N	Y	
7. Is it 'no regrets'?	N S	N	Y	
8. Other considerations				

Appendix 2 – Planning Foundations Report for South Yaamba

Description and Preamble

As part of the Making Water Work Program a Planning Foundations Report for South Yaamba is required to assist forward planning for further agricultural development. South Yaamba has some existing horticultural, cropping and livestock operations with the area being identified as having opportunities for further growth, with potential for existing operations to expand and new higher value operations to potentially come on line.

It has been identified that:

- There are potential opportunities for a 10,000ML water distribution scheme in the South Yaamba area to assist local agricultural development. Please see the map below.
- Access to the river is currently constraining growth with the identification of options for water easements required.
- Necessary road treatments may need to be improved to handle additional agricultural inputs and outputs plus more farm-based workers and service providers accessing the area
- With the growth of agriculture improved power/energy solutions may be required
- Improved telecommunications will be required to assist with smart farming solutions however scoping of what is specifically required is needed; and
- Approximately 15 plus landholders are looking at either expanding operations or seeking new higher value agricultural operations.

The Making Water Program is wanting to secure a professional consultant to develop a planning foundations report at the preliminary design level incorporating the elements outlined above. Noting that engaging with local landholders will be required to help develop the plan.

In terms of specifics, the following agenda need to be understood:

<u>Water Distribution Scheme</u>

- Understanding the irrigation area extent and demand patterns required (based on knowledge being developed by Rockhampton Regional Council
- Undertaking river bathymetry for three potential extraction points will be required
- The identification of power supply connection points will be required
- The provision of three irrigation concept options should take into consideration access to infrastructure the preferred option to be selected using a multi-criterion analysis
- The detail of the capital, operational, depreciation costs and cost per ML from the potential schemes are required to be incorporated into the multi-criteria analysis.
- The design of irrigation trunk infrastructure (preliminary design) including necessary pumps stations and delivery pipelines and potential balancing storage/s based on a preferred option will be required
- Provision of an overall report including a cost estimate for an irrigation system including a cost per ML of water for transportation from the river to the property will be required.

The design of the irrigation trunk infrastructure will need to meet the following criteria:

- Sized to meet peak evaporative crop requirements for the irrigated farmed area with acceptable limitations in extreme weather events
- Recognition of the inherent possibility of the whole area requiring peak water simultaneously
- The consultant to outline additional criteria that they would use.

Road infrastructure

- Based on projected landholder agricultural development plans, the consultant will identify the necessary road treatments required with an order of road developments based on landholder timeframes and requirements.
- The order of the road treatments and the standards to be applied need to meet Council's requirements.

Power / Energy

- Based on project landholder agricultural development plans, the consultant will identify power / energy solutions to assist agricultural development.

Waste streams generated

- Based on projected landholder agricultural development plans, the consultant will need to understand potential waste streams (tonnages) and where possible nutrient cycles could be employed or circular economy opportunities.

Management of water and nutrient

- Based on projected landholder agricultural development plans, the consultant should identify higher level physical mitigation techniques that would / could be employed to assist management of water and nutrient run off.

Telecommunications / Digital communications

- Based on project landholder agricultural development plans identify power / energy solutions to assist agricultural development.

Background Information

The Lower Fitzroy region has on average approximately 5,900GL of water that flows down the Fitzroy River with supplemented water being held in the Fitzroy Barrage Water Supply Scheme, Eden Bann Water Supply Scheme and soon to be completed Rookwood Weir Water Supply Scheme. There is also a 46,000ML volumetric limit for unsupplemented water through the Lower Fitzroy Water Management Area.

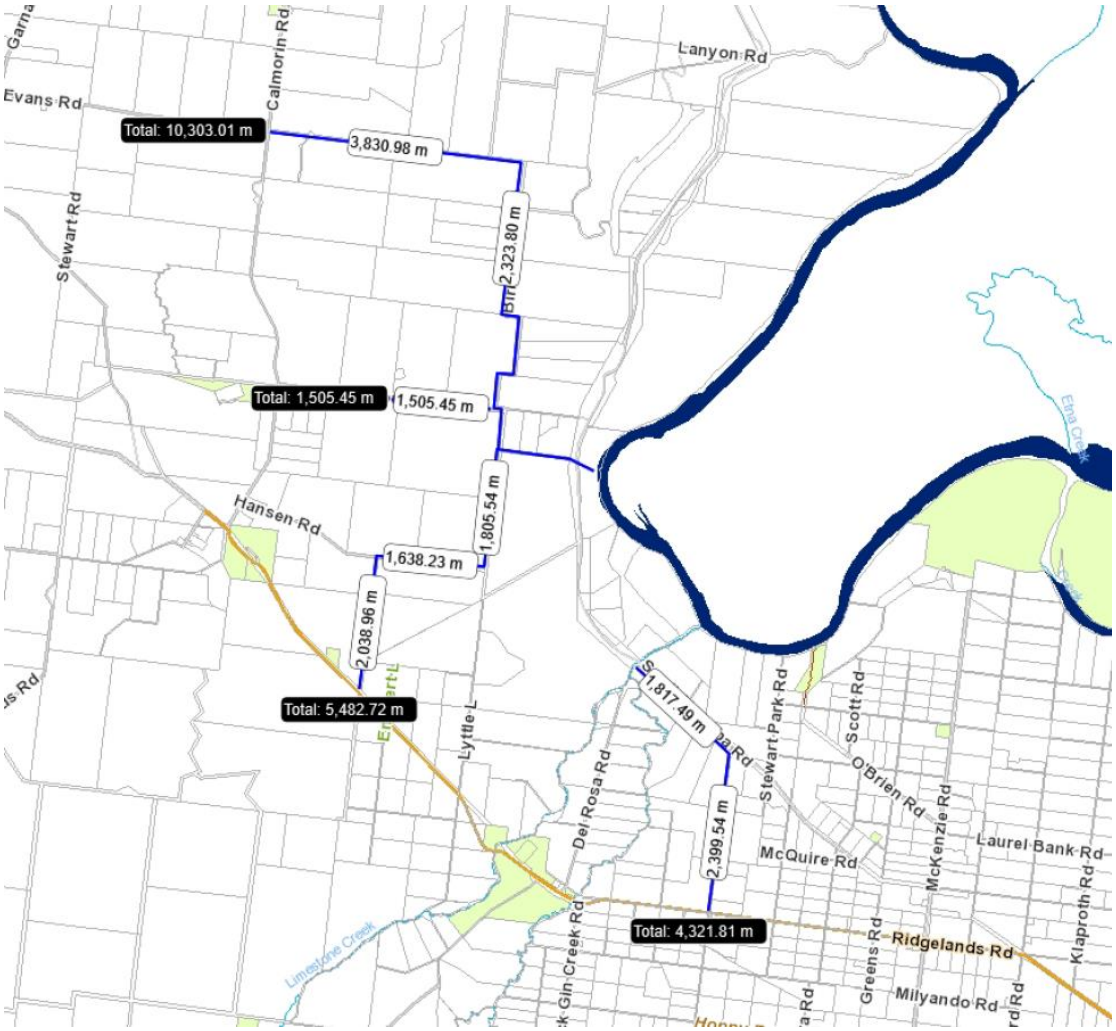
As the Fitzroy River is the largest river catchment on the eastern seaboard of Australia with good agricultural soils (generally 5KM either side of the river), the Rockhampton Region has a significant opportunity to diversify its agricultural product through increased horticulture, cropping and more intense livestock production.

South Yaamba as a district has progressed its agricultural development to have macadamia, lychee, partial irrigation and dry land cropping however the main limiting factor is obtaining water from the Fitzroy River for non-riparian areas.

Landholders have expressed a desire to explore a potential irrigation scheme to transport water from the Fitzroy River to their properties to aid their agricultural production and this scope seeks to obtain this information.

Key deliverables for the South Yaamba Foundations Report

- Irrigation Analysis report based on known local landholder demand with consideration of additional land that has suitable soils for cropping and horticulture using the Crop Suitability Mapping Investor Tool
- An options development report which includes the preferred irrigation option
- Preliminary concept design drawings, pumps required, schematics plans for pipelines and design report
- Preliminary costings of preliminary concept and order of cost estimates
- Financial analysis including cost $/ML, Cashflow (over the life of the asset) BCR, NPV, Payback Period and ROI
- Presentation of findings to the Making Water Work Governance Group
- Completion of the overall report.



South Yaamba : Water Distribution area to be investigated

Other Available Resources

- Grow Rockhampton: https://www.advancerockhampton.com.au/files/assets/advancerocky/advance-documents/grow-rockhampton.pdf

- Rock e Plan: http://rockeplan.rockhamptonregion.qld.gov.au/Pages/XC.Home/Default.aspx

- Rookwood Weir Project: https://www.sunwater.com.au/projects/rookwood-weir-project/

- Rookwood Weir Irrigated Crop Suitability Tool and report: https://www.daf.qld.gov.au/business-priorities/agriculture/sustainable/rookwood-weir/mapping-tool-report