FINAL REPORT

Making Water Work in the Lower Fitzroy:
Lessons from and Prospects for the Rookwood Weir

Defining a Supply Chain for Lower Fitzroy
A.7.2122006

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2024

Research for **sustainable** and **inclusive** development in **northern Australia**.







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The Cooperative Research Centre for Developing Northern Australia recognises the continuing connection to sea and country of Australia's First Nations People. We acknowledge the Traditional Custodians of the land and water on which our staff and researchers live and work, and pay our respects to their Elders past, present and emerging.

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The author(s) confirm(s) that this document has been reviewed and approved by the project's steering committee and by its program leader. These reviewers evaluated its:

- originality
- methodology
- rigour
- compliance with ethical guidelines
- conclusions against results
- conformity with the principles of the Australian Code for the Responsible Conduct of Research

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List of Acronyms

DEWS	Department of Energy and Water Supply
DNRME	Department of Natural Resources, Mines and Energy
DRDMW	Department of Regional Development, Manufacturing and Water
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning Environmental
EIS	Impact Statement
GL	Gigalitres
LFRIP	Lower Fitzroy River Infrastructure Project
ML	Megalitres
QBWOS	Queensland Bulk Water Opportunity Statement
WRP	Water Resource Plan

Executive Summary

The fundamental importance of water supply and infrastructure for successful agricultural development in northern Australia, alongside developments in other areas (e.g., mining, forestry, aquaculture, defence, tourism, urban population centres and fishing), was recognised by the Australian Government in the *Developing Northern Australia* White Paper and through the National Water Grid. CSIRO studies have suggested that the water resources in northern Australia could potentially support up to 1.4–1.6 million ha of irrigation land, thus potentially increasing Australia's irrigation area by 50%. However such estimates are highly optimistic given the number of constraints around water and irrigation development in northern Australia, creating the need for targeted research to identify where there are opportunities to make water work effectively.

The most recent water infrastructure project in northern Australia is the development of the Rookwood weir near Rockhampton in Central Queensland. The feasibility study for the project was supported through the National Water Grid (The National Water Grid, 2017), and the $568.9 million capital cost was shared between the Australian and Queensland Governments ($183.6M each), with Sunwater contributing the remainder . Construction commenced in 2020 and was completed in late 2023.

It took nearly three decades to plan, approve and construct the weir from the initial concept proposals in the mid-1990s. The purpose of this report is to identify the key components of the planning and development processes for the development of the Rookwood weir precinct, and to distil key lessons that might be relevant for other potential water resource developments in both the lower Fitzroy River and more generally across northern Australia.

The research used interviews with key stakeholders to collate knowledge and insights. Key themes were then distilled from the data as:

- Collaboration and governance;
- Obtaining a cross section of support from stakeholders, Investment attraction information, and
- Long term commitment.

These were analyzed and discussed in the context of the need for more effective approaches to regional development. Key aspects that explain why Rookwood weir has been successfully advanced and now being implemented have been identified as:

- Provision of water to different uses (agriculture, urban, industrial).
- Strong business case across multiple industries that generated strong local support. Completion of multiple steps over a long time period to meet all planning, infrastructure funding and approval criteria.
- Capacity to capitalise on funding from the National Water Grid.
- Bipartisan government support at state and federal levels.

These review outcomes are augmented with the results from the Making Water Work project, which identify and analyse the constraints and opportunities around further water use and supply in the lower Fitzroy basin.

The results of the Making Water Work project identify that there are substantial opportunities for further water development in the lower Fitzroy, but that a number of constraints exist, both in terms of the long term advocacy, planning and approvals processes required and the difficulties of ensuring that water is taken up and used effectively once supplies exist. This understanding of the reasons why the Rookwood weir progressed, together with the results of this Making Water Work program, should help to provide insights for new irrigation projects in Northern Australia into the future.

1. Introduction

The expansion of agriculture is a major opportunity for northern Australia, alongside developments in other areas (e.g., mining, forestry, aquaculture, defence, tourism, urban population centres and fishing). This was recognised by the Australian Government in the *Developing Northern Australia White Paper* (Australian Government 2015).

The Developing Northern Australia White Paper highlights the fundamental importance of water supply and infrastructure for successful agricultural developments. CSIRO studies have suggested that the water resources in northern Australia could potentially support up to 1.4–1.6 million ha of irrigation land, thus potentially increasing Australia's irrigation area by 50% (Petheram et al., 2018). Northern Australia covers the Northern Territory (NT), northern parts of Western Australia (WA), and north Queensland (QLD). Beef production, mining, conservation, and agriculture (horticulture, broadacre cropping, and plantation forestry) are the main land uses in the region, with pastoral use being the dominant sector across all jurisdictions. Over half of the landmass in this region possesses a legal recognition of Indigenous interests (freehold and native title), and the rest supports freehold or lease tenure arrangements for diverse land uses (Hart et al., 2020).

The most recent water infrastructure project in northern Australia is the Rookwood Weir project near Rockhampton in Central Queensland. Construction of the weir commenced in 2019 and was completed in late 2023. The capital cost of $568.9 million was shared between the Australian and Queensland Governments ($183.6M each), with Sunwater contributing the remainder[1]. Additional planning, project and funding support from state government departments, local government (Rockhampton Regional Council), investment stakeholders and investors. In February 2018, the Queensland Government committed $176 million of funding towards the project (half of the initial capital costs), and by April 2018, the Federal Government had committed the remaining half of the required funds. In July 2018 SunWater was identified as the developer and operator of Rookwood weir (Infrastructure Partnerships Australia, 2022).

Although the Rookwood Weir has been successfully developed, it is the exception among potential water infrastructure projects. There have been a number of potential water infrastructure developments across northern Australia that have failed to progress to date, despite many undergoing feasibility studies[2]. One example comes from the Rookwood approvals process, which was first progressed as the Lower Fitzroy Regional Infrastructure Project (LFRIP) that included constructing the Rookwood weir and raising the Eden Bann weir, both on the lower Fitzroy. The combined projects were declared a Coordinated Project on 6 May 2011, and then approved by the Queensland Coordinator General in December 2016, followed by the Australian Minister for the Environment and Energy[3] in February 2017, subject to conditions. However only the Rookwood weir progressed, and the Eden Bann option has not been pursued to date.

There are significant barriers to advancing and developing water infrastructure projects in northern Australia that include technical feasibility, economic and financial viability, planning and governance processes, government approvals from multiple layers, political support from the local through to the national level, including support to fund the infrastructure, and concerns over impacts on environmental, social and complexities associated with negotiating native title and Traditional Owner interests. Proponents for the Rookwood weir have successfully negotiated those hurdles, but proponents for other projects, including the raising of Eden Bann weir, have not.

This report aims to identify the process that was successful in gaining approval and funding for the Rookwood weir precinct, and to canvass the key opportunities for further agricultural development in the lower Fitzroy basin. In relation to the latter aim the results of this Making Water Work project are

[1] https://www.rdmw.qld.gov.au/water/consultations-initiatives/rookwood-weir
[2] See https://www.nationalwatergrid.gov.au/science/feasibility-projects
[3] Under the Environment Protection and Biodiversity Conversation Act 1999 (Cth),

summarized which identify and analyse the constraints and opportunities around further water use and supply in the lower Fitzroy basin. The aim of providing a better understanding of the development of Rookwood weir precinct and the opportunities to capitalize on this is to provide insights for new irrigation projects in Northern Australia into the future.

The purpose of this Making Water Work Supply Chain for the Lower Fitzroy project is to identify a vision and action steps to develop a major agricultural precinct in the Lower Fitzroy region of Central Queensland. Funding for the project is provided by the Cooperative Research Centre for Northern Australia (CRCNA), Queensland Department of Agriculture and Fisheries (QDAF), and Rockhampton Regional Council. CQUniversity (CQU) is leading this project in partnership with KPMG and the University of Queensland, with in-kind support from AgriVentis and Gladstone Ports Corporation.

2. Background

In 2004, the Queensland Government signed the National Water Initiative Agreement, which committed Queensland to working with the Australian Government and other states and territories to progress national water reform (NWC 2009). The agreement committed the state and territory governments to a number of key principles, including:

- Prepare water plans with provisions for the environment.
- Achieve sustainable water use in over-allocated or stressed water systems. Introduce registers of water rights and standards for water accounting. Expand trade in water rights.
- Improve pricing for water storage and delivery.
- Better manage urban water demands.

A key focus of the reform process has been on achieving more efficient pricing for water storages and other infrastructure. The purpose of this, together with water rights and trading systems, is to ensure that water is allocated to highest value uses. One implication is that proponents of new water storages requiring public funds have to demonstrate that projects will deliver net economic benefits, noting that these may include more than commercial returns. The multiple emphasis on careful planning, minimising environmental harms and generating economic benefits creates approval requirements
that are challenging to meet.

2.1 The planning process for Rookwood weir

Like most infrastructure projects, Rookwood weir had a long gestation period, including significant discussion about the potential for irrigated agriculture and feedlots in the lower Fitzroy region during the 1990s. Here the most significant steps in the process to approve Rookwood weir are outlined post-2004, when the National Water Initiative Agreement came into effect.

In 2006, the Central Queensland Regional Water Supply Strategy identified the Rookwood Weir as a means of meeting short-to-medium-term urban and industrial demand for water in the Lower Mackenzie-Fitzroy sub-region. The Central Queensland Regional Water Supply Strategy (CQRWSS) was the outcome of the Central Queensland Regional Water Supply Study, which assessed current water availability and future demands, and how demand could best be met while protecting the natural values and ecosystems (Queensland Department of Natural Resources and Mines, 2005).

The CQRWSS covers approximately 153,000 square kilometres (km), including Queensland's Fitzroy River Basin and the coastal streams of the Capricorn Coast and the Gladstone region. It is a long-term strategy to meet the water supply needs of the region. It proposes a framework for sharing supplies into the future, particularly addressing the following key issues:

- Continued urban growth and industrial development, particularly in the Lower Fitzroy and Gladstone areas, and mining development in the Bowen and Surat coal basins;
- entitlements in some existing regional water supply systems that are at or approaching full usage;
- a number of existing water supply schemes performing below water user requirements and water demand projections indicating regional supply shortfalls for urban, industrial, coal mining and agricultural requirements.

The CQRWSS identified the Lower Fitzroy River as the ideal location for the region's next main water storage. Development of a new weir at Rookwood and/or the raising of the existing Eden Bann Weir was acknowledged as the preferred solutions to meet the urban and industrial needs of the region. These findings were followed by the Queensland Government declaring in July 2007 that the Gladstone Area Water Board (GAWB), SunWater and the former Rockhampton and Livingstone Shire Councils would come together as proponents for the Lower Fitzroy Joint Venture. After amalgamation the Rockhampton Regional Councilwithdrew soon after but remained a key stakeholder.

The Lower Fitzroy River Infrastructure Project (LFRIP), including the new weir at Rookwood and/or the raising of the existing Eden Bann Weir, was declared a Coordinated Project (previously a Significant Project) in 2011 for which an Environmental Impact Statement (EIS) was required. Gladstone Area Water Board and Sunwater jointly completed the EIS. The Lower Fitzroy Regional Infrastructure Project (LFRIP) was declared a Coordinated Project on 6 May 2011, with the Coordinator General's Evaluation Report (December 2016) recommending that the project proceed subject to conditions. In February 2017, the Minister for the Environment and Energy, approved the LFRIP under the Environment Protection and Biodiversity Conversation Act 1999 (Cth), subject to conditions.

The LFRIP was initially conceived as an assessment of the raising of Eden Bann Weir; and/or the construction of the new Rookwood Weir. Rookwood and Eden Bann were awarded funding through the National Water Grid, which allocated funds to water projects across Australia for feasibility studies (The National Water Grid, 2017). The construction of the Rookwood Weir was later determined to be the most effective method of gaining the requisite water yield, and is now the focus of the project.

Sunwater is the operator and developer for the $568.9 million Regional Water Project (The Department of State Development, 2018). The project commenced construction in 2020 and was completed in late 2023. The development included the construction of the weir and fishway infrastructure, construction of new river crossings, road realignments, and an upgrade of the Capricorn Highway. However it did not include any water offtake or water channel systems, with water entitlement holders required to access water from the impoundment directly or from the downstream river channel.

2.2 The infrastructure development process for Rookwood weir

The Queensland Government has various frameworks, policies, and guidelines to assist in the delivery of projects (Department of State Development, 2021). The infrastructure development lifecycle can generally be characterised across four phases:

1. Planning: identifying future service needs based on clearly defined problems and/or opportunities.
2. Assessment: developing infrastructure options, including working through to an investment decision at the conclusion of this stage.
3. Delivery: procuring and constructing infrastructure solutions.
4. Operation: operating and maintaining the infrastructure through its in-service life and withdrawing from service or managing transition to replacement.

The process for Rookwood weir development started with the Queensland Co-ordinator General in conjunction with Queensland Department of Agriculture, and a number of consultants. They worked collaboratively on planning what was possible for agriculture development in the area, with soil mapping and suitablity,requirements for heat stress for feedlot animals, and understanding the current agricultural industry,its exisitng capacity for growth, and how to best support growth (Figure 2).

A number of economic assessments were also completed. A water resource plan and evalution were then completed, before both the State and Federal governments committed money to the infastructre development. This then lead to the delivery of the infastructure through construction and then operation of the weir.

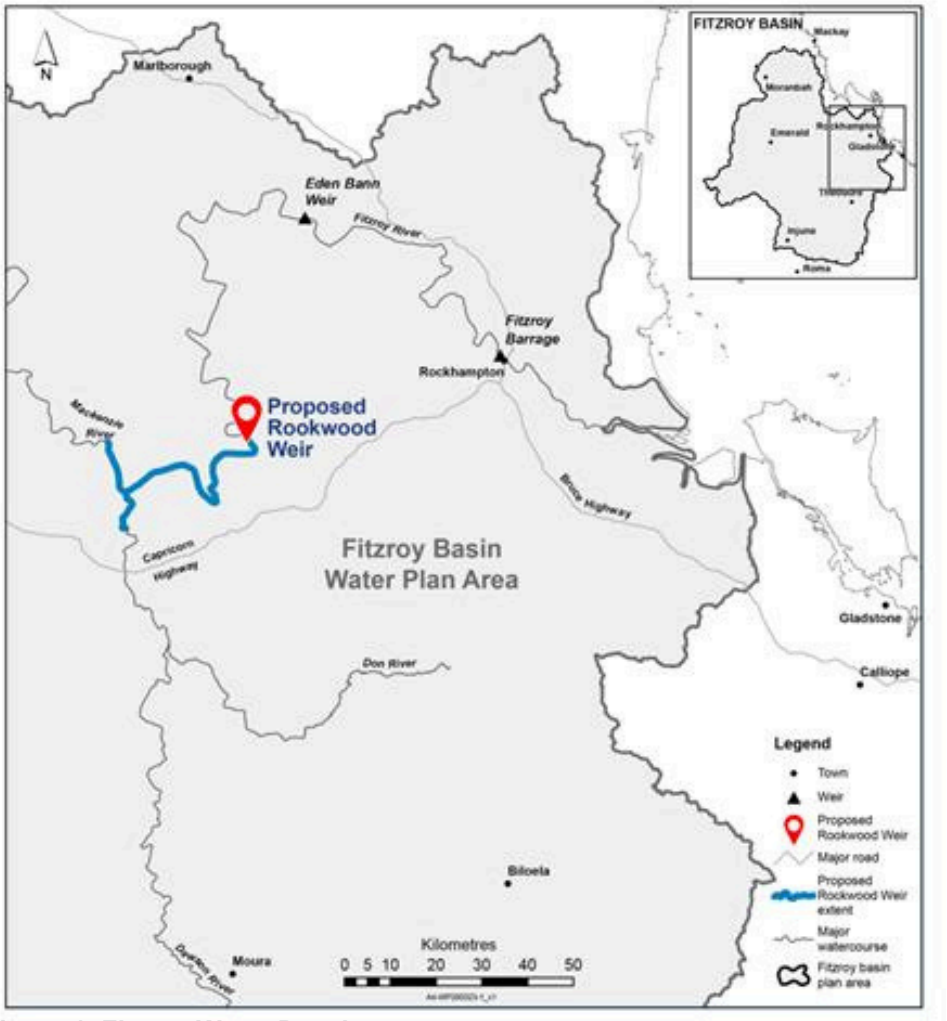


Figure 1. Fitzroy Water Development

The process has involved a large number of Federal, State and local governement stakeholders which have all implemented components of the project. The Co-ordinator General through the Department of State Development engaged with the then named Department of Primary Industries, the Department of Natural Resources and Water, and the Department of Heritage and Protection. These agencies then engaged with Sunwater, Advance Rockhmapton, and the Rockhampton Regional Council, to ensure that each step of the process was achieved over time (Figure 2). An important component of the planning and approvals process was to ensure that the water allocations were available under the Fitzroy Basin Water Plan (2011).

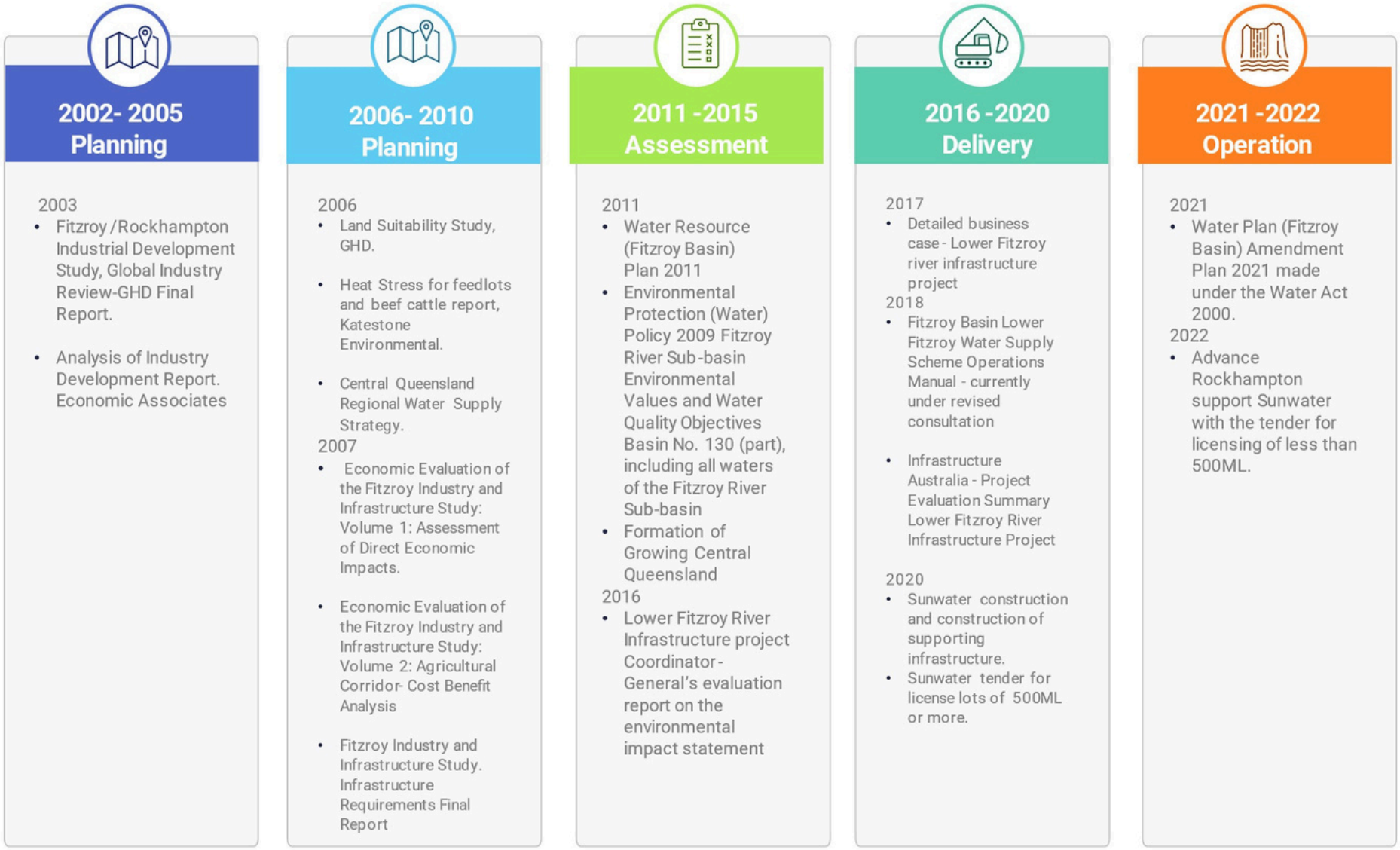


Figure 2. Key timelines in the planning, assessment, delivery and operation process for Rookwood water infrastructure development.

3. Data collection

To understand the issues and processes regarding justification and development of the Rookwood weir a number of discussions were held with key stakeholders. These were completed during September 2022 through to May 2023. Given that the roles that stakeholders played were very different, discussions were unstructured, and specific to the issues and processes relevant to their involvement.

Table 1. Interviewee names and organisations

Rockhampton Regional Council	Angus Russell
Advance Rockhampton	Wade Clark
Regional Development Manufacturing and Water	Stephenie Hogan, Virginia Hunter, Carla Littlejohn
Department of Agriculture	Peter Donaghy John Grimes (Now Retired)
Formally: Growing Central Queensland	Anne Stunzner

The aims of the discussions were to:

1. identify the issues and processes around the development of irrigated agriculture in the Rookwood weir precinct, historically and currently,
2. categorize those issues that are likely to be relevant to other irrigation development precincts in northern Australia, and
3. identify research programs that may develop processes to address those issues within different precincts.

The key aspects of the discussions were then documented and discussed with the research team. The critical categories for water infrastructure development were summarised from the discussions as:

- Collaboration and governance
- Obtaining a cross section of support
- Investment attraction information
- Long Term commitment.

4. Findings from the process review

4.1 Collaboration and Governance

A clear vision and the purpose of water use was formed very early in the project from key stakeholders. The project was to deliver;

- Increased water security for urban Rockhampton and surrounding towns.
- Gladstone Area Water Board made a commitment to take water from the weir to supplement its supplies from Awoonga Dam and improve the reliability of water supply to the people and heavy industry in the Gladstone region,
- An opportunity for more intensive agriculture close to existing agricultural infrastructure.

Having clear intentions from the inception of the process ensured a shared vision was held by all stakeholders. Having a combination of uses for the water (urban, industry and agriculture) allowed the infrastructure to meet a range of political drivers, ensuring it was relevant and timely to a number of interests over time. It also helped to justify strategic and business cases, given the importance of additional supplemented supplies for industrial uses in Gladstone and the higher capacity to pay from those users.

The approval process for the Rockwood Weir was coordinated by the Office of the Coordinator General in the Department of State Development. This allowed each of the other state agencies to have a defined role that was to be followed and an understanding of the component that they would lead (Figure 3). Local government was also involved initially to ensure that investment, infrastructure and local planning was also in place. This coordination and collaboration was critical to ensure that the complexity of the approvals process could be navigated.

During the early phases of the project, State Government Departments had strong engagement and collaboration with organisations such as Capricorn Enterprise, Central Queensland Regional Organisation of Councils and Growing Central Queensland. Growing Central Queensland was a partnership formed between the Department of Agriculture and Fisheries, Department of State Development, Department of Natural Resources and Water, Regional Development Australia, CQUniversity, and the Rockhampton Regional Council and Livingstone Shire Council. This organisation created a political collaboration that made it easier to engage landholders and identify and advance investment opportunities. Having this broader collaboration beyond the state-based departments assisted in progressing funding commitments at the federal level, and provided a platform to bring both state and federal governments together. Eventually this led to a commitment from the federal government to co-invest in the project.

A wide range of skills were required, and large interdisciplinary teams were often required to work together to ensure that the relevant information was cohesive for a range of audiences such as investors, public engagement, planning process and legislation (Figure 3). The different skill sets and organisations that came together allowed the fostering of collaboration and the respect for the contribution to the overall process.

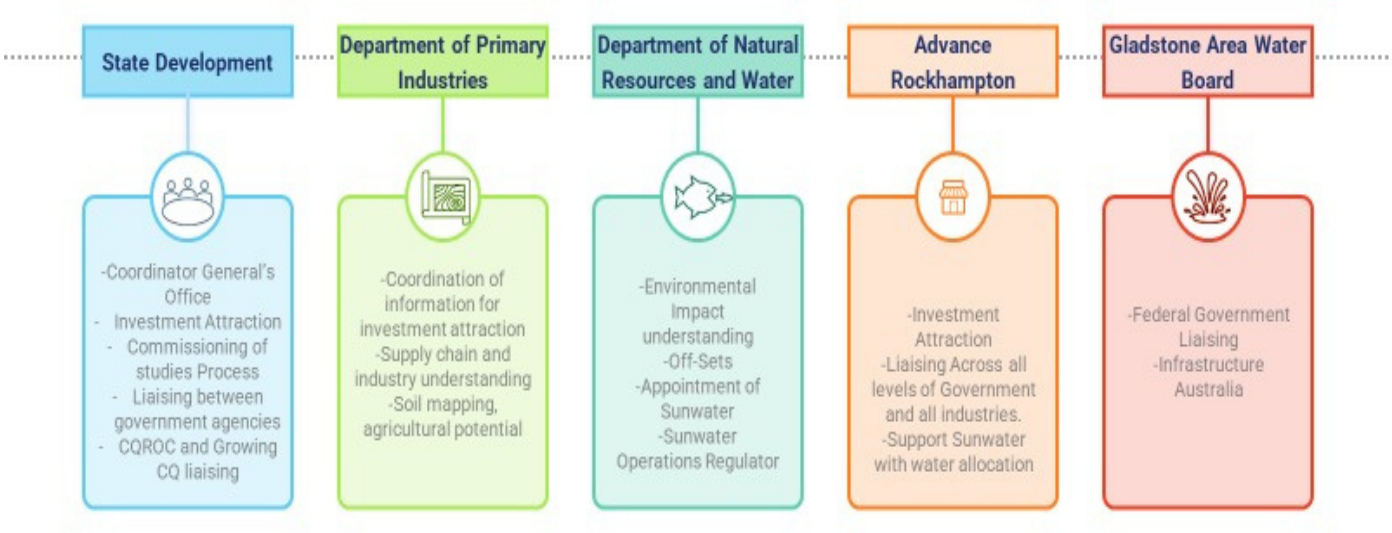


Figure 3. Different organisation roles at a state level (Previous department names to align with reports).

A large number of senior staff in the government departments were based in Rockhampton. Having this capacity at the local level resulted in long-term relationships being established across stakeholders. Collaborative relationships were critical to ensuring that process stages were completed and adjustments could be managed. These collaborative relationships spanned long periods of time, changes in the governing party, department name and structural changes. This continuation of corporate knowledge ensured that progress continued to occur, and that components of the knowledge base were built on over time (i.e. building business cases). Champions of the project emerged over time as their understanding of the project.

This retention of institutional knowledge during the key phases of the project over the long term is an important explanation of the success of the overall project development. The selection of the right people was crucial across the full lifecycle of the project. Having many senior staff locally allowed for simpler coordination and collaboration between stakeholders, and a transfer of information to new staff as they became part of the project. As the project progressed, locally based senior leads continued to drive the process, and stakeholders were engaged, thereby building on earlier work and understanding, contributing to an on-going culture of collaboration (Figure 4).

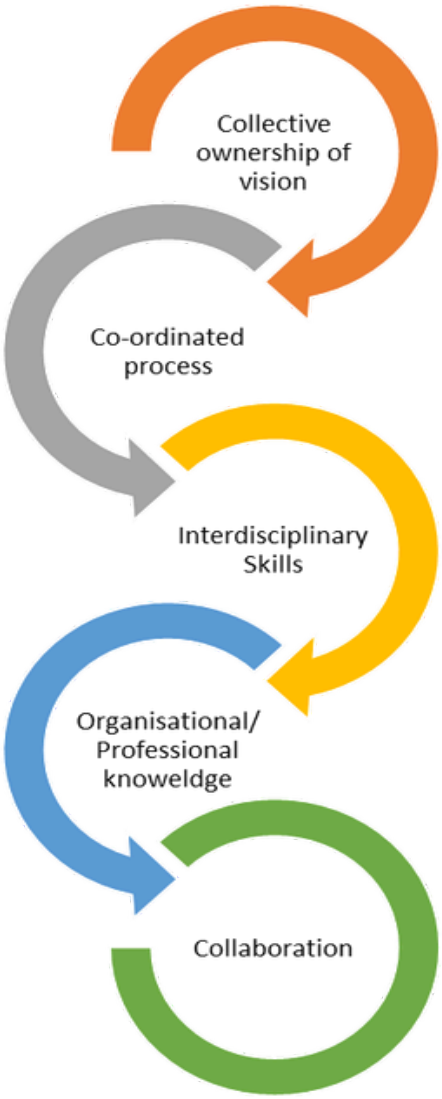


Figure 4. Co-ordination and collaboration across organisations

4.2 Investment attraction

Water infrastructure projects involve both public asset and private investment aspects. From the public asset viewpoint, infrastructure projects are resources which benefit communities by providing useful services. From the private investor viewpoint, the services available from infrastructure projects should deliver predictable cash flows for long periods of time. Ideally, there should be a connection between the value the infrastructure assets deliver to the public and the returns earned by investors.

Investment attraction is critical to generating effective use of infrastructure, and creating the desired jobs and economic impact. There are however several barriers that obstruct investment in the agriculture sector in Northern Australia, including:

- The challenging climate.
- Gaps in infrastructure and support supply chains, such as logistic networks.
- Lack of information regarding investment requirements, leading to uncertainty and risk.
- Lack of reliable information for investors (domestic and international) about the business, agronomic and climate conditions, and the infrastructure timeline of other investments in the region.

To overcome these barriers appropriate information needs to be available to investors (Figure 5). This includes:

- Soil suitability and water availability,
- Crop suitability information,
- The level of risk,
- Land tenure and property rights (this also includes indigenous access and allocation) Environmental requirements and considerations,
- The level of government support available,
- Existing and proposed infrastructure in the region,
- State and prospects of the proposed agricultural industry,
- The ability to export,
- Exit strategy,
- The available business structure, and
- The foreign investment review board requirements (for foreign investors).

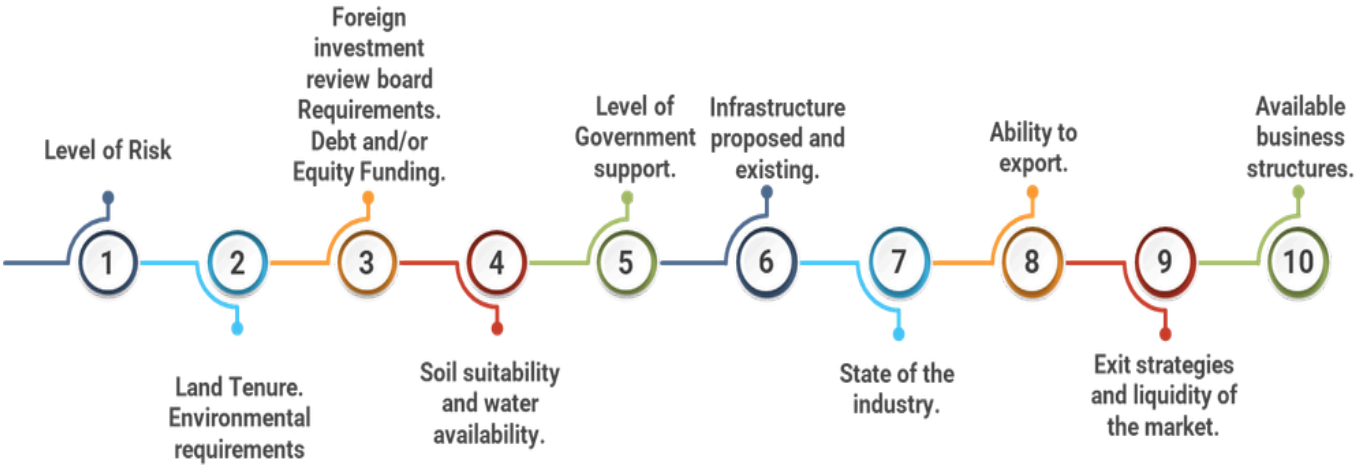


Figure 5. Investor information requirements. Adapted from Northern Australia Agriculture Investor Identification (Dale and Marshall, 2020).

To ensure that information gaps were met for agricultural investors, a series of reports were generated on soil mapping, identification of suitable industries, and relevant industry information, including:

- Fitzroy/Rockhampton Industrial Development Study, Global Industry Review- Final Report Analysis of Industry Development Report
- Land Suitability Study
- Heat Stress incidence report for Feed lotted cattle.
- Economic Evaluation of the Fitzroy Industry and Infrastructure Study: Volume 1: Assessment of Direct Economic Impacts 26 March 2007
- Economic Evaluation of the Fitzroy Industry and Infrastructure Study: Volume 2: Agricultural
- Corridor- Cost Benefit Analysis
- Rookwood Weir Financial Analysis Tool.

There were three key components to increasing attractiveness for investors:

1. Mapping how products would move through the supply chain
2. Ensuring relevant information for Government approvals was completed and this risk was removed for the investor.
3. Completing a range of analysis levels to ensure that different levels of investment could be attracted.

4.3 Supply chains

The requirements for different supply chains vary and are a key factor in investment attraction, particularly in Northern Australia. To improve confidence for large investors, supply chains for different products were mapped out, identifying key areas and existing supporting infrastructure. An example of supply chain mapping for feed lotting is provided in Figure 6. The geographical areas with minimal heat stress for animals were identified, along with the logistics for receival of grain, feed processing, livestock supply, access to processing, and the capacity for the processor to cope with a specific number of head through the facility. Another key aspect was that all the environmental and animal health approvals and impacts were assessed, with a report commissioned on the impacts of heat stress and another report regarding impact on water quality. This approach removed significant risk for the investor in that they understood the existing industry and the supply chain to ensure that their investment would be viable.

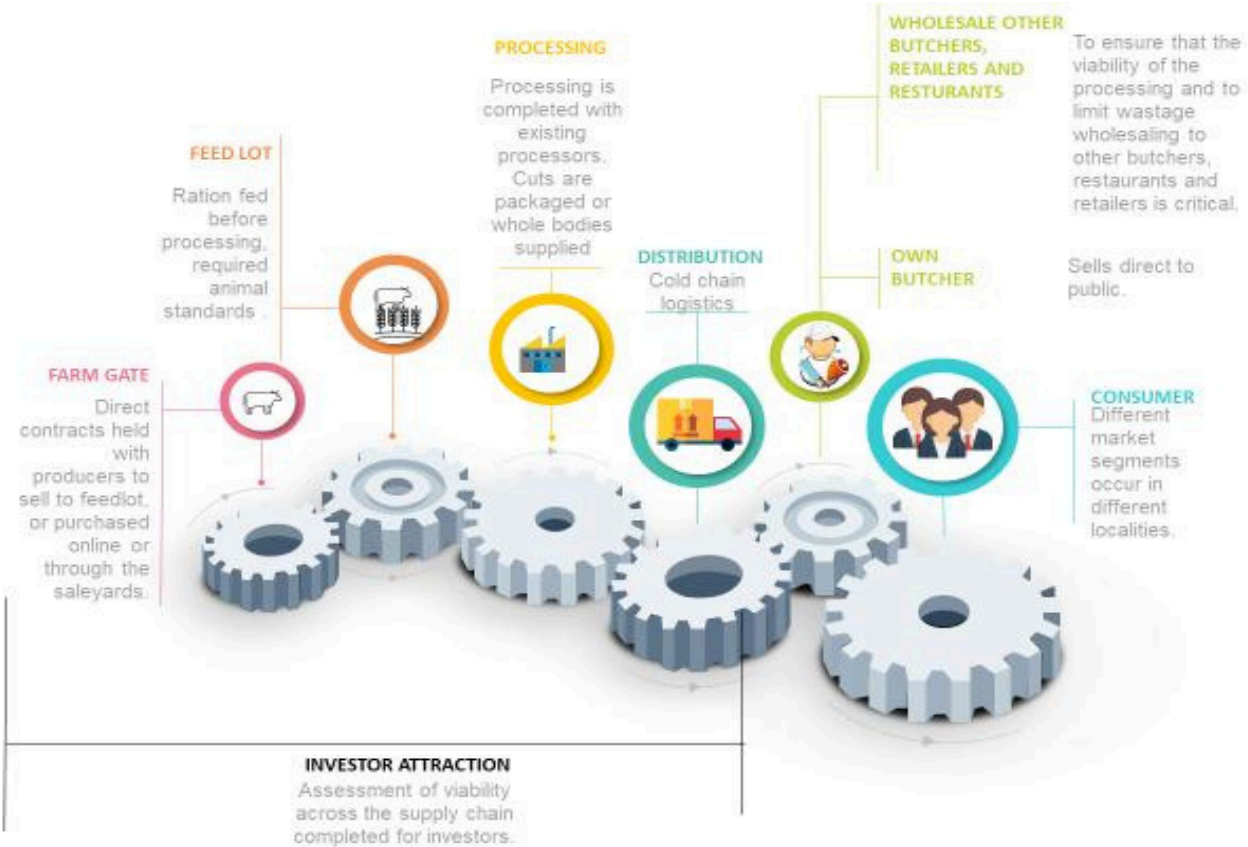


Figure 6. Components of the supply chain that were mapped for investor attraction.

A key aspect of having the supply chain mapped out and streamlining the planning approval process wasthat the timelines in achieving returns on investment were reduced, and therefore the timelines forpayback period were also shorter. This improved confidence in investment. Government support to improve information flows, reduce risk and streamline approvals processes was a key factor in increasing investor interest in water purchases.

4.4 Scale of Analysis

The scale of analysis varied at different stages of the project. High level information on soil types, potential crops and the required capital infrastructure along with indicative gross margins was able to be used at the initial stages of the planning process. The mapping also supported broader infrastructure planning and identifying critical components required to be upgraded or modified to ensure that the produce could move through the supply change more easily (particularly power and roads). Over time much of this analysis became available at finer scales.

However more detailed information was required at the enterprise level, particularly for potential investors and landholders who were not familiar with irrigation. For them, information on soil types, potential crops and operational issues needed to be tailored to the enterprise level. Over time better soils and enterprise mapping became available. More sophisticated information was provided to landholders interested in irrigation through support from Sunwater and Advance Rockhampton so that landholders could assess their potential options for irrigation development and water use.

5. Analysis and Discussion

The success of the Rookwood development has largely been based off place-based approaches. Dale et al. (2021) identified eight critical factors that were important to maximizing Rookwood development and its contribution to regional development. These included five assets (social capital, human capital, natural resources, infrastructure/technology and environment/amenity) that provide the foundation for agricultural development and three factors (balancing needs, strong regionalism and governance and institutions) that influence whether the different opportunities presented by the models are realised (Figure 7) (Turnour et al., 2015).

The frameworks' combination of assets, governance and institutional environment and models of agriculture provides a new structured way of looking at agricultural development. This expanded vision demonstrates how agriculture can contribute to regional development building on the traditional agri-industrial model of development.

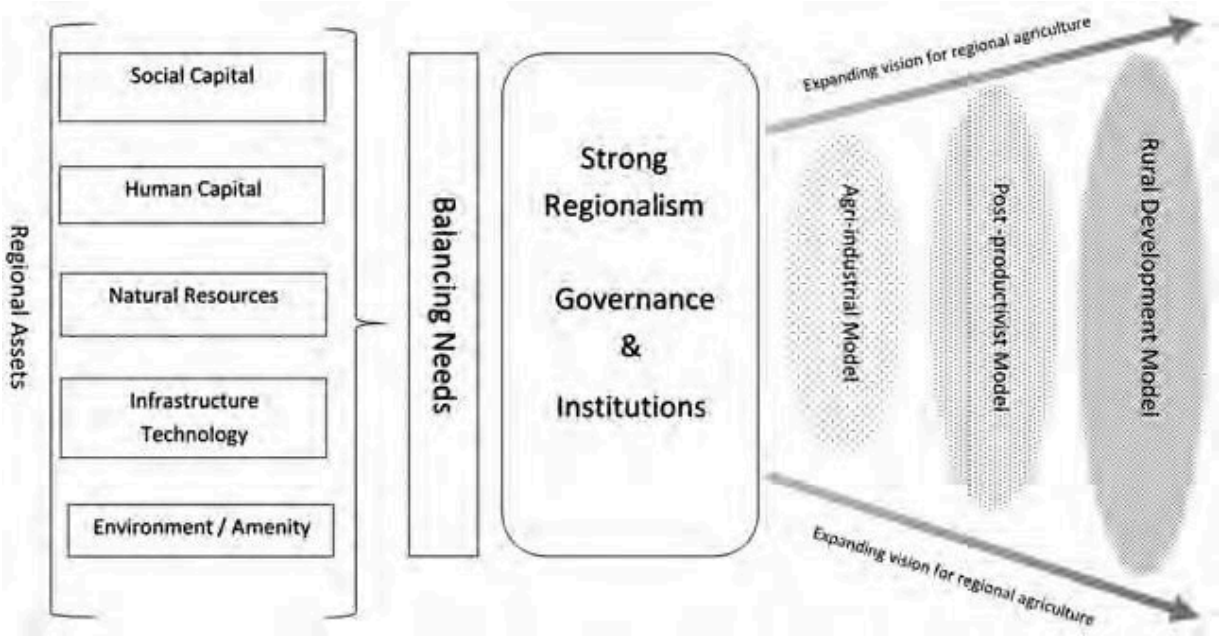


Figure 7. Agricultural model that Rookwood Infrastructure development followed (Dale et al., 2021)

5.1 Regional assets

The existing regional assets and mix of industries across agriculture, heavy industry in Gladstone and urban demands ensured that the business case was strong and positive. These regional assets of infrastructure and natural resources that support the industries ensures that supply chains were well established and the infrastructure required such as ports, abattoirs, and processing infrastructure were already in place. Not having to build supporting infrastructure in the supply chain resulted in the business case being much stronger.

The existing industries already in the region already had supporting services such as agronomy, animal nutritionist, suppliers of products and contract services. Similarly the human resources that were required for these industries and the supporting infrastructure for workforces such as schools and hospitals was already in place. Therefore, the social and human capital and infrastructure already existed in Rockhampton, Yeppoon and Gladstone, so that the Rookwood weir development would result in an expansion, rather than the creation.

Having high levels of technical and background knowledge has been a key factor in the success of the water infrastructure. The location of Rookwood and the surrounding natural resources such as soils, temperature and biophysical attributes were mapped and specific crops and opportunities identified for investment. That background information complemented the existing production of mixed horticulture, intensive livestock and cropping in the region, providing some certainty of opportunity to investors.

5.2 Balancing needs

The priorities of the Rookwood water development were across a diverse need of indigenous, urban, agriculture and industry. Indigenous groups at Woorabinda were considered in the allocations initially. The urban demand of providing water for a growing urban population of Rockhampton, Gracemere and on the coastal communities of Yeppoon and Emu Park resulted in demands from the urban community.

Industry also had strong demands for water with the Gladstone heavy industry through smelter plants demanded water for further growth. This was a large demand for the Rookwood expansion, with the increased output demanding water which leads to creation of jobs and increased throughput of the port. Finally, the potential for agricultural growth supported rural communities and the demands to expand, diversify or invest.

5.3 Strong regionalism

The strong regional support for the project was critical, given it was across different sectors and populations in the regional economy (urban, heavy industry and agriculture). This support, and positive business case ensured the Rookwood water infrastructure was able to capitalise on the National Water Grid funding.

The capacity to have local stakeholders with strong background knowledge to support the project was important. The multidisciplinary teams and champions of the project ensured that the process continued over time and progressed to the build stage. The autonomy of institutions such as Growing Central Queensland allowed landholders to openly discuss opportunity and change. These regional stakeholders were able to support investor inquiries and have the knowledge basis to develop information and reduce the risk for investors.

5.4 Governance and Institutions

The involvement of a number of State Departments that had the underpinning support from the Queensland Government ensured that at the state level there was commitment to the process, including to manage environmental or cultural heritage checks. This also ensured that Federal Government initially through the National Water Grid and then through National Partnership arrangement was then able to support the Rookwood project. The bipartisan support for the project both at a state and federal level was critical, particularly given the long time frames involved.

Finally supporting institutions such as Growing CQ and CQROC were provided local champions and awareness. Growing CQ was able to have large political influence and access to key decision makers that enabled progress to continue and lobbying to occur when required. Despite local debate about another dam option in the area, strong local support ensured that the Rookwood development process continued.

6. Opportunities for further agricultural development in the lower Fitzroy

The Making Water Work project was focused on identifying and analysing opportunities for future development in the region as Rookwood Weir neared completion. The findings of the project are summarised below in four sections, each corresponding to a theme and associated report in the research project.

6.1 Potential for additional supplies

In the lower Fitzroy region (the freshwater part of the Fitzroy River below the junction of the Dawson and Mackenzie systems), the development of the Rookwood weir has stimulated substantial interest in further access to bulk water supplies.

There is a total of 1,367,015 megalitres (ML) of water available for use in the Central Queensland region, encompassing both the Fitzroy and Gladstone regions (DRDMW 2022).

This incudes:
- 545,554 ML of supplemented water,
- 346,248 ML of unsupplemented surface water 191,775 ML of groundwater, and
- 283,418 ML of unallocated reserves.

Within the lower Fitzroy section, with the completion of Rookwood weir in 2023, the availability of medium security water can be summarised as:

- Supplemented water supplies: 161,439 megalitres (ML), comprising of
  - Rookwood weir : 72,000 ML[4]
  - Eden Bann weir : 27,346 ML
  - Fitzroy Barrage : 62,093 ML
  - Unsupplemented water : 49,508 ML

- Approximately 24,200 ML of supplemented water is allocated to urban uses
  - Approximately 22,200 ML from the Fitzroy Barrage is used for urban water supplies in Rockhampton and the Capricorn Coast, with potential for this to increase with the Mt Morgan pipeline.
  - 2,000 ML from the Rookwood weir is allocated to the Capricorn Coast

- Approximately 54,000 ML of supplemented water is allocated to industrial uses
  - 24,000 ML from the Eden Bann weir is allocated to Stanwell Power Station
  - 30,000 ML from the Rookwood weir is allocated to the Gladstone Area Water Board

Approximately 40,000ML of supply from Rookwood weir is being made available to agriculture, with much of the remainder allocated to industry and urban uses. Tender mechanisms have been used to sell allocations from Rookwood weir, with over half of agricultural supplies going to Rural Funds Management to plant macadamias and other crops and to establish a new feedlot owned by Mort and Co at Gogango.

The development of the new infrastructure has stimulated more interest in access to water supplies. There appears to be three main options for improving access to water:
- Increasing the use of un-supplemented water
- Increasing the access to and efficiency of supplemented water use
- Building additional water infrastructure.

[4] While the full supply volume in Rookwood weir is 74,325ML, the yield will be approximately 86,000ML. https://www.sunwater.com.au/projects/rookwood-weir-project/

6.1.1 Increasing the use of unsupplemented water

Utilisation rates of unsupplemented water are currently very low, averaging 6.8% from 2013/14 to 2017/18, although they have increased in recent years since Rural Funds Management have begun using more water. As there are large amounts of unsupplemented water (49,508 ML), this represents a potential resource. Some of the reasons why supplemented water has not been used include the risk of floods to infrastructure, some constraints over soil suitability for ring tanks, and limited land for broadscale irrigation. Strategies to improve usage include the development of water markets so that allocations can be transferred, supporting the design of off-stream storages, and encouraging greater integration of supplemented and unsupplemented water use.

6.1.2 Improving the efficiency of supplemented water use

Utilisation rates of supplemented water have historically been low in the Eden Bann and Fitzroy Barrage systems, with utilisation rates estimated for the 2013/14 and 2017/18 period at:

- 68.2% from Eden Bann weir
- 40.8% from the Fitzroy Barrage.

However these data are confounded with substantial reserves held by Stanwell Power (Eden Bann) and the Rockhampton Regional Council (Fitzroy Barrage), so underutilisation for agricultural purposes is much lower. There is still potential to improve water use efficiency, particularly by facilitating the transfer of water to higher value uses. Water markets in the lower Fitzroy have been limited in the past because of the small volumes available, but with the establishment of the Rookwood Weir there is increased scale, needs and opportunities for water markets to operate.

6.1.3 Building additional water infrastructure

New water infrastructure is another option for increasing water supplies, although there are typically large approvals, funding and environmental hurdles to consider. New greenfields sites are challenging for these reasons, but two extension projects have been suggested:

(a) Raising Eden Bann weir
(b) Raising the Fitzroy Barrage .

The raising of Eden Bann weir was originally included with Rookwood Weir in the Lower Fitzroy Infrastructure project, with only Rookwood proceeding to the business case and construction. Raising Eden Bann weir would provide up to another 35,000ML of supplemented water, and provide greater access to good agricultural and upstream. The returns from agriculture will not be enough to solely support a business case for new infrastructure, but a mixed use model (e.g. 50:50 water allocation between industry and agriculture) may be viable.

6.2 Market opportunities

KPMG and CQU facilitated some workshops in Rockhampton with key stakeholders to identify the potential for new irrigation crops in the region. The major opportunities were identified as follows:

- High-value Horticulture crops such as macadamias, mangoes and citrus were consistently identified due to the potential to generate higher returns per hectare and it being the most productive use for the land.
  - Macadamias – already responsible for the largest allocation of water from Rookwood Weir. However, the ability to achieve sufficient scale was identified as a major limitation, impeded by the difficulty in purchasing a sufficient sized land area with suitable soil types, away from flood zones and with access to water / water infrastructure. Between 400-500ha was identified as being required for an operation to be commercially viable.
  - Mangoes – grow well in the Rockhampton region, with a lot of value-adding opportunities. Growing conditions in Rockhampton means mangoes mature late in the season (January-February), enabling producers to sell at favourable prices and times to compliment other growing regions.
  - Citrus – Rockhampton's growing environment is extremely well suited for the growing of citrus fruits. However, the market for citrus may be saturated due to established nearby production regions in the Central Highlands.

- Beef – beef production is currently the Lower Fitzroy's largest agricultural industry, supported by a number of feedlots and processing facilities.

- Traditional crops such as cotton and irrigated cereals – identified due to the large amounts of suitable land, access to domestic markets and demand for high quality fodder for local cattle feedlots and production.

- Spices – such as black and white sesame were identified as key high-value emerging crop opportunities that have shown commercial potential during the current Spicing Up Northern Australia1 trial.

- Aquaculture – land-based freshwater aquaculture producing red claw crayfish and barramundi was identified as a significant opportunity for the Rockhampton region to diversify its agricultural products, similar to other QLD regions. However, high setup costs, current policy environment, and concerns around run off into the Great Barrier Reef were potential challenges raised that could impact attracting aquaculture investors.

- Other crop opportunities identified by stakeholders as ideal for the region include lychees, melons, finger limes, pulses, herbs, legumes, tomatoes, mungbeans, and native foods.

6.3 Developing agricultural supply chains

Potential growth in agriculture in the lower Fitzroy is dependent on a number of factors, including those relating to supply chain issues. This work reviewed the existing and potential export supply chain in the lower Fitzroy region to explore what industries would have the best upstream and downstream support for future expansion.

Beef, macadamia and irrigated fodder crops are identified as the most promising agricultural commodities in this region. The feedlot establishment in the Gogango area by Mort and Co will strengthen the beef industry. The region has adequate infrastructure to support additional production. In addition, the road network and availability of truck and temperature-controlled transportation need to be increased.

Rural Funds Management are establishing a 2500 ha macadamia orchard in the Gogango district, and they have secured water from Rookwood weir for this purpose. Australia is a leading macadamia exporter, and the increasing macadamia production can be justified by the demand in the international market. However, the lack of macadamia processing centres in this region is a challenge for this industry.

Among the other commodities mango, mandarins, lychees, spices, vegetable production through hydroponics and cotton have high potential. This study identified that the processing centre and cold supply chain are the barriers to the future growth of the mango and mandarin industry in the lower Fitzroy region. Some expansion of irrigated grain and fodder crops for the beef industry is also likely.

To support the expansion of irrigated agriculture in this region it is recommended that there are:

- Development of road infrastructure in the Gogango, Alton Downs and South Yamba districts, as well as the Rockhampton Ring Road
- Development of a macadamia processing centre close to the production region
- Development of skilled labour force and associated housing and services to support the growing agriculture industry.

6.4 Investor analysis

KPMG conducted interviews with large potential investors in the lower Fitzroy as well as facilitating a workshop with key stakeholders was used to identify major factors that are relevant to future investors. A summary of key findings is provided below.

Theme	Details
The Lower Fitzroy presents unique investment and agricultural development opportunities	Potential investors acknowledged the strengths of the investment proposition of the Lower Fitzroy Region and its comparative advantages. • Multiple investors expressed that the Lower Fitzroy region has strong comparative advantages across water and land availability, supply chain infrastructure and potential for conversion to high- value industries, such as horticulture. • Potential investors also expressed that the development of new water storage infrastructure in Australia is relatively scarce, with the Lower Fitzroy presenting unique development opportunities.
Making water work in the Lower Fitzroy will require a coordinated approach to regional development	Water is 'one part of the puzzle' with several other factors identified by potential investors as barriers to the expansion of agricultural development in the region. • Stakeholders expressed that the Lower Fitzroy must also consider broader development requirements to successfully attract investment in water and associated agricultural development opportunities. • These development priorities include workforce planning, housing, social support services (hospitals, schools etc) and a range of other regional development needs as key priorities
Market mechanisms can be enhanced to support attractiveness of the region to potential investors	Investors require clear market information and mechanisms to underpin investment and production decision-making. • The enhancement of market mechanisms, such as the provision of timely and detailed water market information and trading platforms, are key to supporting further investment in the region. • Establishing clear and transparent methods for water information and trading will support improved utilisation of water entitlements in the Lower Fitzroy by more efficiently marrying supply with demand. • Potential investors expressed that there is a lack of available water information compared to other Water investment schemes. This may lead to underutilisation of water entitlements in the Lower Fitzroy.
A long term vision and agricultural supporting policy settings	This vision is required to underpin sustained agricultural investment in the region. The transformation of the Lower Fitzroy as a food bowl and agricultural investment destination of choice is a long-term endeavour. This vision needs to be supported by the right strategic and policy framing.

6.5 Precincts

The lower Fitzroy is different to most irrigation districts in Australia in that the area to be developed is not defined by a water distribution system. Instead, water can be accessed directly from the weir impoundment or downstream from releases into the river, with the latter option incurring a 10% discount on entitlement to account for transport losses. There is a mosaic of different soil types along the river system, creating variations in crop and development opportunities.

It is possible that further irrigation development in the region will be piecemeal, driven by the interests of individual landholders. However, it is also possible that some districts have more development opportunities, and competitive market forces will lead to greater concentration of water use in particular areas. Where those concentrations occur in precincts, then there are economies of scale in providing supporting infrastructure and additional services.

The interest in precincts is underpinned by economic efficiencies in both upstream and downstream supply chains. Upstream supply chains relate to the inputs required for irrigated agriculture, whereas downstream supply chains relate to the processing and/or distribution into market chains. Infrastructure for roads, power and telecommunications is particularly relevant for identifying the precincts that have competitive advantages for future irrigation development.

The key infrastructure types considered for this analysis were power, telecommunications, roads and labour force. The key precincts which were identified were Gogango-South Mornish, Glenroy-Mornish, Canoona, Garnet, South Yaamba, and Ridgelands/Alton Downs. All of these potential districts have varied cropping opportunities and infrastructure challenges.

To better understand requirements for landholders and the implications for infrastructure supply a meeting was held at the Gracemere Livestock Exchange on the 31st of August with interested landholders and stakeholders. At the workshop the potential precinct areas were discussed to identify the opportunities and infrastructure requirements in each area. All attempts have been made to accurately capture these contributions from participants.

The workshop and desktop review process identified that all precincts are attractive for potential development, but that two precinct areas appear to be most suitable in the short term. The Gogango-South Mornish precinct has had the most public and private investment to date and is likely to be the dominant area in terms of new development, although there are still a number of challenges in the context of power, roads infrastructure and labour force to be supplied. The current development of macadamia plantations, the Mort & Co feedlot, and future plans for a macadamia processing plant means that this will be the dominant precinct in terms of scale of operations and workforce requirements.

The second area of focus is the South Yaamba and Ridgelands/Alton Downs which has smaller property sizes and a number of landholders already investing in horticulture. This area is in close proximity to Rockhampton giving it advantages in terms of access to services and labour force.

Although these core precincts have been identified it is important to note that individual landholders may continue to invest in high value crops through irrigation supplementation in other parts of the lower Fitzroy. Looking to the future it is likely that the Glenroy-Mornish and Canoona precincts will have more strategic advantages in the future if Eden Bann Stage 2 is developed, given the adjacent location of these precincts to the potential water impoundment.

7. Conclusions

The Rookwood weir had a long gestation period, from significant discussion about the potential for irrigated agriculture and feedlots in the lower Fitzroy region during the 1990s through to funding approval in 2018 and construction from 2020-2023. There was never any guarantee that the development would proceed, so an important question is what distinguishes Rookwood weir from a list of other water infrastructure projects in northern Australia that have been proposed but never commissioned. Three broad themes of reasons can be identified.

The first is that the strategic and business case for Rookwood was very strong, particularly in its supply of water for agricultural, industry and urban needs. This provided a strategic justification for the infrastructure (to ensure urban and industry needs were met) as well as supporting the business case (there were higher returns from supplying water to urban and industry needs than to agriculture).

The second is that there were high levels of support over long periods of time from all levels of government, industry and the community. The development of agriculture was important in the central Queensland region, but the provision of water to urban and industrial users as well created broadscale support across the region. Ongoing support from key staff in agencies and other champions over the long term was critical.

The third is that there was very careful attention to planning and detail over a long period of time. Importantly this was not just focused on the technical information required for the Environmental Impact Assessment, but also focused on the information and planning needed to make the project attractive to potential investors and purchasers of water entitlements.

Looking forward, there are significant opportunities and challenges for further development in the region so as to maximise the opportunities created by Rookwood weir. Opportunities include the development of new crops and industries, growth of irrigated agriculture in districts along the lower Fitzroy and facilitating access to water for new entrants. Challenges include the provision of appropriate infrastructure and labour, creating processing facilities and better supply chains, development of water markets, and establishing more water supplies.

The development of the Rookwood weir required decades of visioning, support and planning across a variety of stakeholders and proponents. The same level of cooperation and support will be required post- establishment to ensure that the water from Rookwood weir, together with other supplies in the lower Fitzroy, crystalises the opportunities that irrigated agriculture has in the region.

References

Dale, A. 2015. *Our North, Our Future, Developing Northern Australia*. In: Comission., P. (Ed.). Canberra, Australia pp. 1-200.

Dale, A., Marshall, A., 2020. *New directions for facilitating quality agricultural development in Northern Queensland*. The Australasian Journal of Regional Studies 26, 269-292.

Dale, A.P., Taylor, B., Lane, M.B., 2021. *Land Tenure and Development in Northern Australia*. In: University, A.N. (Ed.), LEADING FROM THE NORTH. Australian National University Press Canberra, p. 293.

Department of State Development, Local Government and Planning., 2021. INFRASTRUCTURE PROPOSAL DEVELOPMENT POLICY. Effective from 2 June 2021 In: Department of State Development, Local Government and Planning., (Ed.). Queensland Government Brisbane.

Hart, B., O'Donnell, E., Horne, A., 2020. Sustainable water resources development in northern Australia: the need for coordination, integration and representation. International Journal of Water Resources Development 36, 777-799.

National Water Commission (NWC) 2009, *Australian Water Reform 2009: Second biennial assessment of progress in implementation of the National Water Initiative*, National Water Commission, Canberra

Petheram, C., Gallant, J., Stone, P., Wilson, P., Read, A., 2018. *Rapid assessment of potential for development of large dams and irrigation across continental areas: application to northern Australia*. The Rangeland Journal 40, 431-449.

Queensland Department of Natural Resources and Mines., 2005. *Central Queensland regional water supply strategy: study report* In:Department of Resources and Mines. (Ed.). Queensland Government Brisbane

The Department of State Development, Manufacturing, Infrastructure and Planning. 2018. *Rookwood Weir Project Report* In: The Department of State Development, M., Infrastructure and Planning (Ed.). Queensland Government, Brisbane.

Infrastructure partnerships Australia 2022. https://infrastructurepipeline.org/project/lower-fitzroy-infrastructure-project-rookwood-weir

Appendix 1. Project report details

Report 1: Rolfe, J. and Rajapaksa, D. 2023, *Making Water Work in the Lower Fitzroy: Potential for Additional Supplies*, Research project report for CRCNA, pp 42.

Report 2: Kemp, L. and Payne, J. 2023. *Making Water Work in the Lower Fitzroy: Agricultural Market Opportunities*, Research project report for CRCNA, pp 10.

Report 3: Rahman, A., Akbar, D., and Rolfe, J., 2023. *Exploring and Envisaging Agricultural Supply Chain for Lower Fitzroy Region*, CRCNA, Townsville, Australia, pp 46.

Report 4: Payne, J., Nevison, M. and Allen, G. 2023, *Making Water Work in the Lower Fitzroy: Investor Analysis*, Research project report 4 for CRCNA, CQUniversity, Rockhampton.

Report 5: Rolfe, J., Star, M. and Sarker, J. 2023. *Making Water Work in the Lower Fitzroy: Predicting Precincts for Agricultural Water, Research* project report for CRCNA, pp 33.

Report 6. Rolfe, J., Star, M., Payne, J. and Akbar, D. 2024. *Making Water Work in the Lower Fitzroy: Lessons from and Prospects for the Rookwood Weir* Research project report for CRCNA, pp 29.