UrannaH
WATER SCHEME

Preliminary Business Case

2019



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Urannah Water Scheme
Preliminary Business Case

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DELIVERING LONG TERM ECONOMIC BENEFITS TO THE BOWEN & COLLINSVILLE COMMUNITIES

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DNRME Statement

Urannah Dam Proposal - Preliminary Business Case Statement by the Department of Natural Resources, Mines and Energy

The Urannah Water Scheme Preliminary Business Case and accompanying appendices have been prepared by Bowen Collinsville Enterprise Limited. As part of the facilitation arrangements for the Australian Government's National Water Infrastructure Development Fund, the Department of Natural Resources Mines and Energy (DNRME) has reviewed the documents before they are submitted to the Australian Government. Following the review and in accordance with a grant deed between DNRME and Bowen Collinsville Enterprise Limited, this addendum has been attached to the Preliminary Business Case documents.

As a result of DNRME's review, it has been identified that there are particular matters which readers should be aware of when considering the findings and recommendations of the Preliminary Business Case. In addition it is acknowledged that the complexities and scale of the report documents could make it difficult for readers to identify some of the critical caveats, assumptions and clarifications that need to be understood when considering the viability of the Urannah Dam project.

This statement is intended to bring many of those key items into a consolidated location that allows an objective view of the study's outcomes. The comments below are made in the context of the level of certainty DNRME would expect to be provided in a business case that has been developed using the Building Queensland framework and is intended to be used to inform a Queensland Government decision about whether to support advancing to a Detailed Business Case.

There is a fundamental assumption made in this assessment that has the potential to lead to the assessment overstating the viability of Urannah Dam, being the inclusion of the Burdekin to Moranbah pipeline (BMP) duplication in the Base Case.

- In the assessment of options where Urannah Dam is built as an alternative to duplicating the BMP, not duplicating the BMP is assumed to result in an "avoided cost" for the assessment of Urannah Dam, thereby improving the apparent economic viability of Urannah Dam.

- DNRME is of the view that in order to justify inclusion of the BMP duplication in the Base Case, a formal funding commitment needs to have been made by the Queensland Government to that project. Such a commitment to the BMP duplication does not exist at this time.

- Sunwater is concurrently and continually assessing water needs and the best way of meeting them for potential customers of the BMP. While duplication of the BMP is currently considered to be an option for meeting future water demand in this region, the lack of any formal commitment to duplicate the BMP precludes it being considered in the Base Case.

- At this time, duplication of the BMP would be better assessed as a standalone supply option for consideration of servicing the needs.

- DNRME believe the base case should not include the duplication of the BMP and it is noted that Addendum A (section 20) in this final report includes assessment of the viability of Urannah Dam against a scenario that does not include the duplicated BMP. This is referred to as the 'Do Nothing Base Case' and is considered to lead to a better reflection of the viability of Urannah Dam than is included in the body of this assessment.

- Under this additional scenario, assessment of the viability of the identified development options results in different Benefit Cost Ratios, such that Option 1 has a BCR of 0.9 and is recommended for further assessment to better refine the project's potential viability.

- Options 2 and 3 both have BCRs of 0.5 under the revised scenario, noting that only Option 2 is recommended for further assessment.

In addition, there are a number of assumptions made throughout the business case that continue to have a high degree of uncertainty, may not be supported by sufficient evidence and may contribute to an overly optimistic assessment of the project's viability. The most critical of these include:

- Elements of the assessment related to the commercial, project finance and delivery arrangements provide mixed and unclear messages regarding the roles of key stakeholders and some of the funding and financing assumptions. There is ambiguity around the need for government subsidy or not and parts of the assessment appear to suggest this is a privately led project that has the potential to be commercially and financially viable in its own right.

- Before proceeding to a Detail Business Case, DNRME recommends that the financial viability of the proposal be better clarified. This is of critical importance as it informs the potential roles of various parties in the proposed delivery and governance structure and should be clearly articulated before progressing to the Detailed Business Case stage. For instance, if the project owners are to be all private sector participants and there is no requirement for government funding (i.e. fully commercial pricing arrangements covering all construction and ongoing costs) then a Detailed Business Case in a form required by Infrastructure Australia or Building Queensland may not be required as the project justification requirements of debt and equity participants in the project may be different.

- The assessment has no reference as to whether or not the proposal complies with the Water Plan for the catchment. Although it is identified that amendment of the Water Plan will be required, there is no indication of the nature of the amendments that would be required nor the implications for the viability of the project if those amendments are not made.

- The demand for water from the Urannah Dam project, rate of take up and price that will be paid for that water across the various potential types of use are uncertain. These assumptions have a significant link to the assessment of financial and economic viability of the project and need to be founded in robust and reasonable evidence. DNRME acknowledges that many of the customers interviewed for the market sounding mandated that their confidential information, onsite water management and names be restricted (at this stage) from disclosure.

- The need for the region’s water service providers to use a potential Urannah Dam as a source for urban water requirements at the volume and price indicated are all assumptions made for the Preliminary Business Case without sufficient evidence or justification.

- The Regional Water Supply Security Assessment relevant to this area outlines availability of water entitlements from existing sources that could be accessed by local government for urban purposes. The RWSSA indicates that local government’s first action is to discuss its needs and potential to secure a portion of the uncommitted water from existing sources with Sunwater. As a result, demand for water from the urban sector (and hence the likelihood of revenue from the urban sector) from a proposed Urannah Dam is unclear and needs to be discussed with and agreed by the region’s water service providers.

- Assumptions around the water demand for agricultural purposes appear to be based on the area of land with soil types suitable for irrigation of relatively high value crops, rather than confirmed indications from potential businesses. As such, these assumptions present a best case scenario in terms of the volume of water required by the sector. Without any supporting advice from businesses or potential customers in this sector, the adoption of such a best case scenario is considered optimistic and also has a high degree of uncertainty of occurring. Assumptions regarding the price at which water for agricultural water is made available are unsubstantiated and potentially higher than is likely to be realised based on recent activity in water sales and trading markets in nearby areas.

- Statements are made in the Preliminary Business Case regarding the capacity and performance of existing water supply sources which are unsubstantiated and lack the provision of evidence or appropriately referenced sources (for example, Eungella Dam which at the time of writing has spare water entitlement capacity).

- The implications of reef protection regulations for the project’s viability are not fully analysed and outlined. This is likely to have implications for the demand for water for agricultural purposes and the price at which potential customers may be willing to purchase water.

  Whilst the Preliminary Business Case documents submitted by Bowen Collinsville Enterprise Limited meet the requirements of the terms of reference for the National Water Infrastructure Development Fund feasibility study, DNRME considers many of the assumptions made in the assessment to be significantly uncertain. If these assumptions and uncertainties are not all realised, the viability of the Urannah Dam proposal will be lower than is presented in this Preliminary Business Case.

Glossary.

BCDF	Building Queensland Business Case Development Framework
BCE	Bowen Collinsville Enterprise Association
BBWSS	Bowen Broken Water Supply System
DAF	Department of Agriculture and Fisheries
DAWR	Department of Agriculture and Water Resources (Australian Government)
DILGP	Department of Infrastructure, Local Government and Planning
DNRME	Department of Natural Resources, Mines & Energy
DSD	Department of State Development
GOSS	Gattonvale Offstream Storage
Ha	Hectares
HP	High priority
ML	Mega Litres (one million litres)
ML/a	Megalitres per annum
MP	Medium priority
MRC	Mackay Regional Council
MSES	Matters off State Environmental Significance
NWI	National Water Initiative
NWIDF	National Water Infrastructure Development Fund
NWILF	National Water Infrastructure Loan Facility
PFD	Peter Faust Dam
PAF	Project Assurance Framework of Queensland
QCA	Queensland Competition Authority
QTC	Queensland Treasury Corporation
ROL	Resource Operations Licence
ROP	Resource Operations Plan
SBC	Strategic Business Case
SRG	Stakeholder Reference Group
SunWater	SunWater Limited
UWS	Urannah Water Scheme
WSS	Water Supply Scheme

EXECUTIVE SUMMARY

Overview

The Mackay, Isaac and Whitsunday Region along Queensland's central coast, halfway between Brisbane and Cairns, is one of state's most productive regions. While coastal communities support a strong tourism sector, the regional economy is primarily founded on agriculture, and mining in western areas where the region takes in the coal-rich Northern Bowen Basin, making the region one of the largest contributors to the Queensland economy.

Water security is critical in this part of Queensland, which experiences a highly variable climate with regular drought and cyclones. Safe, accessible and reliable water supplies are an essential regional resource and underpin both community health and economic growth.

The Urannah Water Scheme (UWS) continues to be a privately led project and while this preliminary business case (PBC) has been developed using the Building Queensland business case framework given its potential for growing the North Queensland economy, we have placed a forthright focus on the commercial aspects of this project. This project, should it proceed, will be privately funded and potentially operated as a third-party utility, therefore has not be considered a state-funded project.

Our broad commercial focus has centred on the potential to leverage existing economic infrastructure to grow the economies in the region. UWS will provide additional water for agriculture, mining, port and energy developments and will support demand for urban water and tourism growth, particularly in the Whitsunday Region. Any valuation applied to this project should therefore consider a whole-of-life approach to the asset.

This PBC explored some 26 varying options for service delivery in the region. Technical engineering and economic studies were completed over 13 options resulting in two areas of focus. These are:

1. Option 1 – a new Urannah Dam yielding 150,000 ML per annum supplying via the rivers (instream) to Collinsville and two new pipelines to Proserpine and to Moranbah via Eungella Dam.
2. Option 2 – a new Urannah Dam yielding 70,000 ML per annum supplying via the rivers (instream) to Collinsville and two new pipelines to Proserpine and to Moranbah via Eungella Dam.

A supplementary study was conducted in consultation with the State of Queensland to explore the economic outcomes of a Do Nothing Base Case (Addendum A).

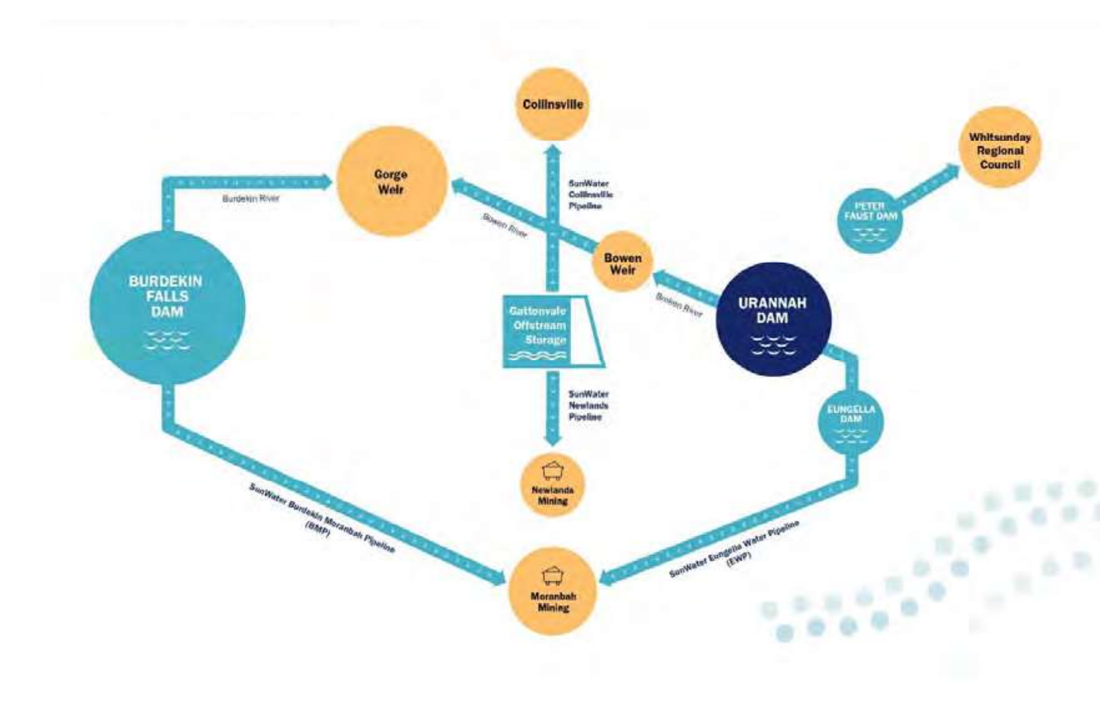
The State of Queensland (Department of Natural Resources, Mines and Energy) is currently conducting additional demand studies and whilst this data has not been made available to this study, the State has expressed its desire to explore a limited approach known as 'Do Nothing or Do Minimum'.

While a water asset will be essential in this region in the very near future, a dam alone will not provide a positive return on money invested. Building the asset with no consideration of the holistic opportunities for regional prosperity reduces the potential value to the region. This is why it is essential that the whole project is viewed with a commercial lens to determine benefits including the water infrastructure to support the existing water network and a new agricultural precinct to strengthen agricultural production. The anticipated benefits can then be expected at the local, regional and national level.

The area shown in Figure 1 - System Overview outlines a complex water balance. Water is supplied from Eungella Dam to Collinsville (downstream north west) and Moranbah (to the south west) and from Gorge Weir (Burdekin Falls Dam) via pipeline south to Moranbah.

All the supply areas have excess water available for use as either unallocated or unused water and trading history and prices are not high in volume or price.

Figure 1 - System Overview[1]



The UWS has sought to review the current state of supply and demand in the region as to develop understanding of the long-term use of water and the supply scenarios.

This PBC has found that abundant supply in the Burdekin, Bowen Broken and Proserpine systems are not available to customers.

This is due to three primary reasons.

1. Transport infrastructure (Burdekin to Moranbah) is fully contracted to its capacity
2. Trading of water allocations is not a liquid market and allocations are used as insurance and as a barrier to entry to other users
3. Reliability of Peter Faust Dam and Eungella is uncertain; users cannot rely on supply to underwrite large capital investments

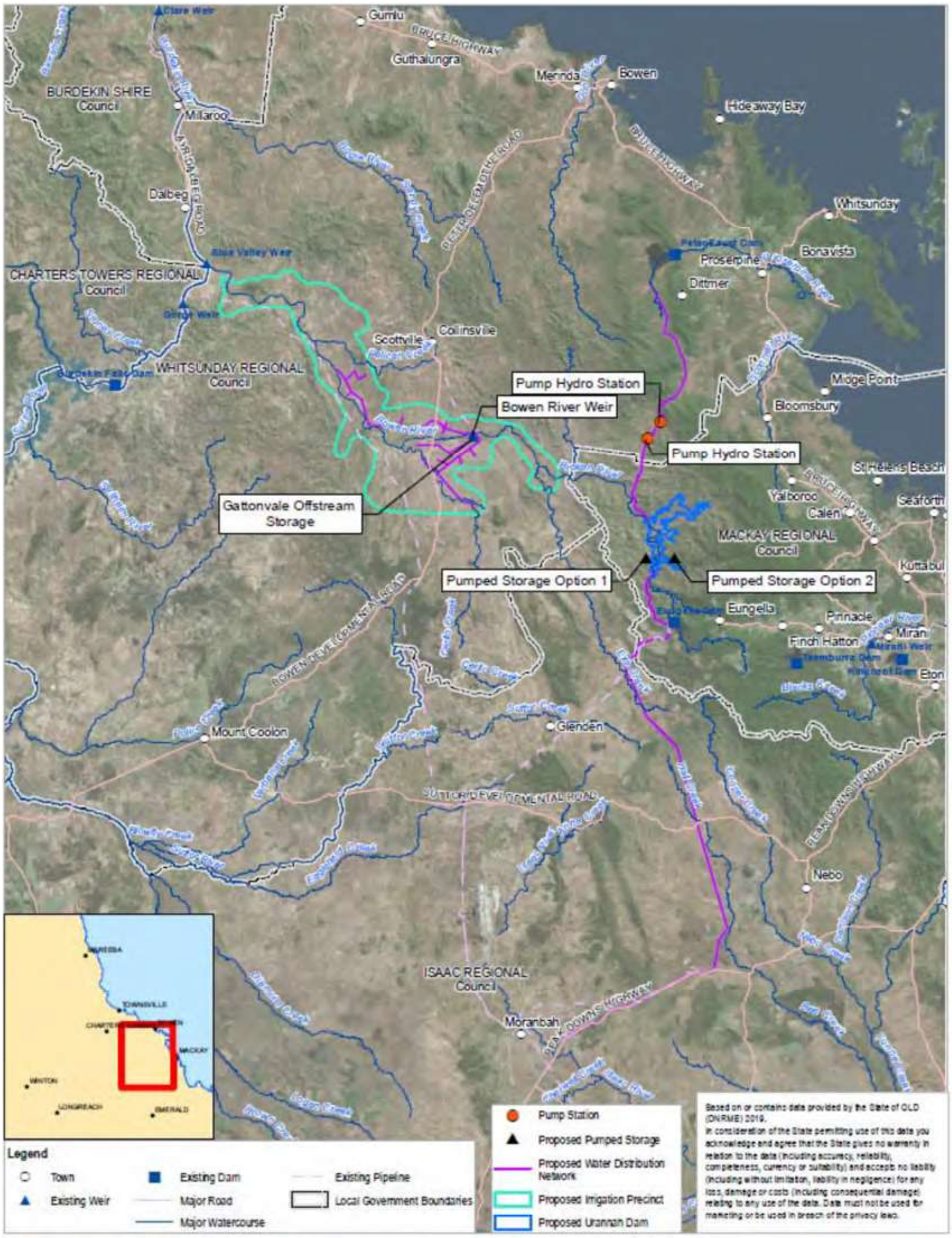
This PBC examines a new water source, closer to the users of water, which can provide higher certainty of water despite large availability from state owned assets.

This PBC examines the large industrial users and their options over time to continue their operations, provide certainty for proposed expansions, facilitate new projects and explores new irrigation uses for balance water given the large volume of water that the Urannah Dam could supply. Figure 2 - Location Map shows the three major catchments and supply to the demand nodes.

[1] N.B. This is a diagrammatic representation only and does not reflect the actual positions of infrastructure.

The PBC has found that a new supply of water is feasible and commercially viable based on the certainty that the volume and predictability of the Urannah supply. The project is scaled at a level that it is dependent on new irrigation uses and this will be subject to significant ongoing studies to verify the assumptions of uptake.

Figure 2 - Location Map



Climate Change modelling indicates the region will experience reducing annual rainfall with larger major rainfall events eg cyclonic activity. These future challenges will need to be met by building strategically located, larger water storages over a wider area to ensure water from these events is captured and stored for longer periods. Regional water security will be further enhanced with the establishment of a Water Grid linking major storages and distribution nodes as proposed by the Urannah Water Scheme

In the western areas of the region where annual rainfall patterns are highly variable there are three main sources of water supply to urban and industrial users in the Northern Bowen Basin:

- The main source of supply is the Eungella Dam on the Broken River supplying urban and industrial water to Collinsville, Glenden and Moranbah.
- The Fairbairn Dam at Emerald supplies water north to Dysart and Moranbah via the Bingegang Weir on the Mackenzie River.
- A pipeline from the Gorge Weir on the Burdekin River to Moranbah supplies additional water to the mining hub around Moranbah.

The above supply sources are currently fully allocated and this PBC examines the proposal for a Water Grid linking a new large storage at Urannah with established supply hubs at the Proserpine and Eungella dams to underpin regional water security over the next 30 years. Additionally, Urannah water supplied to the Moranbah / Dysart hub could replace water currently supplied from the Fairbairn Dam, increasing its reliability.

Investigations show existing unmet and latent demand for water in the region (excluding Mackay). The Burdekin to Moranbah pipeline is operating at capacity and mines are trading antidotally in water at prices of up to $6,000 per megalitre (ML), large industrial users such as Abbot Point coal terminal are trucking in water and many existing agricultural and mining customers are limiting their activities to avoid using their full water allocation due to concerns about ongoing water security. When dam levels are low, water supply to industrial and agricultural users with low priority water allocations can cease completely.

Following lobbying by local business leaders, community members and elected representatives, in 2016 the Australian Government committed $3 million to investigate the feasibility of a dam at Urannah, on the Broken River, to supplement and improve the reliability of existing regional water supplies.

In keeping with Queensland Government frameworks and policies, this PBC also examined non-infrastructure options to improve existing services through reform or by influencing demand, and capital works to supplement existing systems. Options ranged from policy changes on groundwater and pricing to duplicating the pipeline from the Burdekin to Moranbah or constructing an alternate, shorter pipeline.

Shortlisted options all centre around a new dam with instream supply to Collinsville and piped connections to existing regional networks. The capacity of the dam and the nature of new network connections differ between options. One option also includes irrigation distribution infrastructure for an agricultural precinct around Collinsville while another includes duplication of the pipeline from the Burdekin.

Urannah Water Scheme has the potential to become the cornerstone of regional water security and economic development. The dam would become the lynchpin in an expanded regional water grid that links together and enhances the reliability of three of the region's four main water schemes (Bowen Broken WSS, Proserpine WSS and Emerald WSS). As well as delivering new water for western mining and agriculture, Urannah Water Scheme would guarantee water security for urban coastal communities, agriculture and industry for decades to come by boosting existing water supplies and making them more reliable. It would also enable more efficient water transfer on the BBWSS and create potential new opportunities for irrigated agriculture to reinvigorate Collinsville, create new jobs and broaden the regional economic base.

A key strength of the Urannah Water Supply Scheme is its capacity to supply water to Proserpine and Bowen on the coastal plain, Collinsville downstream of the Dam, and via Eungella Dam, supply water to Moranbah and areas to the South. This diverse supply network affords flexibility and water use options for the dam.

Urannah Dam will enable the further growth of existing industries within the region. The Urannah Dam project is unique in that it is centrally located within an existing vibrant region consisting of large scale established industries (Bowen Basin coal industry & rail infrastructure, high value irrigated horticulture industry in nearby Bowen, Whitsunday and Burdekin sugar industries, the coal port at Abbot Point, and the future industrial opportunity that is the Abbot Point State Development Area. Water from Urannah Dam will enable these existing established industries to further grow and develop, allowing a much faster uptake of water allocations from the Urannah scheme than would be the case for any alternate projects in areas without existing industrial demand. This will significantly improve the financial viability of the Urannah scheme.

Unlike many proposed dam projects, the Urannah Dam site is contained entirely within two landholdings, with the native title landholder having expressed support for the construction of the dam. This significantly reduces the complexity of the project.

Urannah Water Scheme, constructed to its full potential, would almost triple the dam capacity of the Mackay, Isaac and Whitsunday Region, and avoid the need to pump more water in from outside the region by duplicating the Burdekin to Moranbah pipeline. With an ultimate capacity of more than 1,400,000 ML, Urannah Dam would deliver almost 80 per cent of the capacity of Burdekin Falls Dam whilst inundating less than 20 per cent of the land area.

Unlike the Burdekin to Moranbah pipeline duplication, which would primarily supply water to western mines, the Urannah Dam Water Scheme could be used to ‘top up’ existing dams (Eungella and Peter Faust) for agricultural, industrial and urban users and supply water to new agricultural users

Aligning with the objectives of key federal, state and local government policy and planning documents, Urannah Water Scheme would sustain the continued economic growth and liveability of the region. In the future, it could also support one of Australia’s largest hydro-electricity projects.

Preliminary economic modelling indicates the two preferred Urannah Water Scheme options (Shortlist Option 1 and Shortlist Option 2) have benefit cost ratios (BCRs) of 1.7 and 0.9 respectively (seven per cent discount rate).

Recommendations

This PBC recommends the Urannah Water Scheme proceed to the detailed business case (**DBC**) phase.

It is recommended the two highest scoring options (as determined by a two-phase selection and assessment process) be carried through to the DBC. These preferred options are as follows:

- Shortlist Option 1 (Multi Criteria Analysis (MCA) Option 12): new Urannah Dam yielding 150,000 ML per annum (at 290 RL Full Supply Level) with instream distribution to Collinsville; new pipelines from Urannah Dam to Peter Faust and Eungella dams; duplication of the existing pipeline from Eungella Dam to Moranbah to provide incremental supply to Moranbah, and irrigation distribution infrastructure near Collinsville.

- Shortlist Option 2 (MCA Option 11): new Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville; new pipelines from Urannah Dam to Peter Faust and Eungella dams, duplicating the existing pipeline to provide incremental supply to Moranbah.

Shortlist Option 1 has an anticipated capital cost of $1,465 million and total annual operational costs of $15.3 million. Shortlist Option 2 has an anticipated capital cost of $1,221 million and annual operational costs of $12.8 million.

Introduction

Urannah, on the Broken River, has long been considered a potential site for a large-scale water storage to augment regional water supplies for urban, agricultural, mining and industrial customers and support economic development. The surrounding sub-catchment has a strategic water allocation of 150,000 ML annually (already allocated in the Burdekin Water Resource Plan). Bowen Collinsville Enterprise (**BCE**) has been driving investigations into a potential dam since the 1990s.

In 2016, the Australian Government committed $3 million of NWIDF funding for a 'detailed examination of the economic feasibility of Urannah Dam', as part of a broader suite of 39 feasibility studies for new water infrastructure across the nation. BCE was selected to undertake the three-stage study.

A strategic business case (**SBC**) was subsequently submitted by BCE to Queensland's NWIDF administrators, the Department of Natural Resources, Mines and Energy (**DNRME**) in 2018. This PBC represents the completion of the feasibility study and is supported by associated technical studies.

Development of a detailed business case (**DBC**) is the next step required to inform a formal investment decision.

The Urannah Dam, connecting pipelines and irrigation scheme form the Urannah Water Scheme.

Proposal Background

Harnessing the Broken River, a tributary of the Burdekin River, offers the potential to:

- support regional mining expansion and new resource projects
- provide water security for existing agricultural, industrial (including future power generation) and urban users
- stimulate irrigated agriculture

Multiple studies have examined Urannah Dam since the 1950s. The Snowy Mountains Engineering Company (SMEC) conducted geotechnical investigations and site mapping in 1963 and 1969. Previous assessments indicated the dam is economically viable, with an acceptable social impact.

Designs produced in the 1950s include gravity-fed irrigation channels along the Bowen River to irrigate 30,000 hectares of prime agricultural land near Collinsville.

Urannah, where the dam would be constructed, is located high in the Mackay hinterland in the Mackay local government area, part of Queensland's Mackay, Isaac and Whitsunday Region. Surrounded by steep hills in a high-rainfall area, it would support a deep reservoir that could deliver almost 80 per cent of the capacity of Burdekin Falls Dam on less than 20 per cent of the land area. The site receives significantly more water, more frequently, than Eungella Dam, which is located upstream nearby.

Plans developed by SMEC in 1977–78 provide for a two-stage dam with an ultimate capacity of 1.5 million ML. The dam's elevation also offers potential to generate up to 1,000 megawatts (MW) of hydroelectric power, making it one of Australia's largest potential renewable energy projects.

The site is strategically located close to a comprehensive, existing water network connecting to agricultural and urban users, large numbers of adjacent industrial customers and land suitable for irrigation along the Bowen River, south of Collinsville. The key opportunity is for Urannah Dam to enable the expansion of the significant existing industries within the region, leveraging existing facilities, without the need for significant new enabling infrastructure (pipelines, power distribution, rail, road and port infrastructure).

SBC investigations found existing unmet and latent demand for water in the region (excluding Mackay). Water supply from Eungella Dam and Peter Faust Dam is unreliable, the Burdekin to Moranbah pipeline is operating at capacity and coastal and western customers are limiting their activities to avoid using their full water allocation due to concerns about ongoing water security. When dam levels fall, water supply to industrial and agricultural users with low priority water allocations from Peter Faust Dam can cease completely. Concern with water reliability is also undermining confidence to proceed with mining expansion plans.

Construction of Urannah Dam would be accompanied by development of a supporting distribution system, potentially via the Broken River to Collinsville (instream) and via pipelines south to Eungella and Moranbah and north-east to Proserpine.

The SBC identified opportunities to deliver water to:

- Proserpine for urban, agricultural and potentially industrial customers
- Collinsville for industrial and mining customers
- Eungella Dam for mining customers in Moranbah and Newlands
- new irrigated agricultural areas in Collinsville (instream)

Regional Context

Agriculture, mining and tourism are the foundation of the regional economy. Coal mining is the region's largest employer and will continue to be an important economic driver in the future. The region hosts the Bowen and Galilee basins which contain some of the nation's largest coal mining deposits and two major economic development hubs – the Abbot Point and Galilee Basin State Development Areas (**SDAs**).

Regional economic diversification is an ongoing challenge. The experience of Emerald, a western Queensland town, demonstrates how broadening the economic base of a mining town can stabilise the local economy and employment. Completion of Fairbairn Dam in 1972 enabled Emerald to develop an irrigated agricultural precinct that became the springboard for a thriving agricultural sector.)

The population of the Mackay, Isaac and Whitsunday Region is expected to reach 280,000 by 2031. Mackay will absorb much of this growth but communities in the Bowen Basin such as Moranbah will continue to experience pressures from residential and non-residential population growth (e.g. fly in/fly out workers).

Five water supply schemes operated by SunWater supply the region, specifically

- Pioneer River: supplied by the Teemburra Dam (147,500 ML capacity), which provides water to Mackay's urban areas
- Proserpine River: supplied by the Peter Faust Dam (491,400 ML capacity), which provides water to Whitsunday communities and agricultural and industrial users
- Burdekin Haughton: supplied by the Burdekin Falls Dam (1,860,000 ML capacity), which provides water to western mines and rural communities such as Moranbah
- Bowen Broken: supplied by Eungella Dam (112,400 ML capacity), which provides water to western mines and rural communities such as Collinsville and Moranbah
- Eton: supplied by Kinchant Dam (62,800 ML capacity), which provides water for agriculture

Service Need

Urannah Water Scheme would become part of the BBWSS. It also has potential to connect into the Proserpine WSS and supplement the Burdekin Haughton WSS. These schemes incorporate the key potential demand nodes.

The BBWSS supplies water via Eungella Dam to customers downstream at Collinsville and Newlands and via pipeline to Moranbah. Due to Eungella Dam's small size and unreliable supply, Moranbah users prefer to source water from the larger Burdekin Falls Dam, supplied via the Burdekin Moranbah Pipeline (BMP). However, the BMP is very costly to operate (pumping water upstream across 209km) and is fully allocated and operating at capacity.

Users in Collinsville and Moranbah secure water through trading exchanges at significant price premiums. Many do not use their full allocation due to water security concerns. Unallocated entitlements by Whitsunday industrial and agricultural users are also high.

In the absence of any viable alternative proposals, some mining operators and proponents of new resource projects have expressed support for a second pipeline from the Burdekin that connects the Gorge Weir to Moranbah and is able to supply around 25,000 ML per annum. This is considered the Base Case in this PBC. Any alternative option must be comparable to this pipeline in service delivery.

SunWater has not considered a new storage solution for the region given the Burdekin Dam is underutilised and would prefer a new pipeline that services industrial demand only.

Total demand anticipated from demand nodes in the regional water system (excluding Mackay) is modelled at a conservative 125,650 ML per annum, split into four major areas:

- Collinsville/Newlands/Byerwen – 9,650 ML per annum
- Collinsville irrigation precinct – 80,000 ML per annum
- Proserpine and Abbot Point – 5,000 ML per annum
- Moranbah – 31,000 ML per annum

The large and sophisticated resource customer base would be expected to take up demand beyond the modelling assumptions as the level of new projects without adequate water supply is high.

Meeting the service need would benefit the region by delivering new water for mining and agriculture, providing water security for urban coastal communities, opening up new opportunities for irrigated agriculture, generating employment by supporting business growth and giving business greater confidence to invest in the region.

Options Generation, Filter and Shortlist

In keeping with Queensland Government frameworks and policies, multiple options to address the service need were identified, from reform and demand management measures to capital works that supplement existing systems and large-scale new infrastructure.

Options examined include:

1. Duplication of the Burdekin to Moranbah Pipeline at 25,000 ML per annum (Base Case).
2. Implementing pricing signals to restrict future water use in the Whitsundays and meet water demand beyond 2025.

3. Increasing pressure on ground water supplies in Bowen and the Whitsundays to meet water demand beyond 2025.
4. A new pipeline from Claire Weir on the Burdekin River to Bowen and Proserpine at 15,000 ML per annum as an alternative to supply water direct from Urannah utilising Dam Options 1 or 2.
5. A series of new weirs on the Bowen River and an upgraded pump station.
6. A series of new weirs on the Bowen River and an upgraded pump station, combined with Option 1 or 2.
7. A new pipeline from Burdekin to Byerwen with new pipeline at 8,000 ML per annum as an alternative to supply water direct from Urannah utilising, combined with Option 1 or 2.
8. A new pipeline from, from Burdekin to Collinsville Coal Mines at 20,000 ML per annum as an alternative to supply water direct from Urannah utilising, combined with Option 1 or 2.
9. new Urannah Dam and pipeline from Urannah to Peter Faust Dam at 35,000 ML per annum (high priority).
10. A new Urannah Dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and Eungella dams, augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline.
11. A new Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella dams duplicating the existing pipeline to provide incremental supply to Moranbah.
12. A new Urannah Dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and Eungella dams duplicating the existing pipeline to provide incremental supply to Moranbah.

A two-phase process was used to assess options. First, all twelve options were assessed through a multi-criteria analysis (MCA) in order to select three options for shortlisting. Options were examined for their operational viability, ability to meet the service need and possible financial, environmental and regulatory, land use, economic and social impacts. Criteria were weighted according to their importance, with operational viability and ability to meet the service need given the highest weightings. Following the MCA, stakeholder consultation was undertaken to verify scores and rankings.

The three top ranking options from the MCA were shortlisted and further economic and financial analysis was conducted to select the final two options. Shortlisted options all centre around a new dam with instream supply to Collinsville and piped connections to existing dams. One of the shortlisted options (Option 10) also includes duplicating the pipeline from Burdekin to Moranbah

Shortlisted options include:

- Shortlist Option 1 (MCA Option 12): large-sized Urannah Dam yielding 150,000 ML per annum, Collinsville connection, pipes to Eungella and Peter Faust dams, new pipeline from Eungella Dam to Moranbah and irrigation distribution infrastructure near Collinsville
- Shortlist Option 2 (MCA Option 11): medium-sized Urannah Dam yielding 70,000 ML per annum, Collinsville connection, pipes to Eungella and Peter Faust dams and duplicating the existing pipeline to provide incremental supply to Moranbah

- Shortlist Option 3 (MCA Option 10): small-sized Urannah Dam yielding 50,000 ML per annum, Collinsville connection, pipes to Eungella and Peter Faust dams, and Burdekin to Moranbah pipeline duplication.

Key points from the options assessment include:

- Option 1: duplication of the 209km Burdekin to Moranbah pipeline, was considered the 'do minimum' (Base Case). Using weighted and unweighted criteria, this option achieved the lowest (poorest) overall score. Although this option maximises the use of existing water storage (i.e. Burdekin Falls Dam), it has significant annual operational costs as water must be pumped uphill to Moranbah. Combining this option with Urannah Dam however significantly lifts its viability
- Reform measures alone such as policy changes on groundwater and pricing would be insufficient to meet the service need and could not be used to promote regional economic development.
- The four highest-scoring options all propose a dam at Urannah and supporting distribution network. All create new water supply allocations and could be used to 'top-up' water supply in other parts of the regional network to meet growth needs and boost reliability of supply. Scores for the dam increase as the number of connections to other parts of the regional water network increase.
- In the MCA, the option to combine a small dam at Urannah with a duplication of the Burdekin to Moranbah pipeline (Base Case) ranked third. This was confirmed through the shortlisting process.
- Shortlist Option 1 (MCA Option 12), the highest scoring option overall, has the largest dam and also includes an irrigation distribution system for an agricultural precinct around Collinsville. This is the only option that could stimulate new, large-scale agricultural production and provide significant, long term, regional, economic development from expanded agriculture.
- Reform measures combined with a short pipeline from the Burdekin into the region (for example, to Bowen, Byerwen Coal Mine or Collinsville Coal Mine) was preferred after the Urannah Water Scheme. Combining reform measures with a series of weirs on the Bowen River and an upgraded pumping station is similarly viable. Both infrastructure solutions have a lower capital cost than the Urannah Water Scheme or Burdekin to Moranbah pipeline. However, these options would be unable to meet the full spectrum of identified needs, reaching only a limited selection of users.

Strategic Considerations

The Australian Government has a strong preference to invest in water resources with the potential to diversify regional economies and increase exports. Development of the right water infrastructure in the right area is considered key to realising the vision set out in Our North, Our Future: White Paper on Developing Northern Australia.

The Australian Infrastructure Plan states that infrastructure investment in Northern Australia should enhance the nation's regional productive capacity to take advantage of growing demand for Australian produce in places such as Southeast Asia and China. It also notes that successful irrigated agriculture depends on reliable and secure water resources. The Northern Australia Audit: Infrastructure for a Developing North highlighted the potential for new dams to support prospective agriculture.

In the State Infrastructure Plan (**SIP**), the Queensland Government indicates that water supply infrastructure should be in place (or in train) where there is a sound business case and water resources are available. Solutions should be evaluated and determined after water needs are assessed.

The framework by which new proposals for water storage are considered is outlined in the Queensland Bulk Water Opportunities Statement (**QBWOS**). For new water storage projects to proceed, the proponent currently needs to have commitment from foundation customers to take the water that will be made available. This allows long-term contracts to be put in place ensuring that construction costs will be recouped, and revenue will be ongoing. The project team examined this approach against the BQDF and the Project Assurance Framework (PAF) and determined that these policy documents outweigh the QBWOS application in full.

The Mackay, Isaac and Whitsunday Regional Plan examines anticipated growth in the region – both population and economic – and underscores the importance of water security for economic and community health.

Queensland's Agricultural Strategy (2013) highlights the importance of agricultural industries to the state economy and the social fabric of rural and regional communities. Most jobs in agriculture and half of all jobs in food processing are regionally based. One of the four key pathways to grow Queensland's agricultural production – securing and increasing resource availability – focuses on enabling agricultural growth through optimal use of critical resources including land and water. The strategy outlines the government's intention to improve access to, and reliability of, water supplies for agricultural producers. Delivering secure and defined water entitlements for agriculture was identified as a key initiative to achieve this aim.

Dam Design and Geology

Varying dam options with a range of reservoir levels were considered, from 255 metres to 295 metres Australian Height Datum (AHD) full supply level (FSL). Three construction types were also examined – a roller compacted concrete (RCC) dam, concrete faced rockfill dam (CFRD) and an earth and rockfill dam (ERD). All present feasible options for the site given the availability of suitable construction materials. A zoned earth dam was eliminated early in the investigative process as it would be less economical than other methods.

It is recommended that Urannah Dam be designed as an CFRD, with a sloping core. This would enable a large dam of 290 FSL using a staged construction. A RCC dam with earth and rockfill dam flanks was preferred at the lower levels below 280 FSL, however does not allow for a staged project unless gates are used.

Urannah Dam is capable of providing a mean annual diversion (yield) of up to 195,000 ML per annum depending on FSL. A dam of this size could support an irrigation area ranging from 8,000 hectares to 15,000 hectares, depending on the FSL and mix of water priorities. For example, a dam with an FSL of 295 metres would support a 40 per cent larger irrigation area than a dam with an FSL of 280 metres.

The Urannah Dam to Peter Faust Dam water supply pipeline has potential to generate hydropower. Hydropower plants are typically located in areas with high rainfall and elevation, similar to the Urannah region. If hydropower was incorporated, the generated energy would be 1.8 times larger than the energy required for pumps in the scheme, resulting in positive net energy recovery.

Key features of a potential hydropower system include:

- two pump stations to raise the water approximately 122 metres to a head pond (or surge chamber or similar) at 380 metres AHD
- low-pressure pipeline with pump rising mains for most of the alignment
- pump stations are fed from or empty into empty pond to reduce pressures in pipes
- penstock and power station are located at 125 metres AHD, for a gross head of 255 metres
- Pelton turbine

Hydropower plants can also include a pumped storage plant, which is generally a smaller dam or turkey's-nest arrangement. Two options for pumped storage were examined.

While hydropower is recommended, it is not currently included in the scope of the Urannah Water Scheme and could be pursued as a standalone project. The facility would not only offset pumping costs and remove excess pressure head but could also generate revenue from surplus energy.

Market Considerations

Market sounding was conducted during SBC investigations and to prepare this PBC with the resource, agricultural and industrial sectors (including operators, potential investors and industry groups).

Participants in the market sounding strongly support the provision of new water sources for the region to diversify the economy and enable the development of resource projects.

Market feedback from the resource sector indicated the following:

- Increased certainty of water availability would increase financial investment certainty.
- Companies will pay premiums for high priority water to have it available when needed.
- Customer experiences with SunWater have been varied with some Eungella High Priority allocations not being available at times of high demand and low storage levels.
- Long-term supply agreements would aid in securing project finance for water.
- Moranbah and Newlands clusters of customers are paying significant premiums and are trading water due to scarcity.
- Companies are optimising their water supplies through re-use and recycling.
- Companies are paying upwards of three times the volume-weighted trading price with all current sources of mining water fully allocated.
- Operational costs associated with the SunWater connection pipelines are high. While associated prices for this water are also high, it is unlikely that costs are being covered.
- A number of resource projects would have proceeded when favourable commodity markets returned had secure access to water been available

Market feedback from the agricultural sector indicated the following:

- Demand for water is solely reliant on the creation of a new irrigation precinct with large-scale, on-farm infrastructure.

- Within the proposed irrigation area at Collinsville, properties are held by a small number of owners. The majority are owned by resource companies who acquired properties for further resource development or to provide buffer areas to existing operations.
- New operations to take advantage of high-quality soils will require a single user approach to manage the full impacts of soil degradation and potential impacts on the Great Barrier Reef

Public Interest Considerations

Preliminary investigations show all shortlisted options would meet public interest effectiveness criteria and align with strategic state and federal government objectives.

Stakeholder consultation identified strong support for an additional bulk water source for the region, particularly to grow the agricultural sector. Many additional benefits were identified, which would mostly be experienced by existing urban, industrial and mining customers through increased reliability of supply.

Localised impacts would occur in the form of land acquisitions and environmental impacts. However, primary landholders of the dam site have not indicated objection to the Urannah Water Scheme concept.

It is not possible to determine a social licence for the shortlisted options from the consultation undertaken for the PBC as stakeholder consultation was targeted and conducted at a regional level only.

Public access to Urannah Dam for recreational purposes was identified by stakeholders as a legitimate matter for discussion as community members may consider Urannah Dam a potential source of increased amenity and tourism.

Social Impact Evaluation

A social impact evaluation (**SIE**) considered the positive and negative impacts of the shortlisted options on the health, wellbeing and economic prosperity of affected communities, both during construction and operation. It found all options would deliver significant social benefits to communities, businesses and industrial sectors across the region.

A total of eleven positive social impacts and four negative social impacts are expected.

Minimal property resumption will be required for the dam itself. Both the registered lessee of the dam site, an Indigenous land corporation called Urannah Properties Association (**UPA**), and the Traditional Owners support the development. However, the dam will inundate up to 10,500 hectares of land.

Demand for water in the region is increasing and economic investment is currently hindered by lack of access to reliable, affordable water. Urannah Water Scheme will deliver new water to support mining growth in western areas and provide greater water security for urban communities, agriculture and industry along the Whitsunday coast by boosting water supplies in existing dams.

It could also support greater agricultural production near Collinsville. This could be expected to reinvigorate Collinsville by creating new jobs and broadening the local economic base, with flow-on benefits to the regional economy.

Specific social impacts identified include:

- an increase in agricultural production, leading to higher value land use
- an increase in mining expansion and project certainty

- an increase in regional employment from enhanced agricultural productivity
- an increase in regional employment from enhanced mining activity
- new opportunities for Indigenous business development and employment
- increased certainty of long-term water supply to at risk urban areas
- enhanced confidence to invest in long-term business operations and succession opportunities
- an increase in the value and flexibility of existing water allocations
- an increase in regional tourism
- a decrease in crime
- additional demand on existing services during construction and operational phases
- potential loss of areas of cultural significance
- displacement of existing land owners and industry
- environmental impacts
- possible impacts on regional housing affordability and supply due to demand for workers housing during construction phase.

Some of the benefits listed above could only be delivered by Shortlist Option 1.

Environmental Assessment

The proposed dam site is currently used for grazing cattle. However, it is located next to a national park and state forest, high in the Mackay Hinterland, in a biodiverse catchment. About 80 per cent of the Broken River sub-catchment is classified as a matter of state environmental significance (MSES) protected area.

Broken River passes through the site and later joins with the Bowen River before flowing 100 kilometres north-west to the Burdekin River. Urannah Creek, Broken River, Dicks Creek, Massey Creek and Ernest Creek would all be impacted by the proposed inundation, as would a number of lower order streams and creeks. All waterways are mapped ecological corridors of significance and have riverine conservation significance. They include wetlands of high ecological significance and mapped wetland protection areas. Development of management and mitigation measures for these wetlands and the broader waterway network would be required for the dam to proceed. Further assessment of potential impacts to groundwater and regional hydrology would also be required.

An estimated 2,763 hectares of ‘of concern’ regional ecosystems and 3,336 hectares of ‘least concern’ regional ecosystems would be inundated by the dam. This could remove or affect the habitats of endangered, vulnerable and near-threatened terrestrial species. Environmental offsets are likely to be required to compensate for this vegetation removal.

Class A (high-value) agricultural land under the Regional Planning Interests Act 2014 is also located downstream. While most of the proposed agricultural irrigation precinct near Collinsville is in a strategic cropping area (with Class A and Class B agricultural land), changes to the local planning scheme may be required to support irrigation. The area currently supports dryland cattle grazing but includes some high-risk flora trigger areas.

State-protected flora and fauna occur in the surrounding area and could be affected by the dam. Potential MSES that could occur downstream of the site include:

- Category B, C, and R regulated vegetation
- regulated vegetation (defined watercourse)
- wildlife habitat (threatened and special least concern animal)
- regulated vegetation (essential habitat).

Thirty threatened fauna species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) may be present in the dam area or downstream. Eighteen listed migratory species, including saltwater crocodile (Crocodylus porosus) and the freshwater sawfish, and 19 threatened fauna species may use or occur in or near the inundation area. Field surveys would be required to identify if Irwin’s turtle (Elseya irwini) is located in the area.

No endangered regional ecosystems or federally listed threatened ecological communities (**TECs**) would be affected by the proposed dam or its inundation area. However, three TECs may occur in the proposed irrigation area along with three nationally important wetlands, which would require assessment before agricultural development could proceed. Potential water quality impacts from this irrigation area would require particular consideration.

As a result of the above, the development of a new dam and the consequential agricultural expansion within a Great Barrier Reef catchment may require approval under the EPBC Act.

An environmental impact statement (**EIS**) may also be required, along with:

- development approvals for matters identified in the relevant planning schemes as well as MSES including material change of use, operational works (such as referable dam, taking or interfering with water, waterway barrier works, vegetation clearing and high-impact earthworks) and building works
- an environmental authority for a prescribed environmentally relevant activities (**ERAs**)
- an amendment to the Water Plan (Burdekin Basin) 2007

Shortlist Option 1 may be sufficiently large to be declared a coordinated project under the *State Development and Public Works Organisation Act 1971* (SDPWO Act), allowing for a more streamlined approvals process. The environmental impacts of this option are larger than other options as it includes an agricultural irrigation precinct.

Native title over the western portion of the Urannah dam site has been determined in favour of the Birriah People. The Wiri People have lodged a native claim over the eastern portion of the site. The Birriah People also hold native title over the proposed agricultural irrigation precinct and this area contains 3,000 Aboriginal cultural heritage sites or registered places. Potential disruption to Aboriginal cultural heritage places, objects and values in both locations would need to be considered due to the presence of undisturbed vegetation and ephemeral water sources (on the dam site), which are strongly correlated with Aboriginal camping and occupation areas, and the large number of existing heritage sites (within the irrigation precinct).

Construction of the dam and related agricultural irrigation area would require acquisition of land with various tenures, and exploration and mining leases. Urannah Station (on the dam site) is held by UPA as registered lessees, with the lease being granted by the Indigenous Land Corporation (ILC) with conditions. The proposed irrigation precinct incorporates 23 land parcels (17 lease tenures and six freehold tenures).

The project has assumed a single approach to the potential Collinsville Irrigation precinct. Landholder engagement has commenced to acquire the land through a development fund through approach. This means that the landholders enter into a 30-year agreement to lease to a single operator who builds the required infrastructure and operates the area as a single customer. The UWS intent is to declare the entire precinct in a similar fashion to a State Development Area which can allow for economies of scale, planning certainty and a singular approach to soil management in the GBRMP catchment.

Economic Assessment

An economic analysis was used to assess the incremental economic benefits and costs of each shortlisted option and the Base Case to society. The table below summarises the key features of these options.

Features of infrastructure options assessed

Asset	Base case	Shortlist Option		
		Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Urannah Dam yield	X	150,000 ML	70,000 ML	50,000 ML
Instream distribution to Collinsville	X	√	√	√
Pipeline to Peter Faust Dam	X	√	√	√
Pipeline to Eungella Dam	X	√	√	√
Moranbah supply	Burdekin to Moranbah duplication	Urannah to Moranbah pipeline	Urannah to Moranbah pipeline	Burdekin to Moranbah duplication
Agricultural irrigation network	X	√	X	X

The table below presents the results of the cost-benefit analysis (**CBA**) undertaken for these options. The analysis assumes a 30-year operating period. Shortlist Option 1 achieves the highest BCR of 1.7.

Summary of CBA Results ($ million, discounted)

CBA Results	Shortlist Options		
	Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
NPV	311.6	-34.5	-264.6
BCR	1.7	0.9	0.4

The primary benefits of the Urannah Water Scheme monetised in the CBA include:

- benefits to urban users: increased certainty of long-term water supply to at-risk urban areas, with less requirement for demand management measures (only under Shortlist Option 1 and 2)
- benefits to agricultural users: increased agricultural production in the region (only under Shortlist Option 1)
- benefits to industrial and mining users: increased mining expansion and project certainty

Analysis of potential agricultural production assumed crops of cotton, sorghum, small crops, avocados and mangoes could be grown within the proposed agricultural precinct based on identified soil types.

Sensitivity analysis was undertaken to determine the impact of changes in construction costs, demand, price and the assumed discount rate. The table below presents the results of this analysis.

Sensitivity test results

	Option 1 (FSL RL290)		Option 2 (FSL RL280)		Option 3 (FSL RL255)	
Sensitivity	NPV	BCR	NPV	BCR	NPV	BCR
Core	**311.6**	**1.7**	**-34.5**	**0.9**	**-264.6**	**0.4**
10% real discount rate	6.8	1.0	-132.0	0.5	-278.7	0.3
4% real discount rate	961.0	3.1	199.4	2.0	-201.6	0.6
CAPEX +40%	87.3	1.1	-181.5	0.5	-419.9	0.3
CAPEX -40%	535.8	3.3	112.6	2.2	-109.4	0.6
Benefits -20%	158.0	1.3	-75.8	0.7	-298.3	0.3
Benefits +20%	465.1	2.0	6.8	1.0	-230.9	0.5
Water price -20%	-23.4	1.0	-6.2	1.0	-236.3	0.5
Water price +20%	339.9	1.7	-6.2	1.0	-236.3	0.5
Cotton crop only	339.9	1.7	-6.2	1.0	-236.3	0.5

Financial Analysis

Financial assessment demonstrate that all three shortlisted options have the capacity to generate positive FNPVs. The table below presents the FNPV of each option (not adjusted for risk).

FNPV of shortlist options

Financial NPV	Base case	Shortlisted Options		
		Option 1 Large dam, network connections, irrigation infrastructure	Option 2 Medium dam, network connections	Option 3 Small dam plus Base Case
Total NPV	**70**	**558**	**598**	**457**

The table below presents the total capital and annual operational costs of the Base Case and all shortlisted options.

Summary of project costs for Base Case and shortlisted options

	Construction cost ($M)	Annual operational cost ($M/annum)
Base Case		
Burdekin Moranbah Pipeline Duplication (25,000 ML/annum)	$757	$27.1
Total	$757	$27.1
Shortlist Option 1		
290 FSL CFRD Dam	$673	
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML/annum)	$210	$3.1
Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML/annum)	$382	$9.7
Irrigation distribution infrastructure	$200	$2.5
Total	$1,465	$15.3
Shortlist Option 2		
280 FSL RCC Dam	$629	
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML/annum)	$210	$3.1
Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML/annum)	$382	$9.7
Total	$1,221	$12.8
Shortlist Option 3		
255 FSL RCC Dam	$258	
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML/annum)	$210	$3.1
Pipeline Urannah Dam to Eungella Dam (5,000 ML/annum)	$22	$2.0
Burdekin Moranbah Pipeline Duplication (25,000 ML/annum)	$757	$27.1
Total	$1,247	$32.2

Demand forecasts used in the analysis considered three forms of potential revenue from users – one-off payments to secure allocations, an annual fixed charge per megalitre of water allocation and a variable charge per megalitre of water used.

The table below summarises the demand estimates for each primary user group and the price per megalitre of water assumed under the different pricing regimes.

Demand and price estimated for primary user groups

User group		Potential annual demand	Price
Industrial/mining demand		33,000 ML	$2,000/ML/annum (user charges)
Urban demand		7,000 ML	$2,000/ML/annum (user charges)
Agricultural demand (Shortlist option 1 only)	High Priority Allocation	Up to 25,000 ML (increasing over time)	$3,000/ML (for allocation) $55/ML/annum (user charges)
	Medium Priority Allocation	Up to 85, 000 ML (increasing over time)	$2,000/ML (for allocation) $55/ML/annum (user charges)

Value capture is unlikely to be an appropriate mechanism for funding the Urannah Water Scheme.

Discount rates used to convert future cash flows into present value equivalents are shown in the table below.

To develop the weighted average cost of capital (**WACC**), this PBC adopted the interest rate under the National Water Infrastructure Loan Facility (**NWILF**), currently 3.12 per cent. Financial modelling assumes that construction would commence in 2020 and take two years to complete.

Discount rate inputs

Inputs	Values
Risk free rate	1.95%
Market risk premium	6.50%
Equity beta	0.46
Cost of equity	5.18%
Cost of debt	3.12%
Level of borrowings (debt)	49.0%
WACC	4.03%

Delivery Model Analysis

Various traditional options for delivering the Urannah Water Scheme were examined and compared to public private partnership (PPP) delivery. The delivery model analysis focused on Shortlist Option 1, which would be split into two packages of work – design and construction of dam and delivery infrastructure (two sub-packages) followed by development of the irrigated agricultural precinct.

Under a traditional delivery model, the dam would be government funded and owned, with the allocation of risk during design and construction differing between models. Traditional delivery models assessed include:

- competitive alliance (**CA**)
- early contractor involvement (**ECI**)
- managing contractor (**MC**)
- construction only (**CO**)
- design and construct (**D&C**)

- design, construct and maintain (**DCM**).

The design, construct, maintain and operate (**DCMO**) and design, construct, finance, maintain and operate (**DCFMO**) models were not considered as it was assumed SunWater would operate Urannah Dam.

Market sounding was undertaken to support the delivery model analysis, which obtained market feedback on potential package structures, delivery model, early works scope and staging, interface with existing operations, procurement timetable and market trends and characteristics.

It uncovered strong interest in the Urannah Water Scheme from qualified large-scale dam builders. Participants agreed that an ECI model with two-stage design and construct was preferable, allowing for risk sharing on identified risks. While constructing the dam is considered relatively straightforward, developing connection pipelines and hydropower is very complex and includes multiple revenue streams. The financing of the various elements would require an innovative financing solution (in the form of a public private partnership).

A desktop analysis of recent dam projects within Australia was also completed.

Conclusions

Key conclusions for each chapter, as summarised in Chapter 18: Conclusions, are presented in this Executive Summary.

1 INTRODUCTION

1.1 Chapter Summary

A large-scale water supply on the Broken River at Urannah has been considered by government since the 1960s. The surrounding sub-catchment has a strategic water allocation of 150,000 ML annually.

In 2018 Bowen Collinsville Enterprise Association (**BCE**), submitted a strategic business case (**SBC**) for a dam at Urannah and supporting infrastructure to connect it into existing regional water networks. The SBC recommended development of this preliminary business case (**PBC**)

The Urannah Water Scheme (including the dam, pipelines and irrigation scheme) offers the potential to support regional economic growth by

- augmenting existing water supplies to meet long-term regional mining, agricultural, industrial and urban demand
- stimulating additional irrigated agricultural demand

This PBC examines the need for, and opportunities offered by, an additional water supply for the region and possible options to meet this need

1.2 Purpose

This chapter introduces the Urannah Water Scheme and the proponent, Bowen Collinsville Enterprise Association (BCE). It also briefly outlines the history of the scheme.

1.3 Overview of Urannah Water Scheme

Urannah, on the Broken River, has long been considered a potential site for a large-scale water supply for the surrounding region. A tributary of the mighty Burdekin River, the Broken River drains into the Bowen River sub-catchment and the broader Burdekin Basin, Australia's second-largest river basin. The sub-catchment has a strategic water allocation of 150,000 ML annually provided for in the Burdekin Water Resource Plan, which means this volume can be used by business, industry and the community while still allowing for sufficient environmental flows.

Urannah Dam was first formally proposed by government in the 1960s by the Queensland Irrigation and Water Supply Commission. Non-profit economic development agency, BCE has been driving investigations since the 1990s.

In 2015, BCE formed a working group to examine regional economic growth opportunities through the construction of a new water storage on the Broken River. The study concludes that the construction of a dam and supporting infrastructure at Urannah offers the potential to:

- supplement existing regional water supplies to ensure reliability and to meet growth in mining demand in western communities, urban and agricultural demand in coastal Whitsundays communities and industrial demand in Bowen
- stimulate irrigated agricultural demand on land with high-quality soils in mining buffer areas along the Bowen River
- strengthen regional water security by improving the reliability and efficiency of existing water schemes

Following a formal funding submission from BCE, the Australian Government committed up to $3 million from the National Water Infrastructure Development Fund (**NWIDF**) in 2016 for a 'detailed examination of the economic feasibility of Urannah Dam'.

This commitment followed the release of Our North, Our Future: White Paper on Developing Northern Australia, which assessed critical economic infrastructure gaps and requirements to meet projected population and economic growth in Northern Australian. It concluded that future agricultural developments in the region needed a range of potential water supply options, including water trading, expansion of irrigation areas and new dams. It also contained recommendations around securing water infrastructure in Northern Australia due to the lack of water resource assessments in the region. The White Paper outlined the Australian Government's intention to establish the NWIDF, 'with $200 million committed to facilitate greater investment in northern water infrastructure'. (Further information on the White paper is contained in Chapter 8: Strategic Considerations.)

The NWIDF is now funding 39 feasibility studies across Australia to accelerate the detailed planning necessary to secure water infrastructure. This includes planning for new dams. The Urannah Water Scheme was awarded NWIDF funding in May 2018.

1.4 Urannah Water Scheme feasibility study

A feasibility study on the Urannah Water Scheme (previously called Urannah Dam) commenced in February 2018 when BCE entered into a Funding Deed with the Queensland Government Department of Natural Resources, Mines and Energy (DNRME), which administers the NWIDF in Queensland.

The study committed to examining the feasibility of the following:

- large water storage (dam) on the Broken River at Urannah (part of the Burdekin River catchment)
- water supply to support large-scale irrigated agriculture along the Bowen River, west and south of Collinsville, via instream delivery or the construction of a trunk delivery canal
- water supply to the northern Bowen Basin for primarily industrial uses via supplement supply to the existing Eungella Dam or direct supply via new pipelines
- water supply to the Bowen and Abbot Point area for agricultural, industrial and urban uses via supplement supply to the existing Peter Faust Dam or direct supply via new pipelines

The Urannah Dam, connecting pipelines and irrigation scheme form the Urannah Water Scheme.

A SBC was submitted to DNRME in August 2018 following early investigations. This PBC represents the completion of the feasibility study and is supported by associated technical studies.

Development of a detailed business case (**DBC**) is the next step required to inform a formal investment decision.

1.5 Preliminary Business Case

The PBC has four objectives, as agreed by BCE and the Australian Government (**NWIDF**). They are to:

- identify and clearly describe the water supply problems and opportunities within the region

- present the Urannah Dam option along with other options as potential solutions to the identified problems and opportunities
- undertake a preliminary analysis of the shortlisted options
- provide recommendations for a Stage 3 DBC

1.6 Review of SBC

The SBC examined the context, high-level service need, key stakeholders, benefits sought from Urannah Dam and presented a strategic response to the service need. It also identified key policy considerations and major mining, industrial, agricultural and urban water users in the study area. These findings are refined and confirmed by this PBC.

As indicated in the White Paper, the Australian Government's overarching policy is to develop new water resources, including those that enable large-scale agricultural development. It remains supportive of the Urannah Water Scheme.

While the Queensland Government supports regional investment projects, new water sources must clearly address the Queensland Bulk Water Opportunities Statement (**QBWOS**). QBWOS highlights the large number of under-used bulk water catchments that exist in Queensland and the government's preference to invest in projects that utilise the existing resources such as pipelines (refer to Chapter 8-: Strategic Considerations for more detail on QBWOS).

1.7 Key findings of SBC

Key findings of the SBC were as follows:

Construction of Urannah Dam is feasible.

There is unmet demand for water to the mining areas of Collinsville, Moranbah and Newlands.

Peter Faust Dam and Eungella Dam are unreliable for customers to invest in long-term supply contracts or systems

Meeting the demand of Moranbah and Newlands will require either

- a new pipeline to use excess capacity from the Burdekin Falls Dam to Moranbah
- a new water source and pipeline that augments Eungella Dam

Ensuring long-term water security to meet the urban/industrial demand of Proserpine and Bowen requires either

- reliance on groundwater and demand management
- a new water source and pipeline that augments Peter Faust Dam

Most supply options to the demand are adequate but are short-term solutions and do not stimulate the tourism or agricultural industries.

2 PROPOSAL BACKGROUND

2.1 Chapter Summary

Multiple studies have examined Urannah Dam since the 1950s. Geotechnical investigations and mapping of the site were carried out in the 1960s.

Urannah is situated in an elevated, high-rainfall area in the Mackay hinterland, part of the Mackay local government area within the Mackay, Isaac and Whitsunday Region. It receives significantly more rainfall, more frequently than Eungella Dam, which is located upstream nearby. The site's elevation offers the potential to generate up to 1,000 MW of hydroelectric power.

Preliminary investigations conducted for the SBC indicate existing unmet demand for water by mining, agricultural and industrial customers in the region (excluding Mackay). Findings also suggest potential for induced demand for water to support new resource and agricultural projects.

2.2 Urannah Water Scheme potential

For more than 50 years, the Broken River has been seen as a potential water source to promote greater economic investment in the surrounding region.

Harnessing the Broken River to supplement existing regional water supplies offers the potential to:

- provide new water supplies, and improve the reliability of existing supplies, to support mining expansion and new resource projects
- provide greater water security for existing agricultural, industrial and urban users to meet ongoing growth in demand
- stimulate irrigated agriculture in mining buffer areas by taking water to fertile locations.

Where the Broken River passes through the Mackay Hinterland is an ideal location for a dam. Steep hills surrounding flat grazing land would support a deep reservoir of water that delivers almost 80 per cent of the capacity of Burdekin Falls Dam on less than 20 per cent of the land area. Early investigations suggest the site's elevation offers potential to generate up to 1,000 MW of hydroelectric power, making it one of Australia's largest potential renewable energy projects.

The site is also strategically located close to a comprehensive, existing water network connecting to agricultural and urban users, large numbers of adjacent industrial customers and fertile land suitable for irrigation along the Bowen River, south of Collinsville. The surrounding region has a significant existing core of supporting infrastructure (railways, power transmission, gas pipeline, road and port infrastructure), which affords the opportunity for incremental growth of existing industry.

A key strength of the Urannah Water Supply Scheme is its capacity to supply water to Proserpine and Bowen on the coastal plain, Collinsville downstream of the Dam, and via Eungella Dam, supply water through to Moranbah and areas to the South. This diverse supply network affords flexibility and increases the opportunity for water allocations to be traded across the network, allowing a more robust water market to function to unlock latent economic potential.

Determining potential demand from users requires an appreciation of both current and latent demand, which was assessed at a high level by the SBC. These preliminary investigations suggest supply is not meeting current demand (except in Mackay).

While dams within the region have met urban demand for consumption purposes, water levels have been unreliable, resulting in periods of limited or no supply for agricultural users on lower priority water allocations. Many agricultural and mining users of the BHWSS, BBWSS, and Proserpine WSS do not use their full allocation of water due to concerns about water security. Water supply from both Peter Faust Dam and Eungella Dam is unreliable. All mines across the region trade in water between themselves and some industrial users supplement existing supplies by trucking water from other areas.

Desktop, stakeholder and preliminary market sounding conducted for the SBC indicated significant potential for induced demand for water to support new resource and agricultural projects.

Most of the Bowen Basin's open cut and underground coal mines are located in the region, alongside a further 24 underdeveloped mining leases. Local mining is experiencing growth with four mines recommissioned in 2018 and numerous operational mines signalling expansion plans. However, these plans are stymied by concerns about the availability and reliability of water.

Current prices place water beyond the reach of agricultural users in many western areas. When commodity markets are buoyant, existing industrial customers take out long-term, high-priced allocations to protect their investment, pushing prices up and agricultural users out of the market. An additional local water source could bring these costs down, particularly for growers downstream of Urannah Dam. Historical studies identified by the SBC found that a new irrigation precinct near Collinsville producing high-value crops, mixed with some commercial users, would largely support the construction of the dam.

Issues related to demand are discussed further in Chapter 4.

2.3 Previous Studies

Urannah Dam was first examined in 1957 and further studied in 1963, 1969, 1977–1978 and 1996. The Snowy Mountains Engineering Company (SMEC) investigated the site in 1963 and again in 1969, when it was mapped and investigated by seismic surveys, dozer trenches, percussion and diamond drilling.

Initial designs were produced earlier, in 1957, and included a gravity-fed system of irrigation channels along the left and right banks of the Bowen River from a weir at Mt Sugarloaf (6 km AMTD) on the Broken River to irrigate 30,000 hectares in the Birralee, Strathmore, Gattonvale, Myuna and Havilah areas adjacent to Collinsville.

Further investigation was undertaken by SMEC in 1977–78, which recommended the two-stage construction of a dam, with the first stage yielding a storage capacity of 863,000 ML and, ultimately, up to a total of 1.5 million ML (Stage 2). This recommendation forms the basis of the current study.

Previous assessments indicated the dam is economically viable, with an acceptable social impact. Environmental impacts were also considered acceptable, with more work required to determine exact impacts.[2]

2.4 Location of the dam

The proposed Urannah Dam would be constructed on property called 'Urannah' currently leased by the Queensland Government to the Urannah Properties Association (**UPA**).

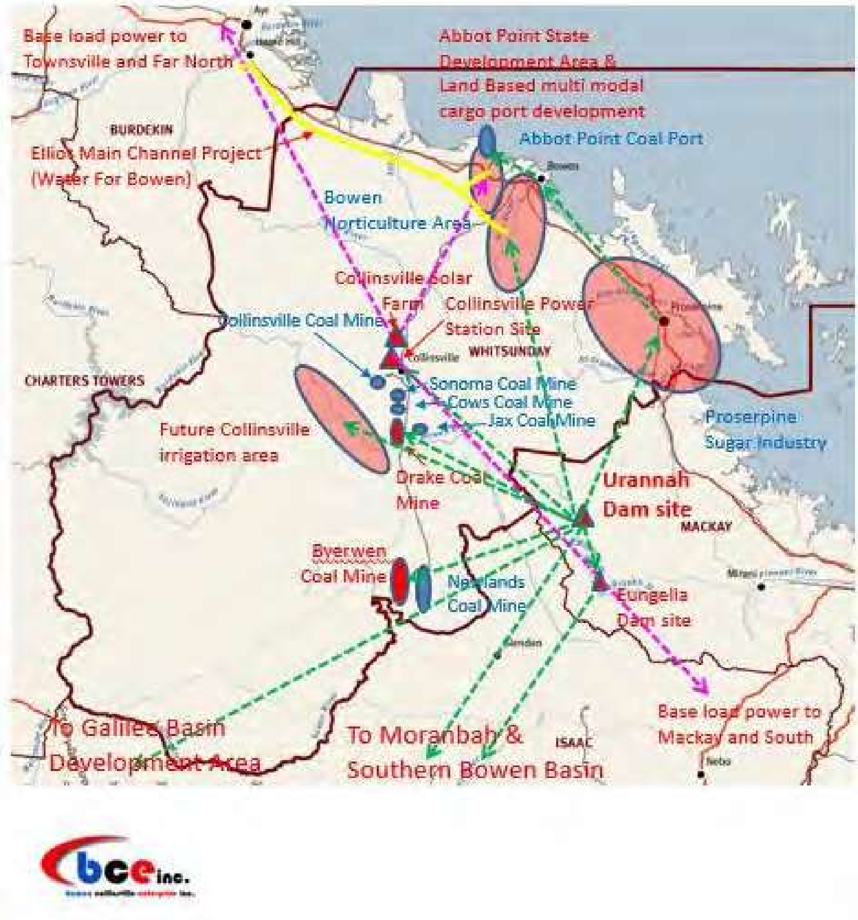
[2] Connell Wagner, The Urannah Scheme, 1996

The site is located within the Mackay local government area, 64 kilometres south-east of Collinsville on the Broken River downstream from Eungella Dam. Users of the scheme would be located within the broader Mackay, Isaac and Whitsunday Region, which contains the local government areas of Mackay Regional Council, Isaac Regional Council and Whitsunday Regional Council.

The site is preferred for its topography and high-rainfall events. It has a high elevation and provides opportunity for energy production (pumped storage and hydropower). Annual rainfall onsite is almost double that of the broader region, which is considered part of the dry tropics. Annual rainfalls are highly variable and most rainfall (68 per cent) occurs from December to March. The site receives significantly more water, more frequently, than Eungella Dam despite its close proximity.

The study area considered by the PBC generally incorporates the potential areas of supply from Abbot Point and Bowen south along the coast to Proserpine and inland down to Moranbah and areas surrounding Eungella Dam. The area, shown in Figure 2-1, is generally referred to as Bowen Basin North.

Figure 2-1 Bowen Basin North



2.5 Urannah Water Scheme description and early demand forecasts

Construction and operation of Urannah Dam would be supported by distribution systems to the surrounding region, which could include instream systems to Collinsville and pipelines south to Eungella Dam and Moranbah and north-east to Proserpine, Bowen and the Abbot Point Port and

State Development Area. The site's topography and hydrological yield would support a larger storage, which in turn would provide more options for distribution.

The SBC identified opportunities to deliver water to:

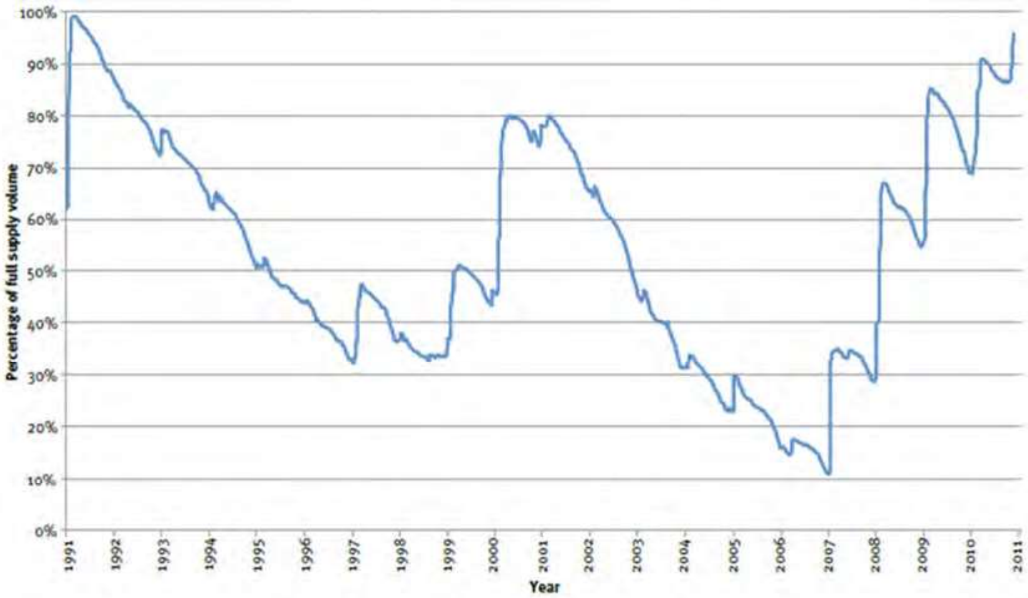
- Proserpine for urban, agricultural and potentially industrial customers
- Eungella Dam for mining customers in Moranbah and Newlands
- Collinsville for industrial and mining customers
- new irrigated agricultural areas in Collinsville (instream)

2.5.1 Water Supply to Proserpine

Peter Faust Dam is the principle supply for Whitsunday communities. It is a large storage that relies on high rainfalls to maintain supply, with a capacity of 491,400 ML. Back up supply to the dam is taken from groundwater. Since its completion in 1990, water levels in Peter Faust have not declined to critical levels that would result in an urban water supply shortfall. However, low levels have resulted in a stoppage of supply to agricultural and industrial uses on lower priority water allocations. As a result, agricultural customers are not using their full allocation due to concerns about water security.

As shown in Figure 2-2, Peter Faust Dam has experienced a series of marked lows in the past 30 years and if full allocations had been used the storage would have failed on three occasions.

Figure 2-2 Historical storage behaviour of Peter Faust Dam



The Whitsunday Regional Council (**WRC**) indicates water demand can be managed in times of tight supply through restrictions and reductions in agricultural use in the short term. However, modelling shows that if agricultural customers were to use just 50 per cent of their allocation at a time when all high priority water was used (as in 2016), the Peter Faust Dam would reach 25 per cent of full supply volume every 11 years (at this level, water supply for industry and agriculture would cease, in order to preserve supply for human consumption). If agriculture allocations increased to 100 per cent, the dam would reach this 'business and industry failure point' of 25 per cent every three years.

Given industry understanding of the dam's capacity, current water supplies are likely to be constraining economic investment for industrial and agricultural activity in the Whitsunday area.

The provision of an additional high demand 16,000 ML per annum, based on 2036 demand, would reduce the frequency of Peter Faust Dam reaching dead storage levels to 1 in 300 years. It would also eliminate water restrictions, groundwater extraction and reductions in water for agricultural purposes. Additional water to the dam would also support Bowen and the Abbot Point Coal Terminal, which currently supplements supplies by trucking water from other sources.

2.5.2 Water Supply to Eungella & Moranbah

Eungella Dam is located on the Broken River upstream of the proposed Urannah Dam. The dam yields 38,930 ML per year, which distributes High Priority water directly to Moranbah via the BMA and Eungella Water Pipelines. The majority of customers in the region are resource companies.

Water supply to Moranbah is supplemented by water from the Burdekin Falls Dam via a pipeline from Burdekin to Moranbah. This pipeline can carry 22,600 ML per annum and is currently operating at capacity.

All mines in the area trade water and are heavily invested in re-use activities as a result of inconsistency of supply. Additionally, many are not using their full allocation or investing in expansion or new works, particularly in times of low inflow, due to concerns about water security.

2.5.3 Water Supply to industry and mining in Collinsville

Collinsville is an industrial and coal mining town. Major local mines including the Collinsville Coal Mine, Sarum, Sonoma and Jax pump water from the Bowen Weir, which is supplied by Eungella Dam. Engagement with mine owners indicates support for access to more secure supplies of water of up to 14,000 ML per annum. All mines and industrial users in Collinsville, as in Moranbah, trade in water and many do not use their full allocation annually to preserve reserves for periods of low availability during extended drought periods.

2.5.4 Water Supply to Collinsville for Irrigation

Early investigations suggest that an 11,000 hectare irrigation precinct south of Collinsville would require up to 8 ML per hectare, each year (88,000 ML per annum). While the precinct has been long identified as suitable for irrigated agriculture, this was confirmed in 1997 through a detailed soils study by Hyder Consulting that estimated up to 30,000 hectares of suitable land for an irrigation precinct. Given the high frequency of rainfall at the proposed dam site (resulting in a reliable water supply), agricultural users are likely to feel confident committing to a medium priority water allocation.

3 REGIONAL CONTEXT

3.1 Chapter summary

The study area is located within Queensland's Mackay, Isaac and Whitsunday Region.

Agriculture, mining and tourism provide the foundation of the regional economy, with coal mining the region's largest employer. Regional economic diversification is an ongoing challenge and could potentially be addressed by greater agricultural development.

Regional population is projected to increase by 55 per cent between 2012 and 2031, placing increased pressure on existing water supply sources.

Five water supply schemes operated by SunWater supply the region, specifically

- Pioneer River
- Proserpine River
- Burdekin Haughton
- Bowen Broken
- Eton

3.2 Purpose

This chapter describes the nature of the broader region where the study area (and proposed dam site) is located, including features of major existing water supplies.

3.3 Regional Population

Approximately 180,000 people live in the Mackay, Isaac and Whitsunday Region, which is expected to grow by 100,000 by 2031.[3] Mackay is the region's principal centre and other major regional centres include Proserpine, Airlie Beach, Cannonvale, Bowen, Collinsville, Sarina, Glenden, Nebo, Coppabella, Moranbah, Dysart, Middlemount and Clermont.

According to government plans, 'existing communities will be the backbone for accommodating future growth'[4]. The Mackay urban area will absorb about two-thirds of future growth, however Bowen Basin communities will continue to face residential and non-residential growth pressures – Moranbah is a key western growth centre. Whitsunday communities will also experience significant growth.

The region borders the Central West, Northern and Central Queensland regions.

3.4 Regional Economic Context

The 90,000-square kilometre Mackay, Isaac and Whitsunday Region (see Figure 3-1) is one of state's most productive regions. Both the regional economy and lifestyle are founded on the natural environment, with a vibrant tourism sector in the east and diverse agricultural activities and mining

[3] Department of Local Government and Planning, Mackay, Isaac and Whitsunday Regional Plan, State of Queensland, Brisbane, 2012
[4] Ibid

operations in the west. The horticulture, aquaculture, marine, agricultural processing, manufacturing and construction sectors are also strong. The region hosts some of the state's most important sugarcane producing areas and infrastructure.

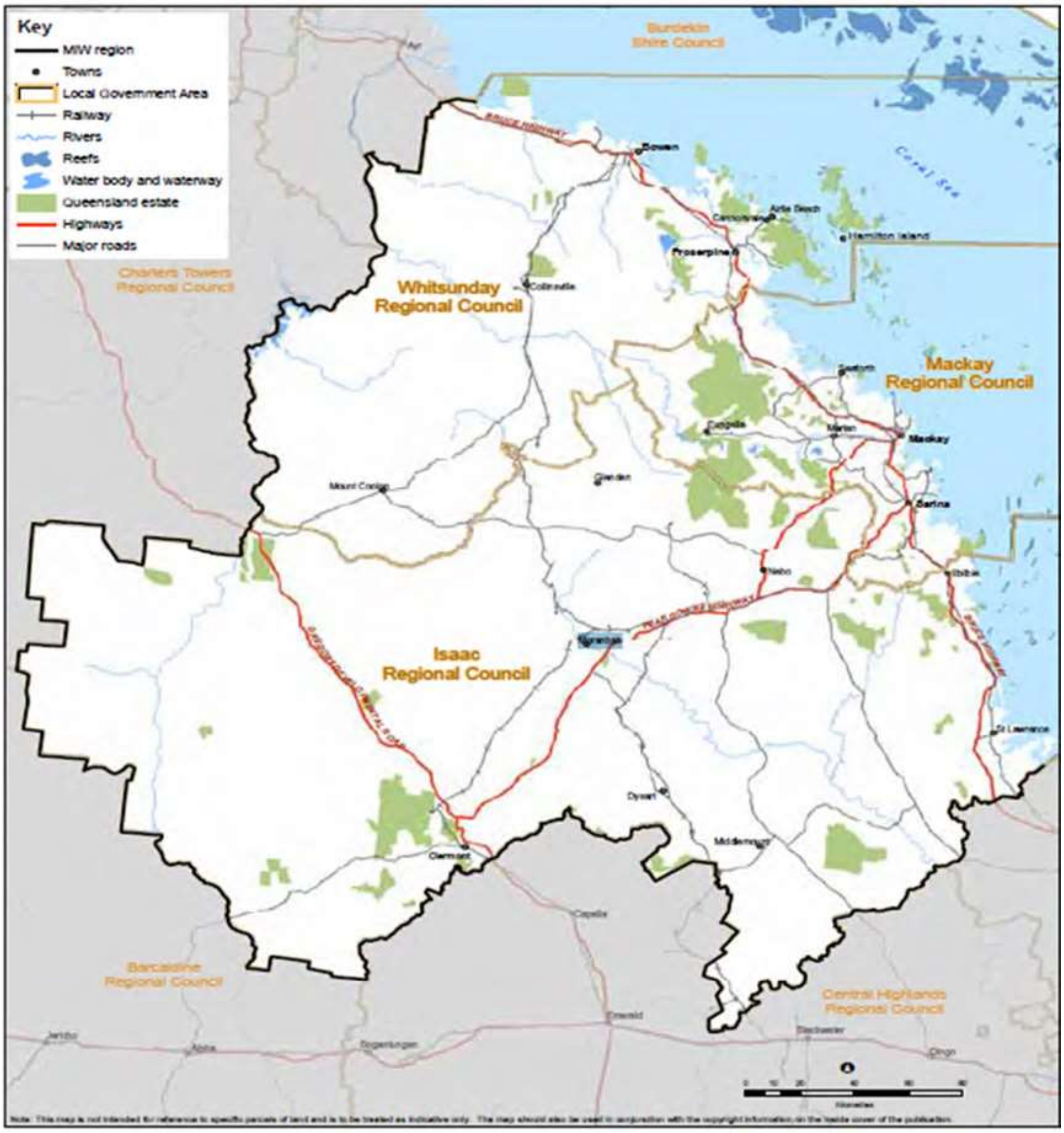
Open cut and underground coal mines, livestock grazing and wheat and sorghum cropping dominate western areas, which contain substantial natural resources, particularly mineral resources and productive agricultural land.

Coal mining is the region's largest employer. The region hosts both the Bowen and Galilee basins, containing the nation's largest coal mining deposits, and two major economic hubs for the future – the Abbot Point and Galilee Basin State Development Areas (**SDAs**). The region is also the principal regional services support centre for the mining and resources sector in Central Queensland, providing specialist industrial, transport and supply chain services.

Economic diversification is an ongoing challenge for the region. The mining industry is particularly vulnerable to shifting commodity prices, which leaves mining-based economies and towns vulnerable to booms and busts and results in fluctuating local populations.

Unlike many other water schemes proposed for Northern Australia the Urannah Water Scheme is not a remote greenfield project requiring high investment in supporting infrastructure. While resource extraction and export will continue to be a major focus for the region, potential exists to strengthen regional water security and provide incremental growth to new and existing industries in the tourism, agriculture, mining and energy and value adding sectors, improving the region's long-term economic sustainability and capacity to contribute to the State economy.

Figure 3-1 Map of Mackay, Isaac and Whitsunday Region



Sourced from Mackay, Isaac and Whitsunday Regional Plan

3.5 Regional case study: Emerald

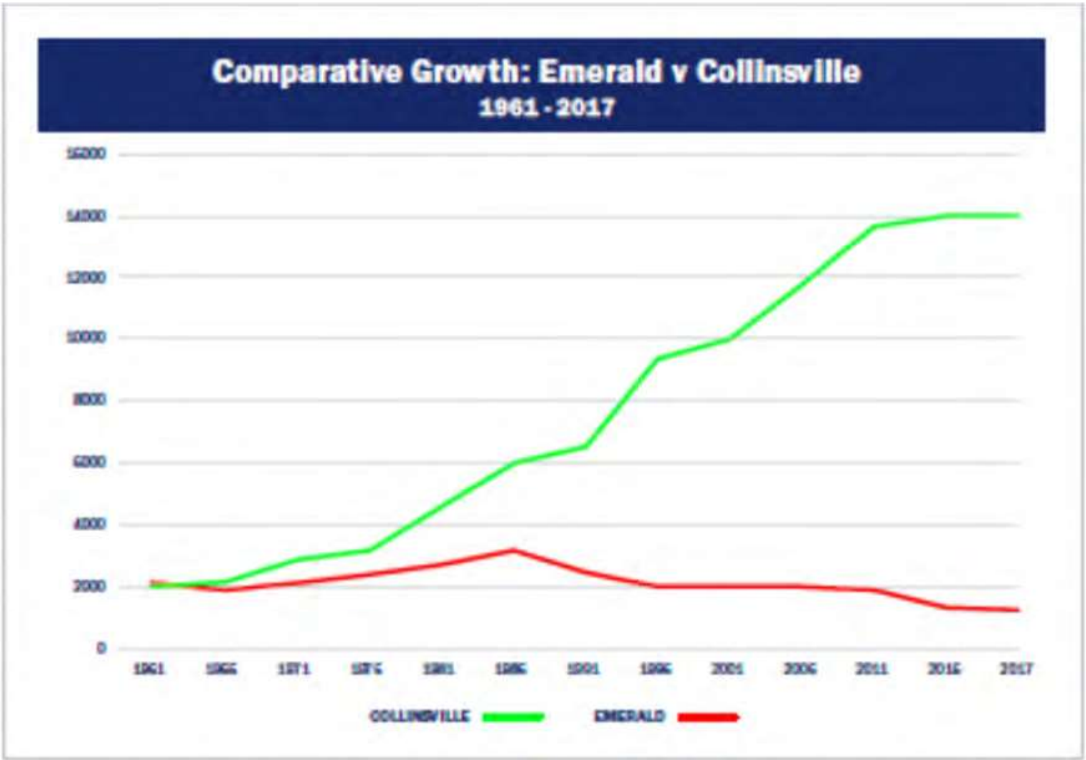
Emerald, a town of 13,500 people in the Central Highlands Region, offers a case study in the value of economic diversification that follows the provision of key water infrastructure (Fairbairn Dam), particularly when compared to mining towns in the study area such as Collinsville.

In the late 1960's the proposed Fairbairn Dam and Urannah Dam Schemes were sister projects with almost identical dam capacities, yields, farm sizes and cropping mix.

Completion of the Fairbairn Dam in 1972, 15 kilometres from Emerald, enabled this mining town to broaden its historical economic base by developing a thriving agricultural sector. (Urannah Dam was originally proposed as a sister dam to Fairbairn Dam.) As well as supplying water to the town and surrounding mining projects, the dam enabled development of a 15,000-hectare irrigated agricultural area, which has developed steadily over the past 40 years. Agricultural production now supported by Fairbairn Dam includes cotton, peanut and horticultural producers, along with grain and beef industries.

Evidence suggests Fairbairn Dam and the associated Emerald Irrigation Scheme have stabilised the economy of Emerald and made it more resilient to mining fluctuations. In 2016 the unemployment rate in Emerald was 5.5 per cent, which compares to an unemployment rate in Collinsville of 10.6 per cent. Median individual income recorded for Emerald in 2016 was $872 per week, which compares to $541 per week in Collinsville. Accordingly, the SEIFA (advantage/disadvantage) score for Emerald in 2016 was 1,001, which compares to a score for Collinsville of 881, making it one of the more disadvantaged communities in Queensland.

While mining remains Emerald's predominant industry, these statistics show that economic activity remained stable during the recent mining downturn. Flow-on social benefits from this economic outcome are also likely to be in evidence. Increased expendable income, for example, generally enables access to a broader range of goods and services, which is socially desirable.



3.6 Regional Water Supply

Five water supply schemes (**WSS**) supply the Mackay, Isaac and Whitsunday Region, operated by the state government owned monopoly, SunWater.

Coastal communities, industry and agriculture are supplied by two primary water supply schemes – the Pioneer River WSS, fed by the Teemburra Dam (147,500 ML), provides water to Mackay's urban areas while Whitsunday communities such as Airlie Beach, Bowen, Cannonvale and Proserpine are supplied by the Peter Faust Dam (491,400 ML) via the Proserpine River WSS. (The Proserpine River

WSS also supplies the small coastal community of Midge Point, which is part of the Mackay local government area).

Water for western areas is primarily drawn from the Burdekin Haughton Water Supply Scheme (**BHWSS**), supplemented by the Bowen Broken Water Supply Scheme (**BBWSS**) and the smaller Eton Water Supply Scheme (**EWSS**).

The BHWSS is supplied by Queensland's largest dam, Burdekin Falls Dam, which holds 1,860,000 ML when full, four times the capacity of Sydney Harbour. Burdekin Falls Dam is located outside the Mackay, Isaac and Whitsunday Region, near the town of Clare, in North Queensland. It waters the Burdekin's rich array of crops, supplies Townsville's urban water and meets the water needs of rural townships, mines, quarries and sugar mills. A 218-kilometre pipeline connects the dam to Moranbah.

The Bowen Broken Water Supply Scheme (**BBWSS**) captures water from the Broken River via Eungella Dam. While its primary purpose is to supply water for mining purposes[5], the BBWSS also provides water to the Collinsville power station, Eungella Water Pipeline and the rural townships of Collinsville/Scottsville, Glendon and Moranbah.

The EWSS is fed by the Kinchant Dam (62,800 ML), which is mainly used to irrigate sugar cane.

All schemes operate independently of each other, that is, they are not linked by pipelines in order to share water. However, the BBWSS is connected via the river system to the BHWSS. The Urannah scheme affords the opportunity to link the existing water schemes to form a regional water grid, with links to Peter Faust Dam at Proserpine, Eungella Dam and Moranbah, and through Collinsville to the BHWSS

[5] SunWater Limited, *Bowen and Galilee Basins Water Supply Strategy Report*, 2013

4 SERVICE NEED

4.1 Chapter Summary

Urannah Water Scheme would become part of the BBWSS. The project determined a whole of catchment approach during the SBC and found that the demand nodes of Moranbah, Proserpine and Collinsville had demand or supply certainty issues that warranted further examination.

The three (3) demand nodes have supply challenges through the certainty of supply which has led to users seeking alternative solutions or onsite demand management. The study team engaged a variety of research techniques which was based on semi-structured qualitative methods and then analysis against quantitative methods on available data.

In each case the themes of research determined latent demand for each of the clusters. The supply certainty to areas of existing water supply indicates several themes:

1. That industrial projects in the Collinsville and Moranbah regions pay a price premium for water supply despite not using the allocations.
2. That irrigation users in the Proserpine region will not commit to lower priority water allocations due to the reliability of Peter Faust Dam
3. That Moranbah industrial users see the Eungella Dam as difficult to manage commercially and the supply is not reliable.

Each of the unstructured discussions conducted, proponents of coal mines indicated long term increases to coal production and the requirement for water certainty. The requirement for water certainty did not indicated a willingness to pay or size requirement at this time beyond variable mega litres to run of mine figures. Every proponent that was interviewed indicated a strong preference for commercial in confidence protection of their water use from regulators and Sun Water.

The BBWSS supplies water via Eungella Dam to customers via pipeline to Moranbah, downstream to Collinsville and pipeline to Newlands and Glenden (through instream releases to the Collinsville Weir and Gattonvale off-steam storage).

The main source of water supply to the Northern Bowen Basin and Moranbah is via 145 km pipelines from the Eungella Dam which has been developed to its hydrological limit and is currently fully allocated. Supplementary supplies are delivered from the Burdekin Dam via a 209 km pipeline which is also fully allocated. Due to current water shortages some mining operations are sourcing additional supplies through water trading at significant price premiums

The Peter Faust Dam at Proserpine has been developed to its hydrological limit, is currently fully allocated with no additional capacity for future growth in the Whitsunday Region. The PFD also supplies the Bowen area via pipeline which has sufficient spare capacity to transport additional supplies to the Abbot Point State Development Area and Port and high value Horticultural users if supplementary supplies can be sourced from Urannah.

In the absence of any other potential option, some mining operators and proponents of new resource projects are seeking SunWater to duplicate the BMP from Gorge Weir to Moranbah with a 209-kilometre pipeline that would supply around 25,000 ML per annum. This is considered the Base Case in this PBC.

Stakeholder consultation indicates users require a new water source that can be compared to sourcing from the Burdekin.

Total demand anticipated from demand nodes in the regional water system (excluding Mackay) is 125,650 ML per annum, split into four major areas:

- Collinsville/Newlands/Byerwen – 9,650 ML per annum
- Collinsville irrigation precinct – 80,000 ML per annum
- Proserpine and Abbot Point – 5,000 ML per annum.
- Moranbah – 31,000 ML per annum.

The large and sophisticated resource customer base would be expected to take up demand beyond the modelling assumptions as the level of new projects without adequate water supply is high. No major bulk water customers are envisaged other than the new irrigation precinct south of Collinsville.

Meeting the service need would benefit the region by delivering new water for mining and agriculture, providing water security for urban coastal communities, opening up new opportunities through irrigated agriculture to generate employment and giving business greater confidence to invest in the region

4.2 Purpose

This chapter outlines the current situation, the method and activities undertaken to determine the service need, findings of the demand analysis and stakeholder views. It then defines the service need to be addressed by this PBC and outlines the expected benefits of a water solution.

4.3 Methodology

The project team conducted a three-phase approach to demand studies in conjunction with the development of the options assessment for the base case and reference project descriptions. This included:

1. Literature Review of previous SunWater demand studies, review of alternative projects for the area (e.g. Connors River EIS, Proserpine River Water Supply Scheme)
2. Commissioning of independent studies:
   a. Moranbah and Bowen Basin Coal (GHD Report)
   b. Irrigation Precinct (Herron Todd White, PSI Delta, Gilby Consulting and Mr Kevin Devlin)
3. Advanced End Use Measurement conducted by the study team as part of the Market Demand and Stakeholder engagement process. This process involved matching publicly published user data, trading histories, trading prices, reported run of mine use and qualitative interview research on user activities, onsite management and efficiency measures.

4.4 Current Situation

4.4.1 System overview

As outlined in Chapter 2: Proposal Background, SBC investigations found existing unmet and latent demand for water sourced from all water supply schemes in the region, excluding the Pioneer WSS, which supplies water to Mackay.

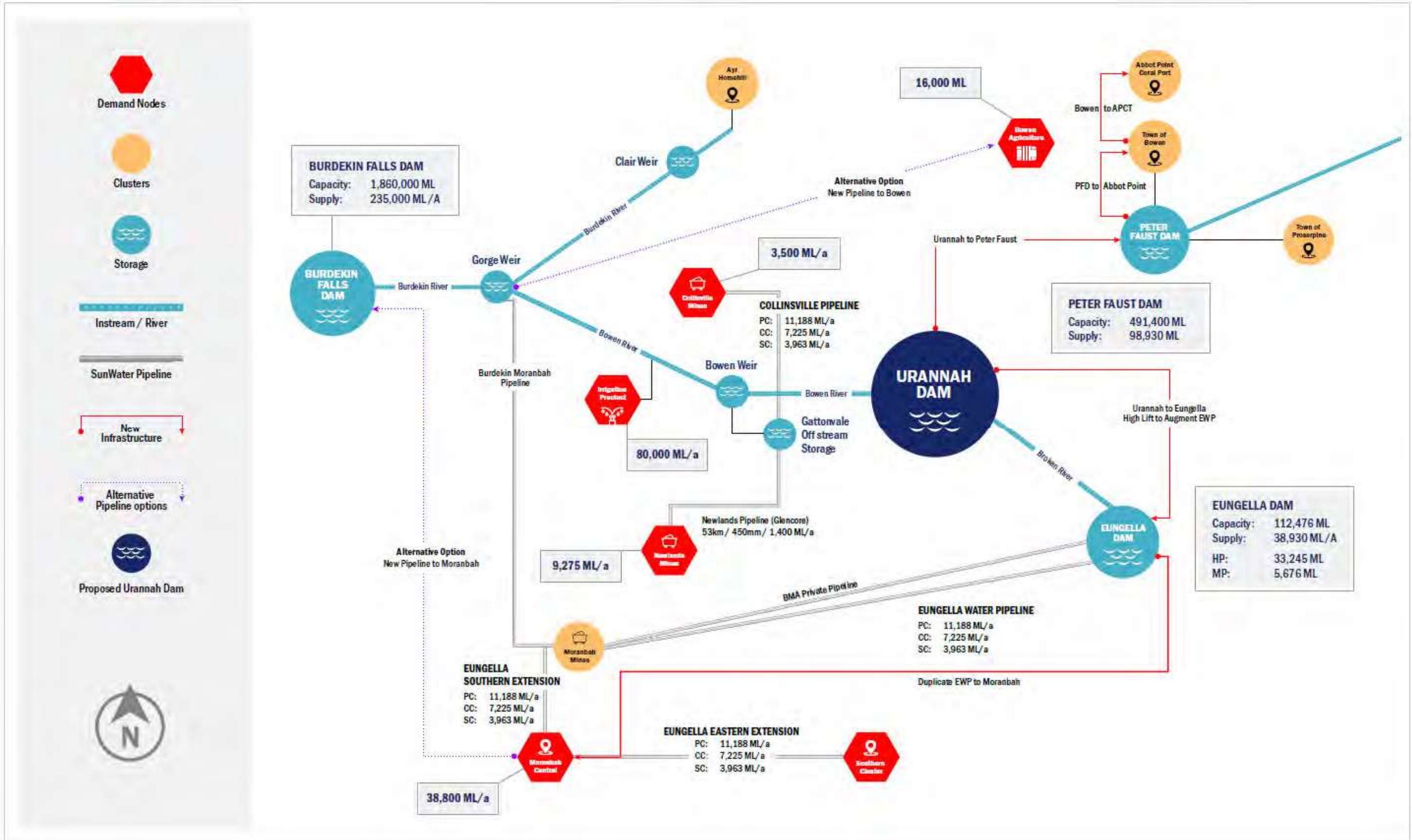
Urannah Water Scheme would become part of the BBWSS. It also has potential to connect into the Proserpine WSS and supplement the Burdekin Haughton WSS.

The BBWSS captures water from the Broken River that flows into the Bowen River before joining the Burdekin River downstream. It has three primary water assets – Eungella Dam, Bowen River Weir and Gattonvale Offstream Storage (**GOSS**).

The system BBWSS starts at the Eungella Dam, which releases water through the river and through pipelines to Moranbah. The releases support water certainty to the Bowen Weir and the GOSS. From the GOSS, water is supplied to the Newlands mining area via private pipeline and northern to Collinsville by pipeline.

The major supply and demand nodes in the BBWSS system, and demand nodes identified by the SBC, are shown in Figure 4-1. Demand nodes are shown in red. These are further described in the following sections.

Figure 4-1 Supply & Demand System



4.4.2 Collinsville

Collinsville has one main water supply harvesting the Bowen River water via the Bowen Weir and GOSS. The Resource Operations Plan (ROP) specifies that pumping may start when the flow in the Bowen River exceeds 1,037 ML per day at the Myuna Gauging Station but must stop when it drops to 750 ML per day at the Bowen River Weir. The pump station has a nominal capacity of 250 ML per day, but this increases as the river level rises.

The GOSS has a capacity of 5,000 ML and the Collinsville Pipeline has a capacity of 11,188 ML currently supplying 7,225 ML to several mines and urban users. The largest customer was the Collinsville Power Station (5,000 ML) but as it is in hiatus currently the water has been traded to QCoal for mining purposes.

The GOSS serves the purpose of harvesting flood flows from the Bowen River to reduce the number of releases and instream losses to adequately meet the supply needs of Collinsville and Newlands/Glenden. This has resulted in increased reliability of high priority and medium priority allocations in the system.

All mines and industrial users in Collinsville however trade in water and many do not use their full allocation due to water security concerns.

4.4.3 Moranbah

Eungella Dam supplies water to Moranbah via the BMA Pipeline and Eungella Water Pipeline (**EWP**) which also passes close to Glenden and the Newlands - Byerwen precinct. Moranbah is also supplied by the Burdekin Moranbah Water Pipeline (**BMP**) from the Burdekin Falls Dam.

Eungella Dam is relatively small (112,400 ML) supplying around 38,930 ML per year of which 33,500 ML is High Priority. Eungella is also the main supply hub for the Northern Bowen Basin coalfields, Moranbah, Collinsville, Newlands and Glenden. Because of its limited size and poor reliability, users have been reluctant to invest in further options to develop this area. The study has examined options to supplement Eungella with 5,000 ML of water to ensure Eungella can meet High Priority water demands following extended drought periods

The BMP, however, is operating at capacity and mines are trading in water at prices of up to $6,000 per megalitre (ML)[6]. In the absence of any alternative options, some mining operators and proponents of new resource projects are seeking a long-term solution from SunWater, which involves duplicating the BMP from Gorge Weir to Moranbah with a 209-kilometre pipeline that would supply an additional 25,000 ML per annum.

Water sourced from the Urannah Water Scheme could be provided to Moranbah via the EWP or a new pipeline. Additional water supply to Moranbah offers potential to provide operational efficiencies in the BBWSS system through rationalisation of the current distribution scheme (e.g. it could potentially supply water directly to Collinsville mines, which currently draw water from the GOSS via aging private pipelines using a very circuitous supply route).

In 2007, the Coal Infrastructure Task Force commissioned a report to assess water demand and supply options for coal mining in the Bowen and Surat Basins for the period 2007 to 2027. The report forecast both a low and high case of water demand for the Bowen Basin at the base case year of 2006. The peak demand forecast for the Bowen Basin was 52,000ML/a (high) and 43,000ML/a (low)

[6] Interview #6 – Water Trader #2 & Coal Company#4

with maximum demand for both reached around 2020. The report reiterated the findings of the CQRWSS that the Connors River Dam and Pipelines project was the preferred medium to long-term surface water supply option for the Bowen Basin.

4.4.4 Peter Faust Dam (Proserpine WSS)

The Peter Faust Dam supplies water to urban users via Whitsunday Regional Council (**WRC**) and Mackay Regional Council (**MRC**), agricultural users, and Wilmar Sugar. WRC holds licences for ground water extraction to supplement Proserpine and Bowen as backup supply for operational issues in Peter Faust Dam.

Peter Faust Dam supplies water to Bowen from a water treatment plant on the Proserpine River (Bowen WTP) via pipeline to Bowen. The stakeholder engagement process and the Whitsunday Regional Water Assessment report has identified current and future water demand for agricultural and urban users plus the Abbot Point Coal Terminal and future Abbot Point State Development Area users through the development of the Whitsunday regional water supply assessment.

While it currently is a supply node in the region, Peter Faust Dam could be used as a conduit to reach the demand node of agricultural, urban and industrial users in the Whitsunday local government area from the Urannah Water Scheme.

Eungella Dam, Peter Faust Dam and the Fairbairn Dam at Emerald are seen as higher risk storages for long term supply contracts due to the potential for system failure following periods of extended drought. As outlined in Chapter 2: Proposal Background, if all agricultural allocations were used during times of high demand, the Peter Faust Dam would reach critical levels for business and industry (that is, 25% per cent of its capacity) every three years. At this point, supply to users of lower priority allocations would stop. Currently the Fairbairn Dam storage is at 12% capacity with zero allocations for Medium Priority agricultural and industrial users in 2019.

4.4.5 Other Connections

As outlined in Chapter 2: Proposal Background, previous studies have identified the potential for a substantial irrigated agricultural precinct along the Bowen River, south of Collinsville. The BBWSS would provide water for the precinct from Urannah Dam via an in-stream distribution network.

4.4.6 System Infrastructure

Table 4-1 outlines the connection infrastructure between the key storage locations on the BBWSS and BHWSS (in the region). Most connectors are fully allocated and transport high priority water, with the exception of the EWP. This is largely because Eungella Dam is not sufficiently reliable to provide the required certainty for further use or infrastructure upgrades

Table 4-1 Infrastructure Details

Infrastructure	Description	Volumes (2015)[7]		
		Capacity	Contracted	Surplus
EWP	Eungella to Moranbah	15,000	9,207	38%
EWP Eastern	Moranbah to Coppabella	5,600	5,600	0%

[7] N.B, No public data is available since 2015. All documents have been removed from the SunWater website at 30 April 2019.

EWP Southern	Moranbah to Vermont	2,500	2,500	0%
BMP	Burdekin to Moranbah	22,600	22,600	0%

4.5 Service Needs Analysis

The service need was developed by:

- review of background documents to re-examine the previous assessments conducted by Whitsunday Regional Council and SunWater
- reviewing the SunWater 2015 Bowen & Galilee Water Options Report
- using the water demand profile from the Whitsunday Regional Water Supply Security Assessment
- developing a potential definition of service need via consideration of the past problem and opportunity statements and consultation with local community groups, stakeholders and major industrial users.
- conducting workshops with internal stakeholder's to examine the proposed service need
- testing the proposed service need via consultation and market sounding with key regional stakeholders and customers (where willing and available)
- commissioning an independent demand assessment by GHD for the Moranbah area
- conducting a series of structured interviews supplemented by unstructured interviews to develop a quantitative demand model
- developing an user demand model on observational datasets (water trading and coal production)[8]
- presenting the proposed service need to the Project Control Group and BCE Board.

4.6 Results of the Demand Assessment

Total demand anticipated from demand nodes in the regional water system (excluding Mackay) is 125,650 ML per annum, split into four major areas:

- Collinsville/Newlands/Byerwen – 9,650 ML per annum
- Collinsville irrigation precinct – 80,000 ML per annum
- Proserpine and Abbot Point – 5,000 ML per annum.
- Moranbah – 31,000 ML per annum.

Key findings of demand assessments are outlined below.

4.6.1 Collinsville

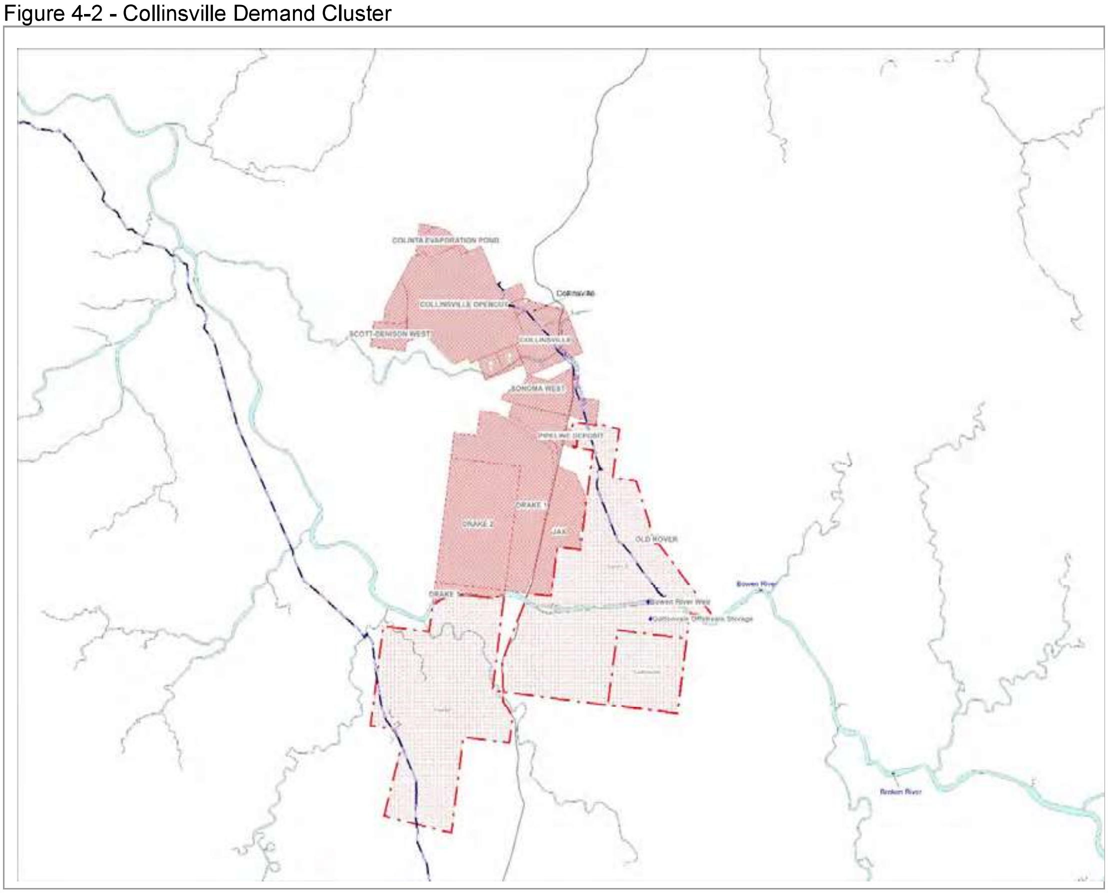
The Collinsville Mine open cut is operated by Glencore and is one of the largest and oldest coal mines in Queensland. Feedback from the operator of the mine indicated a continuation of the current allocations. Glencore is investing in reclamation and treatment to meet further demand but indicated interest in other sources for further development plans.

[8] Queensland Water Modelling Network, "QWN Good Modelling Practice Principles", April 2018

Q-Coal uses water from the BBWSS via the Collinsville Pipeline to supply water to Jax, Cows, Drake and Sonoma mines. This supply is predominantly met by the Eungella instream release and capture at the Bowen Weir and Gattonvale Offstream Storage.

The demand has been modelled at up to 9685 ML/a averaged from 2018 to 2050.

Figure 4-2 - Collinsville Demand Cluster



4.6.2 Moranbah

The Moranbah system comprises 21 major mines with 10 operators. There are a further 31 exploration programs developing resources to mining lease phases. The current coal price has resulted in increased mining exploration. These projects have expressed interest in new water sources however this report discounts the demand based on the early nature of the project.

The demand has been modelled at up to 32,835 ML/a averaged from 2018 to 2050. The GHD report included at Appendix 15 modelled that demand is likely to increase by 17,600 ML/a by 2030 and 33.620 ML/a by 2040.

Figure 4-3 - Moranbah North Cluster

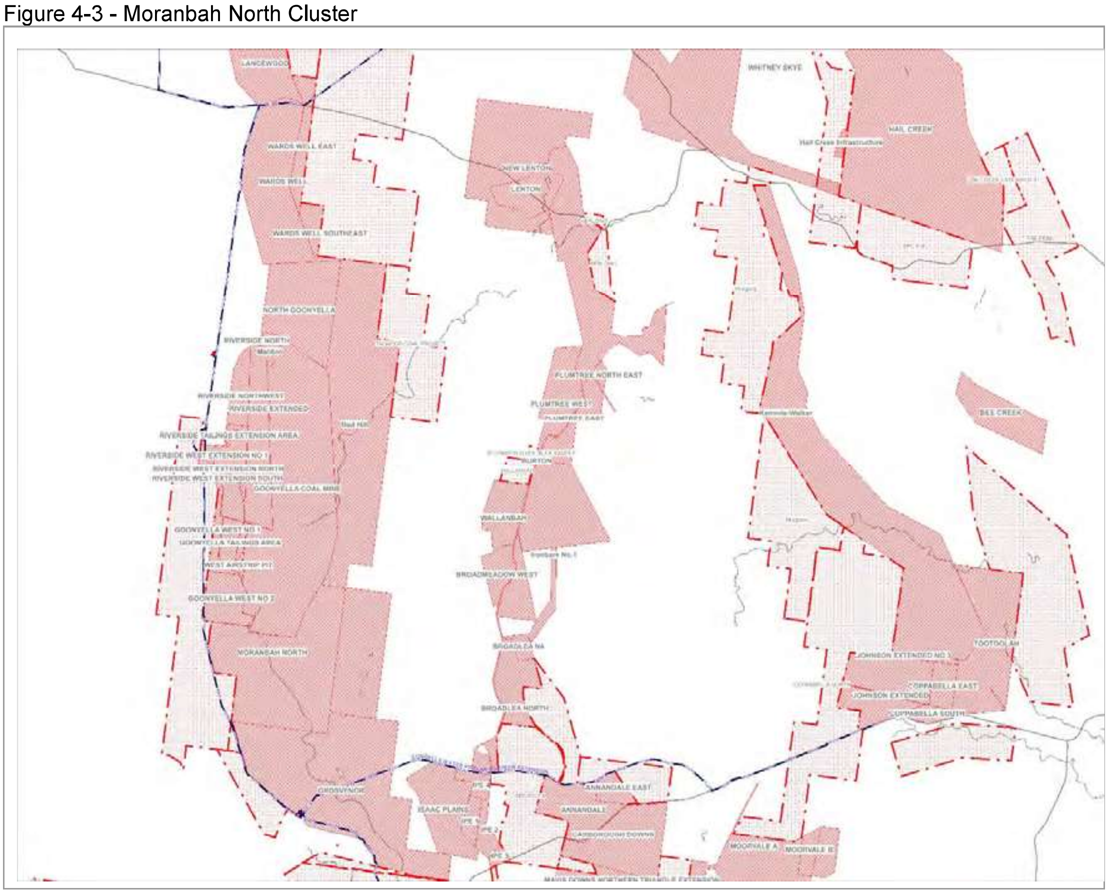
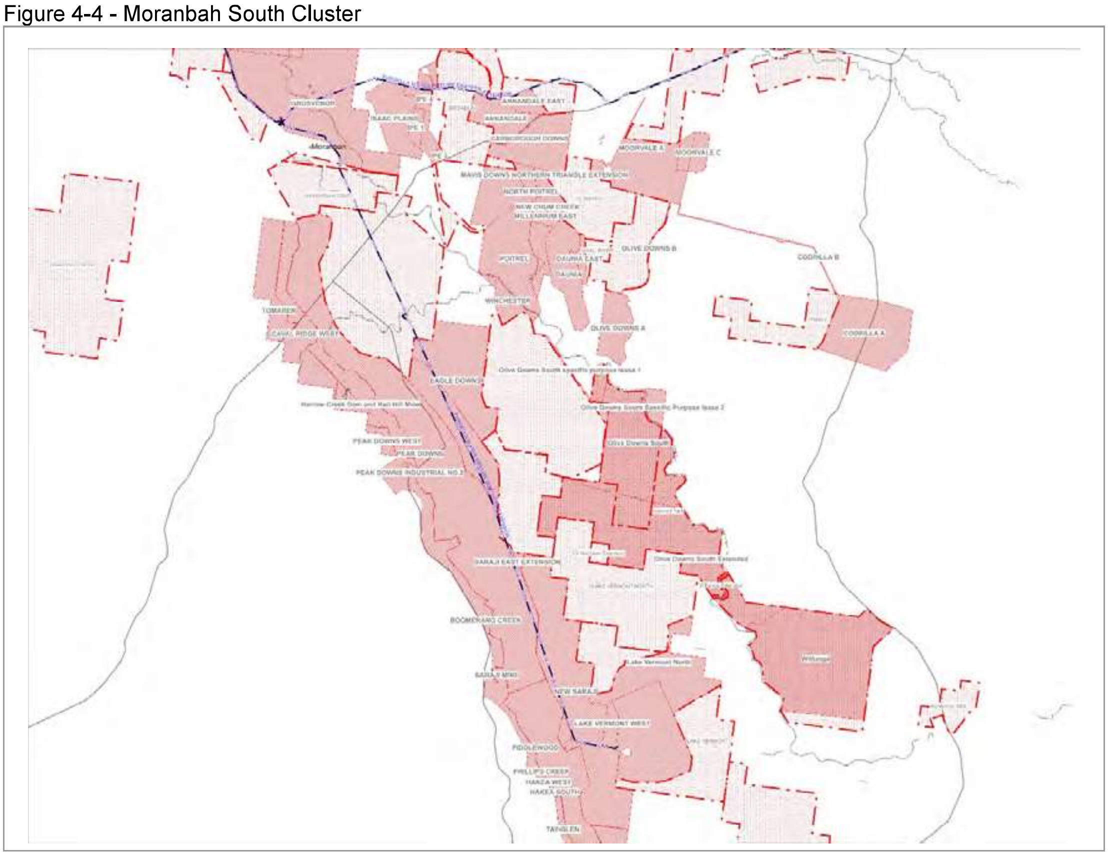


Figure 4-4 - Moranbah South Cluster



4.6.3 Proserpine & Abbot Point

The Proserpine system modelling has been based on the Whitsunday Regional Water Security Supply Assessment. Using the assessment the UWS engaged with several irrigators and industrial users whom indicated higher demand levels based on security of supply. This would change the Council assumptions of existing allocations remaining unused if reliability was to increase.

UWS has assumed the 2036 demand of 16,000 ML/a of high priority water (at a 1 in 100 year dead storage occurrence) with the additional demand of Abbot Point and Irrigators.

After consultation with the State of Queensland, the demand has been modelled at 2000 ML/a (long term) plus 3000 ML/a for industrial demand (5,000 ML/a). The study team originally modelled up to 16,000 ML/a averaged from 2018 to 2050 based on increased demand with an increased reliability to PFD but was removed on advice from review by the State of Queensland.

4.6.4 Collinsville Irrigation

The demand of a future irrigation precinct has been examined in detail through the irrigation systems report and the financial assessment based on the suitable levels of cropping lands. Using a medium series of demand in combination with broad acre, annual cropping and permanent cropping a total medium priority allocation of water has been used to service 13,000 hectares.

The demand has been modelled at up to 85,000 ML/a averaged from 2018 to 2050.

Several independent studies were commissioned to determine the various scenarios for the water demand of a new irrigation precinct.

A major assumption is the collection of the areas identified for assessment as a single precinct that could be managed in a coordinated development approach. This approach, consistent with agricultural trends in industrial scaled production allows for economies of scale, higher environmental standards and simpler commercial framework (both water trading and production scale).

The UWS team commissioned aerial photography and conducted a detailed LiDAR study of the irrigation precinct. This allowed a very detailed study of the remnant vegetation and remote sensing activities of precinct design. For the purposes of demand studies, each option was summarised as:

- Option 1
  - 10,800 / 20,300 (Available area of Cat X / Cat BCRX hectares)
  - Zone 9A,B,C (Birralee, Belmore Downs), Zone 10 (Havilah, Gattonvale)
- Option 1A
  - 9,900 / 19,200 (Available area of Cat X / Cat BCRX hectares)
  - Zone 5 (Myuna, Birralee) Zone 9A,C (Birralee, Belmore Downs) Zone 10 (Havilah, Gattonvale)
- Option 1B
  - 10,100 / 19,700 (Available area of Cat X / Cat BCRX hectares)
  - Zone 3 (Myuna)Zone 5 (Myuna, Birralee) Zone 9C (Birralee) Zone 10 (Havilah, Gattonvale)

Irrigation water delivery costs have been estimated that construction would occur in 1,000 ha increments between 7,000 ha and 20,000 ha based on Option 1A listed in the Water Distribution Report (SMEC) costs for 11,000 ha and 20,000 ha assuming costs are linear between increments. In each of the modelled scenarios it was assumed that demand was 8 ML/ha/yr irrigation demand with 20/80 perennials/annuals ratio for all scheme options.

The study team used the lower projections on a conservative basis that an average of 11,000 hectares of the 25,780 hectares of potential area at 8ML per hectare was a suitable approach for the purposes of the PBC.

4.7 Stakeholder Engagement

Stakeholder consultation indicates that potential users require a new water source that can deliver water with shorter pipeline lengths and at a lower cost than options proposed from the Burdekin Dam. Stakeholders expect water supply to be efficient, with a water grid that supports increased water trading and opportunities to move water around the region during periods of extended drought.

SunWater has not considered a new storage solution for the region since the decision not to proceed with Nathan Dam and the BMP Duplication Tender withdrawal in 2015.

The proposed Urannah Water Scheme provides an opportunity to substantially increase regional water security and deliver water to all identified demand nodes at lower cost than any other option within Study Area

The large and sophisticated resource customer base could be expected to take up demand beyond the modelling assumptions as the level of new projects without adequate water supply is high. There is a regional opportunity for growth in irrigated agriculture that drives land use change through crop creation.

It also offers the opportunity to support existing resource projects, expand agricultural production, significant large scale Pumped Hydro opportunities and support new resource and energy projects in the region.

4.8 Benefits Sought

4.8.1 Anticipated Benefits

Table 4-2 summarises the benefits that could be delivered by addressing the service need.

Table 4-2 Anticipated Benefits from addressing Service Need

Benefit-Related Project Outcome	Benefit Description	Benefit Type	Benefit Unit of Measure
Water for agricultural production on buffer mining areas	The extent to which producers use water to develop their properties for irrigated agriculture which adds to the Collinsville economy.	Quantitative Non-Financial	
	The additional Gross Value Product (GVP) of regional agricultural activities (2015 baseline) related to intervention	Quantitative Financial	Dollars ($)
Provision of new and reliable water for the Southern & Eastern Moranbah coal fields.	The certainty that project owners have in developing existing and new resource projects.	Quantitative Financial	Dollars ($)
Provision of new and reliable water for the Bowen / Proserpine Irrigators.	The certainty that irrigators and SunWater have in providing water that does not pose a reliability threat to the PFD.	Quantitative Financial	Dollars ($)
Positive impacts in relation to community vitality – increase in employment opportunities help to retain/attract people to the area	Amount that implementation adds to the employment and population of the region	Quantitative Non-Financial	Hours
Development of additional community support services and improved community facilities and health	Number of additional community support services developed due to additional short- and long-term investment	Quantitative Non-Financial	Other Benefit Measure 1
Opportunities for indigenous business development and employment	Number of additional indigenous businesses developed due to additional short- and long-term investment	Quantitative Non-Financial	Other Benefit Measure
Equitable allocation of additional water may add to sense of social cohesion	Extent to which additional water supply adds to the sense of social cohesion	Qualitative	
Enhanced confidence to invest in long term business operations and succession opportunities	The level of business confidence within the agricultural sector to make long term investment	Quantitative Financial	Dollars ($)

4.8.2 Dependencies

There are a number of dependencies in relation to the achievement of the anticipated benefits.

The first key dependency is the resource companies responding to any intervention to address the service need, by either:

- on site treatment, reuse or other changing water use practices
- taking up new allocations from other companies or companies that are no longer operating (planned shutdowns)
- investing in ground water extraction
- changing the distribution methodology
- investing in low water use technology.

The second key dependency is the uptake of major land holders to convert grazing land to high value irrigation land, by:

- choosing not to participate in a master planned irrigation precinct
- holding properties in abeyance to protect mining interests.
- Land clearing guidelines impacting on the development of high value irrigated agricultural land
- Failure of current legislation to minimise the impact of mining development on prime agricultural land.

4.8.3 Criticality of intended outcomes and benefits

The anticipated outcomes and benefits are considered central to the long-term diversity and strength of the regional economy. Unemployment, wage disparity and diversity, and social cohesion are key regional issues that could be addressed, in part, by diversifying the economic base.

4.8.4 Conflicts and opportunities between stakeholders

Urannah Dam and the associated water scheme has been traditionally positioned as a water source for Collinsville mining companies and a major new irrigation scheme at Collinsville.

This PBC has determined that the service need of Proserpine and Moranbah could be met at lower cost by the Urannah scheme as opposed to using diminishing supplies in the Burdekin Falls Dam. Other proposals to explore options for the development of the Burdekin Bowen Pipeline, duplication of the BMP and other supply sources from Connors River to Moranbah are higher cost proposals that, if developed, may conflict with the Urannah Water Scheme.

4.8.5 Potential Disbenefits and Risks to Achieve the Benefits

Chapter 12: Social Impact Evaluation and Chapter 13: Environmental Assessment outline the potential low to high areas of dis-benefit for addressing the service need, including impacts on the environment from increased irrigation activity and potential adverse cultural and social impacts.

5 OPTIONS GENERATION

5.1 Chapter Summary and Conclusions

Multiple infrastructure and non-infrastructure options to address the service need have been identified using a development process that aligns with the Queensland Government's Project Assessment Framework (**PAF**) and Business Case Development Framework (**BCDF**).

All options respond to key government policies and plans including the Australian Infrastructure Plan, White Paper on Developing Northern Australia, National Water Initiative and State Infrastructure Plan (**SIP**).

The long list of options identified includes:

1. Duplication of the Burdekin to Moranbah Pipeline at 25,000 ML per annum (Base Case*)
2. Implementing pricing signals to restrict future water use in the Whitsundays and meet water demand beyond 2025
3. Increasing pressure on ground water supplies in Bowen and the Whitsundays to meet water demand beyond 2025
4. A new pipeline from Claire Weir on the Burdekin River to Bowen and Proserpine at 15,000 ML per annum as an alternative to supply water direct from Urannah utilising Dam Options 1 or 2
5. A series of new weirs on the Bowen River and an upgraded pump station
6. A series of new weirs on the Bowen River and an upgraded pump station, combined with Option 1 or 2
7. A new pipeline from Burdekin to Byerwen at 8,000 ML per annum as an alternative to supply water direct from Urannah, combined with Option 1 or 2
8. A new pipeline from Burdekin to Collinsville Coal Mines at 20,000 ML per annum as an alternative to supply water direct from Urannah, combined with Option 1 or 2
9. new Urannah Dam and pipeline from Urannah to Peter Faust at 35,000 ML per annum (high priority)
10. new Urannah Dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and Eungella dams, augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline
11. new Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella dams duplicating the existing pipeline to provide incremental supply to Moranbah
12. new Urannah Dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and Eungella dams duplicating the existing pipeline to provide incremental supply to Moranbah at 150,000 ML per annum

**NOTE: In consideration of DNRME's post-submission comments and their view that the Base Case identified for this PBC does not meet the 'intent' required, this PBC includes an addendum that explores an alternative Base Case scenario representing a 'Do Nothing' approach (refer Addendum A)*

5.2 Purpose

This chapter outlines the options considered to address the service need identified in the SBC, associated technical reports and the options development process. Multiple options were generated by considering the service need, anticipated demand and associated economic and social benefits. These represent a comprehensive list of possible solutions to the demonstrated need for the project.

5.3 State Infrastructure Plan

The SIP outlines the Queensland Government's strategic direction for the planning, investment and delivery of infrastructure in Queensland. It is designed to support economic and jobs growth and create long-term prosperity through an integrated approach to land-use and economic planning.

Infrastructure is typically built to deliver a service, reduce a problem or realise an opportunity or benefit. Complex problems often have multiple possible solutions. Queensland Government policy requires both infrastructure and non-infrastructure solutions to be examined during the options analysis. Often, a combination of options provides the best solution to a given need.

Additionally, it is necessary to include a 'do minimum' option that becomes the baseline option representing what would happen if any proposed project activity does not proceed. During the options assessment process, the 'do-minimum' option can then be used as a base case for comparison purposes.

The Urannah Dam SBC identified the service need, anticipated demand and associated benefits of delivering a Urannah Water Scheme solution. This PBC now defines a range of possible options comprising a combination of strategies to improve the existing service performance through reform, influencing demand or supplementary capital works or to build new infrastructure. This is wholly consistent with the PAF and BCDF. Figure 5-1 shows the Queensland Government's Options Assessment Framework, which has been used to develop the long list of options.

Figure 5-1 Queensland Government Options assessment

5.4 Long List of Options

Table 5-1 below presents a long list of options grouped according to the Option Assessment Framework's four categories of reform, better use, improve existing and new. This list includes options identified through previous studies undertaken on the Urannah Water Scheme.

Table 5-1 Long List of Options

#	Option	Description	Timeframe	Scalability
Base case				
1	Do minimum – What would occur in the event the project didn't proceed?	New pipeline (SunWater Option) from Burdekin > Moranbah at 25,000 ML per annum	Short term	No
Reform				
3	Change in policy to allow use of the existing ground water supplies	Ground water supplies for urban and industrial water supply to Whitsundays	Immediate	Yes
Better use				
2	Influence of demand through water pricing strategies	Pricing signals in Whitsundays Change to Regulatory framework Supply of urban and industrial water supply to Whitsundays	Immediate	Yes

#	Option	Description	Timeframe	Scalability
Build new				
4	New pipeline from Burdekin > Bowen > Proserpine at 15,000 ML per annum	Urban and industrial water supply to Whitsundays	Short term	No
5	Series of new weirs on the Bowen River and upgrade of pump station	Weirs to supply industrial demand at Collinsville	Short term	Yes
6	Series of new weirs on the Bowen River and upgrade of pump station, combined with Option 1 or 2	Weirs to supply industrial demand at Collinsville, combined with Option 1 or 2 to supply Urban demand at Whitsundays	Short term	Yes
7	New pipeline from Burdekin to Byerwen with new pipeline at 8,000 ML per annum with Option 1 or 2	Pipeline from Burdekin to service industrial (single user) and Options 1 or 2 to service demand at Whitsundays. Comes up hill	Short term	No
8	New pipeline from Burdekin > Collinsville Coal Mines 20,000 ML per annum, combined with Option 1 or 2	Pipeline from Burdekin to service Collinsville industrial (multi-user) and Options 1 or 2 to service demand at Whitsundays Comes up hill	Short term	No
9	New Urannah dam and pipeline from Urannah > Peter Faust at 35,000 ML per annum (high priority)	In stream supply to the Bowen River Weir to service Collinsville industrial demand and a 15,000 ML pipeline direct from Urannah to Peter Faust to service demand at Whitsundays	Medium term	Yes
10	New Urannah dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline	Urban water supply to Whitsundays and Collinsville industrial Moranbah industrial (a reliability solution)	Medium term	Yes
11	New Urannah dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	Urban water supply to Whitsundays and Collinsville industrial Moranbah industrial (additional pipeline – more water)	Medium term	Yes
12	New Urannah dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	Urban water supply to Proserpine and Collinsville industrial Agricultural demand (10,000-15,000ha) Mining demand (bigger dam, more water, serving agriculture through channels) Includes Medium Priority water	Medium term	Yes

5.5 Refinement of options

5.5.1 Supply to Eungella

Two options were considered to supply Eungella Dam: via a pipeline following Furious Creek or via existing tracks over the top of the range. The alignment via Furious Creek is about 1.6 km shorter and is a cheaper option to supply Eungella Dam from Urannah Dam.

5.5.2 Supply to Moranbah

There were four pipeline options considered for water transfer to Moranbah.

1. Gattonvale Off-Stream Storage on the Bowen River near Collinsville to Moranbah.
2. Alternative diversion from a Trunk Canal adjacent to Gattonvale Off-Stream Storage to Moranbah
3. Urannah to Moranbah via Eungella following existing Eungella Water Pipeline route
4. Direct supply from Urannah to Moranbah via Hail Creek.

The Moranbah supply option from the potential trunk canal has the lowest NPV cost. It is noted however the trunk canal is not considered likely to be the preferred delivery method for irrigation water from Urannah Dam. If the trunk canal option is not proceeded with, the Pipeline 2 option would require a new weir near Mt Sugarloaf which would add an estimated $10-15M to the CAPEX and render Pipeline 1 as the lowest NPV cost to supply Moranbah.

Options 1 and 2 were rejected due to higher cost and complex supply arrangements.

Options 3 and 4 provided a better solution however the Moranbah supply option 4 via Eungella and Hail Creek was the lowest cost of the two Moranbah via Eungella options and would also provide a new water supply to a large area of existing and potential future coal mines not currently serviced by a piped bulk water supply.

5.5.3 Supply to Dysart (from Moranbah)

This pipeline follows the alignment of the existing Eungella Water Pipeline Southern Extension. It has the potential to replace supplies coming from the Fairbairn Dam at Emerald and allow the return of up to 15,000 ML of High Priority water to Fairbairn for reallocation to potential mining projects in the Southern Galilee Basin .The viability of this proposal would be substantially improved following discussions with existing and potential future industrial users in the area south from Moranbah to Dysart during a subsequent market sounding phase of the project.

5.5.4 Supply to Peter Faust Dam

This option proposes a 15,000 ML pipeline from Urannah to Peter Faust Dam at Proserpine to increase water security for PFD and provide an additional 10,000 ML for delivery to Bowen and Abbot Point. The alignment requires water to be lifted approximately 122m to the top of the escarpment before dropping, near vertically, approximately 255m. This elevation drop provides the opportunity for hydropower generation which has the potential to offset the entire pumping energy required to transfer water from Urannah Dam to Peter Faust Dam making this proposal energy neutral.

5.5.5 Supply to Bowen and Abbot Point

This option proposes a 10,000 ML pipeline from Peter Faust Dam at Proserpine to Bowen for Agricultural, Urban and Industrial use. The proposal is for 3,000 ML for Industrial use and 7,000 ML for Agriculture and Urban use[9]. The proposed alignment to the Abbot Point Port and SDA bisects large agriculture areas near Bowen. This provides the opportunity to supply agricultural customers at a substantially lower rate if costs can be largely recovered from industrial users at Abbot Point.

Capex costs for this proposal can be substantially reduced if alternative options to utilise up 10,000ML of spare capacity in the existing Whitsunday Regional Council owned Proserpine to Bowen pipeline can be negotiated

[9] N.B. All urban demand from the demand analysis has been removed. The assumptions of flow volumes has been kept to explore capital solutions for the options assessment.

6 OPTIONS FILTER

6.1 Chapter Summary and Conclusions

This chapter describes the methodology and shortlisted outcomes of the options filtering process.

The long list of options was filtered against criteria encompassing financial, regulatory, environmental, land use, public interest and social impact considerations, in accordance with the Building Queensland Business Case Development Framework.

The three highest scoring options, in order of scoring (highest to lowest), were:

- New Urannah Dam yielding 150,000 ML per annum with instream distribution to Collinsville and designated agricultural precinct, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah
- New Urannah Dam yielding 50,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, augmentation of the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline
- New Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah

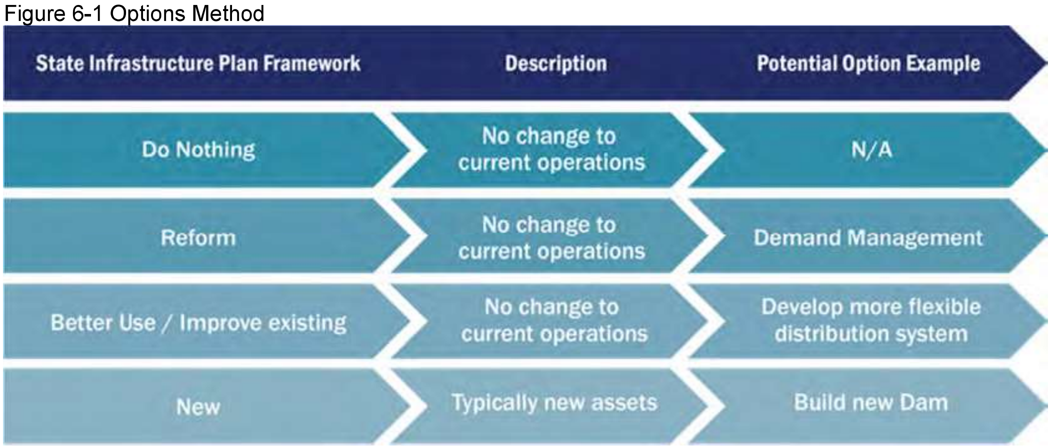
6.2 Purpose

The purpose of this chapter is to explain the options filtering process and summarise how the recommended short list of options was determined.

6.3 Method and activities

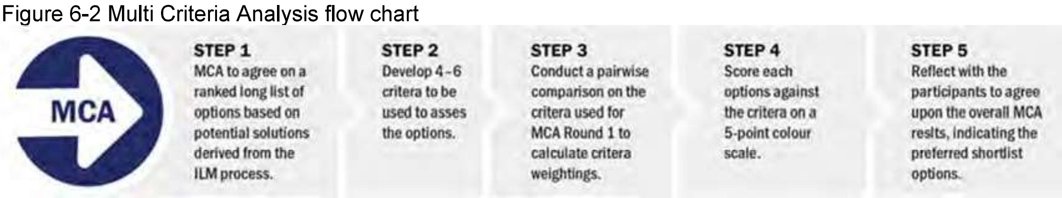
In total, twelve longlisted options were identified with the aim of addressing the demand for water or service need explained in the SBC. These options included reformation, regulatory, non-infrastructure, small- and large-scale infrastructure options and were each assessed according to its ability to satisfy the identified service requirements.

Figure 6-1 Options Method



A multi criteria analysis (**MCA**) was undertaken to develop a shortlist of options for further consideration in the PBC. The MCA process includes the development of a list of criteria to be applied to the longlist of options, in consideration of the Building Queensland Business Case Development Framework requirements and specific service need circumstances. Each criterion is weighted according to its relative importance in determining project success. The outcome ultimately ranks and prioritises the longlisted options to determine the shortlisted options for further detailed assessment.

Figure 6-2 Multi Criteria Analysis flow chart



6.4 Selection criteria

As detailed previously in Chapter 5: Options Generation, a total of twelve options comprised the long list of options which ran from the ‘do minimum’ or Base Case option through to large infrastructure solutions. As such, filtering is required to shortlist these potential solutions into those which best address the project objectives and identified service/demand need. Figure 6-3 below details the criteria used to assess and prioritise the options into a short list of the three most suitable solutions (not including the Base Case).

Figure 6-3 Selection Criteria

6.4.1 Criterion weighting

In order to accurately assess each option's suitability to satisfy the identified requirements, the assessment criteria used to evaluate the options need to reflect the relative importance of the project objectives, service need and its ability to realise the anticipated regional, social and economic benefits if the project becomes operational. Hence, a comparative 'Pairwise' method was used to assign appropriate weightings to each of the assessment criteria. This approach compares each of the criterion against each of the other criterion in a manner designed to determine which is most critical to project success and, therefore, the most heavily weighted. The results of the weighting exercise are detailed in Figure 6-4 below:

Figure 6-4 Ranked Criteria

Criteria		A	B	C	D	E	F	G
Operational Viability	A		B	A	A	A	A	A
Service Need	B			B	B	B	B	B
Cost	C				C	C	F	C
Environmental Impact	D					D	F	D
Land Use Implications	E						F	E
Economic Benefits	F							F
Social Impact	G							
Total		5	6	3	2	1	4	0

Due to its transitive nature, pairwise comparisons will result in one criterion equalling zero. To avoid any criterion from dropping out of the assessment, zero rated criterion were given a minimum weighting of 5%. An applied weighting score average was calculated based on the sum of the pairwise score. The criterion specific weightings were calculated based on the weighting of each criterion's pairwise score by the applied weighing score average.

The criteria weightings are outlined in Table 6-1 below.

Table 6-1 Criteria Weightings

Selection Criteria	Description	Weighting
Service Need	• The degree to which the solution meets the service need • Ability to provide sufficient water to overcome the problem • Achieve the opportunities outlined in the ILM • Does the solution provide water to where it is most needed? • How likely is the solution able to provide the required water supply to the required reliability standards? • Will the solution meet the requirements of potential developers and/or customers? • Will daily flow rates meet customer needs?	27%
Operational Viability	• The degree to which the technical solution is exposed to operational limitations and its ability to achieve the opportunities identified in the ILM and articulated in the SBC • Is the solution technically feasible? • How dependent is the solution to weather conditions? • Are there likely to be any ongoing operational issues associated with the solution? • Does it provide flood mitigation?	23%
Cost	• Relative cost of the option, including capital and operating costs • Relative whole of life costs for each of the options • What are the upfront costs for storage and distribution infrastructure? • Will the solution inundate and regions requiring additional asset purchase?	14%

Selection Criteria	Description	Weighting
	• What are the operating costs, and are they affordable to customers? • What is the ML yield relative to cost?	
Environmental Impacts and Approval	• The impact the technical solution may have on the environment, including potential for renewable energy generation • Is the solution a low sediment option? • What is the impact on the physical environment? • Does the solution allow for reduction of greenhouse gases from renewable energy generation? • Is the solution expected to cause material greenhouse gas emissions? • Are there likely to be community concerns? • Is there an impact on public amenity? • What are the impacts downstream river basin and the Great Barrier Reef? • What is the likelihood of receiving environmental approvals?	9%
Land Use Implications and Approvals	• The impact the technical solution may have on the land use and traditional land owners • What is the impact on traditional land owners? • Have the traditional land owners been consulted? • Does the land have native title rights and interests? • Does the solution affect the native title rights and interests? • Is the surrounding land privately or publicly owned? • Are there any land acquisition requirements/issues? • Given the traditional land owners of the site/location, do we expect that the process to obtain an Indigenous Land Use Agreement (ILUA) to be lengthy or complicated?	5%
Economic Benefits	• The perceived degree to the selected technical option may deliver economic benefits • Is the solution an affordable water supply option for the community? • Does the solution create new jobs for the region? • Does the solution align with Governmental policy? • What are the wider economic benefits? • Does the solution promote increases in the gross value and security of production of the region? • Does the solution allow for ancillary revenue opportunities (e.g. tourism or renewable energy generation (hydro) opportunities)? • Does the solution reduce existing tourism values? • Does the solution address the need to diversify the regional economy?	18%
Social Impacts	• The degree to which the selected technical option impacts public amenity • Are there potential social costs associated with the solution (i.e. community disruptions)? • What is the impact on the public space? • Does the solution require the resumption of private land or of public assets? • How does the solution align with the overall development plan for the region? • Who are the impacted parties?	5%

6.5 Option scoring

The methodology used to score and rank the longlisted options, involved a Multi Criteria Analysis whereby each of the options was scored against its capacity to satisfy the criteria. Scores reflected the results when each of the options was measured against the criteria.

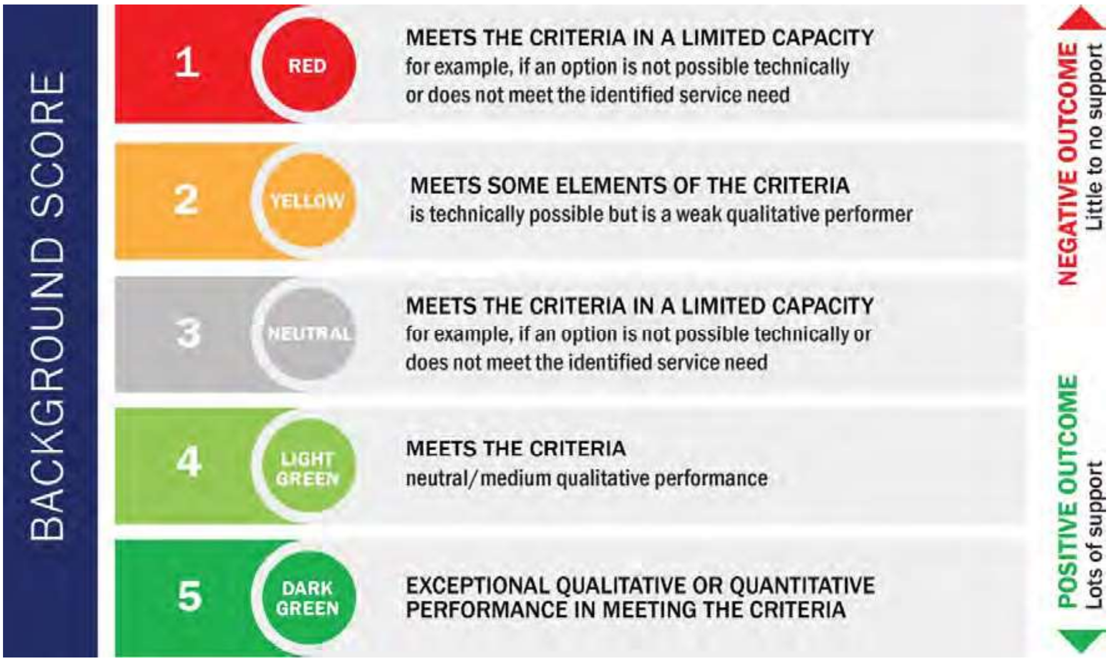
The three highest-scoring options were short listed and verified through consultation with key stakeholders, Assessment criteria were developed, based on the BQ framework and in consideration of the project objectives and service need.

The longlisted options were scored against the selection criteria. A qualitative numerical method was developed where scores were ranked from one to five with higher scores being desirable and low scores indicating potential non-feasibility depending on the criteria. (The 5-point colour scoring system is outlined in Figure 6-5 below.

The long listed options were ranked by applying the scoring system against the weighted criteria, to determine the top-ranking options to be shortlisted. The top-ranking options were then verified through consultation with key stakeholders.

Scores were defined as:

Figure 6-5 Option Scoring



6.6 Results

The following tables reproduce the scores for each option with and without weightings. A higher weighting was given to key assessment criteria in Table 6-2 results. A sensitivity analysis was then performed with no weightings in the Table 6-3 Results (Unweighted Criteria) results.

Weighting scores and applying equal weighting to all criteria did not change the scores materially, and all scenarios resulted in the same three highest scoring options. It is considered this demonstrates a robust filtering process, as it avoids achieving a result via application of judgement-based weightings.

Table 6-2 Results (Weighted Criteria)

Option	Long List of Options	Weighted Total
12	• New Urannah dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	4.0
10	• New Urannah dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline	3.7

11	• New Urannah dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	3.5
9	• New Urannah dam and pipeline from Urannah > Peter Faust at 15,000 ML/yr High Priority and instream delivery to Collinsville of 20,000 ML	3.2
4	• New pipeline from Burdekin > Bowen > Proserpine at 15,000 ML/yr	2.95
6	• Series of weirs on the Bowen River and upgrade of pump station, combined with option 1 or 2	2.95
7	• New pipeline from Burdekin to Byerwen with new pipeline at 8,000 ML/yr combined with option 1 or 2	2.82
8	• New pipeline, combined with Option 1 or 2 from Burdekin > Collinsville Coal Mines 20,ooo ML/yr	2.82
3	• Ground water supplies	2.8
5	• Series of weirs on the Bowen River and upgrade of pump station	2.7
2	• Pricing signals in Whitsundays	2.2
1	• New pipeline (SunWater Option) from Burdekin > Moranbah at 25,000 ML/yr (BASE CASE)	2.1

Table 6-3 Results (Unweighted Criteria)

Option No.	Long List of Options	Unweighted Total
12	• New Urannah dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	25
10	• New Urannah dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline	24
11	• New Urannah dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	23
9	• New Urannah dam and pipeline from Urannah > Peter Faust at 35,000 ML/yr High Priority	21
4	• New pipeline from Burdekin > Bowen > Proserpine at 15,000 ML/yr	19
6	• Series of weirs on the Bowen River and upgrade of pump station, combined with option 1 or 2	19
7	• New pipeline from Burdekin to Byrewen with new pipeline at 8,000 ML/yr combined with option 1 or 2	19
8	• New pipeline, combined with Option 1 or 2 from Burdekin > Collinsville Coal Mines 20,000 ML/yr	19
3	• Ground water supplies	21
5	• Series of weirs on the Bowen River and upgrade of pump station	18
2	• Pricing signals in Whitsundays	18
1	• New pipeline (SunWater Option) from Burdekin > Moranbah at 25,000 ML/yr (BASE CASE)	16

6.6.1 Base Case option

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
1	New pipeline from the Burdekin (Gorge Weir) to Moranbah	BASE CASE	• Under the 'Do Nothing' scenario this pipeline is required, as a minimum, to meet existing demand in Moranbah • Existing distribution infrastructure is at capacity	• Utilises existing strategic water allocation in the Water Resource Plan	• Significant capital cost of construction estimated at >$700M • Annual operational cost estimated at >$90m/yr to pump water uphill to Moranbah • Does not create new water allocations • Does not increase agricultural production

6.6.2 Reform Options

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
3	Change in policy to allow use of the existing ground water supplies	No	• Eliminates the need for significant new infrastructure	• Eliminates the need for significant new infrastructure build and therefore limited capital cost • This option is functional from an operational perspective	• Will not meet the demonstrated service need • Will service some of the identified industrial need • Cannot meet urban requirement nor supply demand nodes in Proserpine, Whitsundays and Moranbah • Limited wider economic or social benefits • Does not increase agricultural production

6.6.3 Better Use Options

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
2	Influence of demand through water pricing strategies	No	• Eliminates the need for significant new infrastructure • Influence of demand to change urban demand amid unreliability of existing supply options	• Eliminates the need for significant new infrastructure build and therefore limited capital cost • Cost effective use of existing infrastructure • Makes better use of existing resources. Shifts water to highest and best use • May not require additional government investment (depending on approach)	• Will not meet the demonstrated service need • Will not be able to supply the identified industrial need • Can meet some of the urban requirement in Proserpine and Whitsundays but cannot cater for additional demand in Moranbah • Will not enable planned industrial use to take up new water allocations and will therefore limit wider economic or social benefits • Does not increase agricultural production • Does not create new water allocations • Requires review of regulatory framework • Requires water users to change behaviour

6.6.4 Build New Options

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
4	New pipeline from Burdekin > Bowen > Proserpine at 15,000 ML/yr	No	• Reduces the need for significant new infrastructure • Services significant areas of the urban demand nodes in Bowen and Proserpine	• Utilises existing strategic water allocation in the Water Resource Plan • Makes better use of existing resources. Shifts water to highest and best use • Provides reliability of water supply to additional urban demand nodes	• Requires additional pipeline infrastructure to be built at significant capital cost • Will not meet all the demonstrated service need • Will not service the identified industrial need in the Southern demand areas to Moranbah • Limited wider economic or social benefits

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
					• Does not increase agricultural production
5	Series of new weirs on the Bowen River and upgrade of pump station	No	• Low end capital cost for infrastructure build • Supply of industrial water to Collinsville	• Eliminates the need for significant new infrastructure build and therefore limited capital cost • Cost effective use of existing infrastructure	• Will not meet the demonstrated service need: • Will not be able to supply the identified industrial need • Can meet some of the urban requirement in Proserpine and Whitsundays but cannot cater for additional demand in Moranbah • Will not enable planned industrial use to take up new water allocations and will therefore limit wider economic or social benefits • Does not increase agricultural production
6	Series of new weirs on the Bowen River and upgrade of pump station, combined with option 1 or 2	No	• Low end capital cost for infrastructure build • Supply of industrial water to Collinsville • Influence of demand to change urban demand amid unreliability of existing supply options	• Eliminates the need for significant new infrastructure build and therefore limited capital cost • Cost effective use of existing infrastructure	• Will not meet the demonstrated service need: • Will service some of the identified industrial need • Cannot meet urban requirement nor supply demand nodes in Proserpine, Whitsundays and Moranbah • Limited wider economic or social benefits • Does not increase agricultural production • Requires review of regulatory framework • Requires water users to change behaviour
7	New pipeline from Burdekin to Byerwen with new pipeline at 8,000 ML/yr combined with Option 1 or 2	No	• Reduces the need for significant new infrastructure • Addresses the benefits realised through increased agricultural productivity • Influence of demand to change urban demand amid	• Reduces new infrastructure build and therefore lower capital cost • Makes better use of existing resources. Shifts water to highest and best use	• Requires additional pipeline infrastructure to be built at significant capital cost • Will not meet all the demonstrated service need • Will not service the identified industrial need

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
			unreliability of existing supply options	• Utilises existing strategic water allocation in the Water Resource Plan • Increases agricultural productivity	• Cannot meet urban requirement nor supply demand nodes in Proserpine, Whitsundays and Moranbah • Limited wider economic or social benefits • Requires water users to change behaviour
8	New pipeline from Burdekin > Collinsville Coal Mines 20,000 ML/yr, combined with Option 1 or 2	No	• Reduces the need for significant new infrastructure • Services some of the urban and industrial demand in and around Collinsville • Influence of demand to change urban demand amid unreliability of existing supply options	• Reduces new infrastructure build and therefore lower capital cost • Makes better use of existing resources. Shifts water to highest and best use • Utilises existing strategic water allocation in the Water Resource Plan	• Requires additional pipeline infrastructure to be built at significant capital cost • Will not meet all the demonstrated service need • Will not service the identified industrial need in the Southern demand areas to Moranbah • Cannot meet urban requirement nor supply demand nodes in Proserpine, Whitsundays and Moranbah • Limited wider economic or social benefits • Requires water users to change behaviour • Requires review of regulatory framework • Does not increase agricultural production
9	New Urannah dam and pipeline from Urannah > Peter Faust at 35,000 ML/yr High Priority	No	• Services significant areas of the urban demand nodes in Proserpine, Bowen and Whitsundays • Increases the reliability of Peter Faust dam	• Creates new water supply allocations • Supplies additional water to the existing schemes • Provides reliability of water supply to additional urban demand nodes	• Requires additional dam and pipeline infrastructure to be built at significant capital cost • Will not meet all the demonstrated service need • Will not service the identified industrial need in the Southern demand areas to Moranbah • Limited wider economic or social benefits • Does not increase agricultural production

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
10	New Urannah dam yielding 50,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella augmenting the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline	Yes	• Services significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen and Whitsundays • Services some of the urban and industrial demand in and around Collinsville • Increases the reliability of Peter Faust and Eungella dams	• Creates new water supply allocations • Supplies additional water to the existing schemes • Utilises existing distribution infrastructure • Provides reliability of water supply to existing industrial and urban demand nodes	• Requires additional dam and pipeline infrastructure to be built at significant capital cost • Will not meet all the demonstrated service need • Limits any ability to increase water availability to new or proposed industrial demands • Limited wider economic or social benefits • Does not increase agricultural production
11	New Urannah dam yielding 70,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	Yes	• Services significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen and Whitsundays • Services some of the urban and industrial demand in and around Collinsville • Increases the reliability of Peter Faust and Eungella dams	• Creates new water supply allocations • Supplies additional water to the existing schemes • Provides reliability of water supply to existing industrial and urban demand nodes • Provides reliability of water supply to enable additional industrial demand nodes	• Requires additional dam and pipeline infrastructure to be built at significant capital cost • Limited wider economic or social benefits • Does not increase agricultural production
12	New Urannah dam yielding 150,000 ML per annum with instream distribution to Collinsville and new pipelines from Urannah to Peter Faust and to Eungella duplicating the existing pipeline to provide incremental supply to Moranbah	Yes	• Services significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen, Whitsundays and Moranbah • Services the urban and industrial demand in and around Collinsville • Increases the reliability of Peter Faust and Eungella dams • Can supply agricultural precinct around Collinsville	• Creates new water supply allocations • Supplies additional water to the existing schemes • Provides reliability of water supply to existing industrial and urban demand nodes • Provides reliability of water supply to enable the development of additional industrial demand nodes • Allows for the creation of an agricultural precinct around Collinsville	• Requires additional dam and pipeline infrastructure to be built at significant capital cost

Option No.	Option	Shortlist	Reasons	Strengths	Weaknesses
				• Satisfies all the identified service needs • Creates to most significant economic and social benefits	

6.7 Verification and refinement of options filtering

The options filtering results were discussed with BCE, SunWater, other key stakeholders, potential customers, constructors and government agencies. The focus of the consultation was on the water infrastructure and potential customers of a large-scale water solution and included discussion of the long list of options, and the draft shortlisted options. The market sounding activities conducted showed that new dams of any scale were hard to envisage as not many have been constructed in recent years. The market has indicated that it would support a larger scale dam and related infrastructure should this improve water reliability and ensure water is available at a reasonable price.

While there was a high response rate from the infrastructure construction market, responses from potential customers in the industrial areas were lower than expected. The market consultation confirmed that customer organisations in the mining and agricultural sectors are interested in the opportunity to partner with UWS and general support for the short-listed options.

7 OPTIONS SHORTLIST

7.1 Chapter Summary and Conclusions

The SBC identified both an existing service need and a number of opportunities, and the various options presented in the short-list both address the existing service need and present solutions to realise additional economic and social benefit.

Base case: 'Do Minimum'

- The Base Case is the minimum required investment to address the existing service need in the event the Urannah Water Scheme does not proceed
- The Base Case includes the construction of a duplicate Burdekin to Moranbah pipeline

Addendum A has been included in the PBC to evaluate the economic outcomes of shortlisted options when assessed against an alternative 'Do Nothing' base case.

Shortlist Option 1: New Urannah Dam with a yield of 150,000 ML per annum with instream distribution to Collinsville and designated agricultural precinct, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah

The aim of Shortlist Option 1 is to construct a full-sized dam to address the identified service need and realise the wider anticipated benefits of the UWS

- increasing operational performance of the scheme to service significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen, Whitsundays and Moranbah
- servicing the urban and industrial demand in and around Collinsville
- increasing the reliability of Peter Faust and Eungella dams
- creates new water supply allocations to ensure reliability of water supply to enable the development of additional industrial demand nodes
- Allows for the creation of an agricultural precinct around Collinsville

Shortlist Option 2: New Urannah Dam with a yield of 70,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah.

The aim of Shortlist Option 2 is to construct a medium sized dam to reduce capital investment whilst:

- increasing operational performance of the scheme to service significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen, Whitsundays and Moranbah
- servicing all of the urban and industrial demand in and around Collinsville
- increasing the reliability of Peter Faust and Eungella dams

Shortlist Option 3: New Urannah Dam with a yield of 50,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, augmentation of the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline.

The aim of Shortlist Option 3 is to construct a smaller sized dam to reduce capital investment whilst:

– increasing operational performance of the scheme to service significant areas of the urban demand nodes in Collinsville, Proserpine, Bowen and Whitsundays – servicing some of the urban and industrial demand in and around Collinsville – increasing the reliability of Peter Faust and Eungella dams

7.2 Purpose

The purpose of this chapter is to describe the shortlisted options. The descriptions underpin the subsequent analysis in the PBC.

7.3 Stakeholder Consultation on Shortlisted Options

Following the options filtering process and determination of the proposed shortlist of options, key regional stakeholders were consulted to further refine the description of the shortlisted options including:

- Coal Mining customers including Rio Tinto, Glencore, QCoal, New Hope, BMA, Peabody, Anglo American, Stanmore, Fitzroy Resources
- Agriculturalists and Irrigators
- Large scale constructors
- Financiers
- SunWater, Government departments both in Brisbane and regions

The stakeholder engagement process was undertaken through significant consultation with BCE, SunWater and other project advisors to identify suitable candidates. The focus of the engagement was on the water infrastructure and potential customers of a large-scale water solution. In alignment with the PAF guidelines for stakeholder engagement, eighteen organisations were identified from top tier organisations through to local organisations, based upon their local market presence, previous experience in delivery of water infrastructure and relevance and suitability to the project scope.

Market feedback on the shortlisted options indicated there was strong support for water security improvement through long term and larger scale solutions. Diversifying the local economy was also an important consideration and therefore the larger scale solutions were considered more attractive.

7.4 Shortlisted Options

Given that there is both a service need (i.e. there is currently allocations within the existing system whereby customers are not taking their full allocations due to reliability issues) and an opportunity (i.e. realising significant economic and social benefit through irrigated agricultural production, increased industrial uptake and increased reliability of existing supply in urban areas) the short listed options reflect the desire to address both the identified need/demand and the anticipated regional economic growth.

The options filtering process determined a short list of three options for further analysis in the PBC in addition to the Base Case. The shortlisted options for this PBC are

Option	Description
Base Case	Duplication of the 209km[10] Burdekin to Moranbah pipeline at a capacity of 25,000 ML/y
Shortlist Option 1	New Urannah Dam yielding 150,000 ML per annum with instream distribution to Collinsville and designated agricultural precinct, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah.
Shortlist Option 2	New Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah.
Shortlist Option 3	New Urannah Dam yielding 50,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, augmentation of the existing pipeline to Moranbah to improve reliability at Moranbah and duplicating the Burdekin to Moranbah pipeline

In alignment with the Building Queensland Business Case Development Framework (**BCDF**) and Infrastructure Australia's updated Infrastructure Assessment Framework, the objective is for two of the three shortlisted options, excluding the Base Case, to be identified as 'preferred options'. A further, more detailed assessment of each of these options will then be conducted in the development of the Detailed Business Case.

7.5 Base Case: 'Do Nothing' or 'Do Minimum'

Development and analysis of a base case is essential as it is the benchmark against which all other options are compared. For infrastructure projects, the base case invariably includes consideration of maintaining specified service levels provided by the existing infrastructure.

In order for the Base Case solution to be suitable for assessment in this PBC, there must be demonstrated intent that it will be implemented in the event that the Urannah Water Scheme project does not proceed to construction whether by committed funding, a business case or other means. Importantly, the base case is not necessarily a 'zero spend' or 'dummy' option. Rather, it represents the minimum required investment to address the existing service need.

During the development of the SBC, it was identified that a 'Do Nothing' approach would not satisfy the existing demand for water supply in the region, let alone anticipated future demand.

The 'Do Nothing' approach in the development of base case assumes that demand can be met by the existing supplies. Given the supply availability in the Burdekin, Proserpine and Bowen / Broken systems this is a reasonable assumption. To analyse the assumptions the study team applied two approaches, the first a Volume Led approach and the second a Service Led approach.

- A volume approach assumes additional incremental supply through operation efficiencies. This includes no additional capital spending beyond maintenance for the BMP and EWP with the potential for operational efficiencies to provide additional supply. The literature review of the SunWater Network Service Plan[11], Statement of Corporate Intent, the Burdekin Haughton Bulk Water Supply (BHWSS) Service Contract and the

[10] SunWater, Bowen and Galilee Basins Water Supply Strategy Report, December 2013, p. 65

[11] Burdekin Moranbah Pipeline refurbishment and enhancement $497,000 in 2018-19 to repair, maintain, renew and enhance existing water infrastructure assets and water supply schemes for Burdekin Moranbah Pipeline.

Bowen Broken Water Supply Scheme (BBWSS)[12] showed that the consistent supply of water with minor efficiency gains would not meet the immediate nor long term demand.

- A service led approach was considered where additional capex spending could meet the level of service of the BBWSS and BHWSS demand nodes. This included incremental service provisions (new minor pipelines, facilitation of trading entitlements etc). This process showed with additional capital the issues of the Eungella system contractual arrangements and its reliability of this supply would still not be resolved. The review also showed that the BMP at a pipeline capacity of 22,600 ML/a has a contracted capacity of 22,600 ML/a; **a zero (0) surplus capacity to the Moranbah cluster.** It is also noted that the augmentation of the pipeline from 17,000ML/a to 22,600 ML/a renders further augmentation impractical. The study team also investigated the ability to increase the traditing environment on an 'as is' basis and also though financial derivatives. In each test case, SunWater advised that the approach has been tried unsuccessfully previously and when tested with consumers, most industrial customers did not want to lose the insurance premium of water supply certainty.

Other matters considered in the assessment of the base case were the merits of an unfunded BMP duplication and an examination of the high number of new and expanded coal mines that are conditioned by the State of Queensland to source water from a duplicated BMP.

There is significant material in the policy papers of various Queensland State agencies that indicate support for various industries is predicated on additional bulk water supply options.

It should be noted that during consultation with DNRME, a consensus was not achieved that demonstrated intent was evident for the formulation of the 'Do Minimum' base case. Therefore, a supplementary addendum (Refer Addendum A) was developed to evaluate the shortlisted options against an alternative base case of 'Do Nothing' to explore the effect on economic outcomes.

In this case, the Base Case would involve the following:

- Construction of a 209 km pipeline duplicating the existing Burdekin to Moranbah from the Gorge Weir to Moranbah at a capacity of 25,000ML/yr

Currently there is 100,000 ML of unallocated water in the Burdekin system made up of approx. 50,000 ML high priority (HP) and 50,000 ML of medium priority (MP) supply.

There is potential the HP allocations could be consigned to the Galilee Basin if developed and the MP allocations to the coastal zone for expanded agricultural development between the Burdekin and Bowen.

The existing Burdekin to Moranbah pipeline is operating at close to full capacity and future water needs for Moranbah and the Northern Bowen Basin could be met with lower cost supply options from Urannah due to shorter pipeline distances and lower pumping and operating costs.

Consultation with SunWater has confirmed that the existing Burdekin to Moranbah pipeline will need to be duplicated in the short term (the next 3-5 years) in order to meet existing and anticipated demand from industrial customers in Moranbah alone.

The 'Do Minimum' option is not a viable option to be pursued as it is cost prohibitive, relative to the other shortlisted options, both from a capital and operational perspective. Whilst the duplicated pipeline from the Burdekin to Moranbah would provide for incremental expansion of industrial usage in

[12] Bowen Broken water supply refurbishment and enhancement $428,000 in 2018-19 to repair, maintain, renew and enhance existing water infrastructure assets for Bowen Broken water supply

the Moranbah mining region, this option does not provide the additional Regional Economic Development and Water Security benefits that would flow from the increased availability of new urban, industrial and agricultural water.

The Urannah Water Scheme will provide opportunities for regional water trading, by linking the Eungella Dam, Peter Faust Dam and BHWSS systems, and will facilitate the expansion of existing agricultural areas.

Preliminary discussions with stakeholders have shown support for the duplication of the existing pipeline to provide reliability of supply if all allocations are drawn from Burdekin. However, industrial consumers have also expressed interest in alternative supply from Eungella Dam provided this supply has the reliability required for security of supply in the longer term.

Whilst the Do Minimum option allows for greater utilisation of the existing water supply and a number of stakeholders have expressed their support for this option, the capital and operational costs for a limited serviceable area are seemingly prohibitive. Additionally, this option does not service existing urban demand in the Bowen, Proserpine, Collinsville and Whitsundays regions, allow for increased mining activity in and around Collinsville, nor does it provide any of the additional benefits that an alternative water supply option could provide.

7.6 Shortlist Option 1

Shortlist Option 1 proposes the construction of a large-scale dam to address the urban demand in the Bowen, Proserpine, Collinsville and Whitsundays regions, industrial demand in Collinsville and Moranbah and facilitates the creation of an irrigated agricultural precinct of up to 11,000ha around Collinsville. Shortlist Option 1 includes the following:

- construction of a large-scale dam to a height of 290 FSL with a yield of 150,000 ML per annum to provide additional water supply to the region
- augmentation of supply to the Peter Faust and Eungella Dams to increase reliability of urban water supply to the Proserpine, Collinsville, Bowen and Whitsundays regions by supplementing the existing system
- providing instream distribution through the Bowen/Broken river system to supply industrial use for existing mining operation in the Collinsville area
- augmentation of supply, through duplication of the existing pipeline from Eungella Dam, to Moranbah industrial customers
- provision of an irrigated, agricultural precinct of up to 11,000ha around Collinsville

The notable difference between the options is that Shortlist Option 1 allows for reliable long-term water supply to an irrigated agricultural precinct through instream distribution via the Bowen/Broken River system.

This option exhibits the most advantageous benefits profile of all the options considered for analysis. Whilst this option has the highest capital cost, the difference is considered negligible when compared against the benefits realised for the region particularly, and more broadly for Queensland. It has the ability to generate the most beneficial outcomes, particularly when compared to the outcomes of other water projects previously examined.

Shortlist Option 1 addresses the identified service need (i.e. improving the reliability of urban and industrial supply), addresses the anticipated demand from expanding mining operations in the Moranbah region, allows for reliable supply through instream distribution to the Collinsville region mining operations and, importantly, provides for reliable long-term supply to an irrigated agricultural precinct.

7.7 Shortlist Option 2

Shortlist Option 2 proposes the construction of a medium scale dam to address the urban demand in the Bowen, Proserpine, Collinsville and Whitsundays regions and industrial demand in Collinsville and Moranbah and involves the following:

- construction of a medium-scale dam to a height of 280 FSL with a yield of 70,000 ML per annum to provide additional water supply to the region
- augmentation of supply to the Peter Faust and Eungella Dams to increase reliability of urban water supply to the Proserpine, Collinsville, Bowen and Whitsundays regions by supplementing the existing system
- providing instream distribution through the Bowen/Broken river system to supply industrial use for existing mining operation in the Collinsville area
- augmentation of supply, through duplication of the existing pipeline from Eungella Dam, to Moranbah industrial customers

Shortlist Option 2 provides for similar benefits to Shortlist Option 3, albeit with an increased yield due to dam size and storage capacity. It demonstrates a similar service profile to Shortlist Option 3 in that it services the existing urban and industrial demand identified previously in the SBC.

This option allows for additional supply to the Moranbah industrial customers through the duplication of the existing pipeline from Eungella Dam and will therefore allow reliable supply to the existing demand and cater for some expansion of mining operations in Moranbah. Support for this option with industrial customers remains strong as it provides long term security of supply to underpin capital investment decisions and possible expansion of existing leases or the commencement of new mining operations.

The capital investment required to develop this option is significant and whilst less than Shortlist Option 1, the difference is considered negligible when considering the ability of this option to release the anticipated regional economic benefits. Its Benefit Cost Ratio (BCR) shown in Chapter 15: Economic Analysis shows that it is a less viable option, economically, than Shortlist Option 1 but exhibits a viability consistent with comparable water scheme solutions developed elsewhere in Queensland.

Shortlist Option 2 addresses the identified service need (i.e. improving the reliability of urban and industrial supply), addresses the anticipated demand from expanding mining operations in the Moranbah region and allows for reliable supply through instream distribution to the Collinsville region mining operations. However, it does not provide for supply to an irrigated agricultural precinct nor realise the regional economic benefit that such a precinct would allow.

7.8 Shortlist Option 3

Shortlist Option 3 considers the construction of a comparatively smaller scale dam to address the urban demand in the Bowen, Proserpine, Collinsville and Whitsundays regions and industrial demand in Collinsville and Moranbah and involves the following:

- construction of a small-scale Dam (comparative to Shortlist Options 1 and 2) to a height of 255 FSL with a yield of 50,000 ML per annum to provide additional water supply to the region
- augmentation of supply to the Peter Faust and Eungella Dams to increase reliability of urban water supply to the Proserpine, Collinsville, Bowen and Whitsundays regions by supplementing the existing system
- providing instream distribution through the Bowen/Broken river system to supply industrial use for existing mining operations in the Collinsville area
- augmentation of supply, through the existing Eungella pipeline, to Moranbah industrial customers
- duplication of the existing 209 km Burdekin to Moranbah pipeline

Consultation with industrial customers has confirmed that there is support for an alternative supply to the Moranbah mining area providing this supply provides long term security of supply to underpin investment and possible expansion of existing leases.

The capital investment required to develop this option, whilst less than the other larger-scale options, is significant and goes some way to addressing the identified service need (i.e. improving the reliability of urban and industrial supply). However, this option does not address the anticipated demand from an additional twenty-one planned mines in the Moranbah region, expansion of existing mining operations or the regional economic benefits of supply of water to an irrigated agricultural precinct. This option creates an alternative supply and augments the existing urban supply but presents as a less viable option to be pursued as the capital expenditure does not produce all the anticipated benefits (refer 14 Economics) that the other options allow.

8 STRATEGIC CONSIDERATIONS

8.1 Chapter Summary

Analysis shows that Urannah Water Scheme aligns with, and contributes to, the strategic objectives, programs and policies of government.

Key federal and state government objectives of relevance are to:

- deliver greater water security for Northern Australia
- support the growth of agriculture in the Mackay, Isaac and Whitsunday Region
- promote regional economic investment and development

8.2 Purpose

This chapter provides background to the allocation and use of water in Queensland, describes the framework under which water can be secured from various sources and considers how service need and options will be developed to support the strategic objectives of the Queensland Government, Australian Government and relevant local government plans, programs and policies.

8.3 CoAG Reform

In 1994, the Council of Australian Governments (CoAG) endorsed a framework of initiatives for the water industry to run over a seven-year period. This covered:

- Water pricing reform based on the principles of consumption-based pricing and full cost recovery
- Elimination of cross subsidies and making other subsidies transparent
- Clarifying water property rights
- Allocating sufficient water for environmental purposes
- Facilitating and promoting water trading
- Rigorous assessment of new rural water projects
- Reforming water industry institutions.

Queensland, together with other States and territories, has been systematically working to deliver on its commitments under this framework.

8.4 Water Act 2000

Queensland's Water Act 2000, among other provisions, provides the structure for management of water resources at the catchment/basin level. The concept of 'sustainable management' under the Water Act was recently refined by amendments introduced by the *Water Reform and Other Legislation Amendment Act 2014* (Qld) (WROLA Act) which relevantly commenced on 6 December 2016 and now includes principles of ecologically sustainable development

The WROLA Act amendments introduced a new water planning framework intended to provide a more streamlined and responsive approach to water planning in Queensland. Specifically, the framework supports the achievement of environmental outcomes through water sharing rules that provide for sustainable and equitable sharing of available water between environmental requirements, town water, industrial and agricultural users.

For each major catchment in Queensland, a Water Plan (WP) (formerly Water Resource Plan) has been developed. The implementation of a WP is then governed by a Water Management Protocol (WMP) (formerly Resource Operations Plan). The objectives and functional elements of the WPs and WMPs relevant to regional water supply are further described in Section 8.5 below. The Water Act 2000 also enables the allocation of rights over water resources in Queensland through the above plans.

8.5 Water Plans & Water Management Protocols.

The Urannah Dam is located within the Bowen/Broken catchment which falls under the Water Plan for the Burdekin Basin (2007). A water plan 'targeted' amendment for the Upper Burdekin was recently approved but is yet to be formally gazetted. It is understood that the existing WP has also had its expiry date extended to 2022 to provide adequate time for a full basin review which is anticipated to commence in the near term. Preparatory works have already commenced ahead of a formal announcement of the review in the near future. A full review of the WP involves an extensive public consultation process with the release of a wide range of data and reports by DNRME and a call for public submissions. It could be expected to take in the order of two years to complete. The timeframe for this review could capture any changes that may be proposed through the development of the Urannah Water Scheme Project.

The WP:

- Defines the availability of water in the plan area
- Provides a framework for the sustainable management and taking of water
- Identifies priorities and mechanisms for dealing with future water requirements
- Provides a framework for establishing water allocations
- Provides a framework for reversing, where practicable, degradation that has occurred in natural ecosystems
- Regulates the taking of overland flow water.

The WP also establishes the Environmental Flow Objectives (EFO's) and Water Allocation Security Objectives (WASO's) for the basin.

The implementation of the WP is provided through the Burdekin Basin WMP (2017), which details the practical management of resources (including water trade). The WMP applies to water in each watercourse, lake or spring and overland flow in the plan area. The WMP also defines how to deal with unallocated water within the plan area.

8.6 Allocated and Unallocated Water Reserves.

The volume that may be made available during the life of the WP is specified in the WMP. Regulation of water sources enables the following means to obtaining access to water supply:

- High priority water allocations – These allocations are generally tied to existing infrastructure including pipelines and regulated rivers. Available capacity and willingness to release individual allocations will need to be determined

- Medium priority water allocations – Allocations are generally tied to regulated rivers and irrigation schemes
- Temporary or Permanent Allocation Transfers – Purchasing allocations at the required time from the water market as opposed to leasing the water in advance. This would be subject to price fluctuations and market demand at the time of the transaction.

Supplemented water is water supplied from a water supply scheme under a Resource Operations Licence (ROL), whereas un-supplemented water is water accessed directly by the allocation holder through means such as water harvesting. Water supply schemes also nominate allocated and unallocated reserves.

Generally, rights to supplemented water resources are assigned to the parties for which the assets were originally established. Accordingly, agreement to use water resources will be primarily dependent on the following:

- Ability to access water resources from the ROL holder or associated subsidiary assets
- Available supply capacity for the relevant period
- Acceptance from the relevant customers or stakeholders to allow reallocation of resources.

A separate agreement is required for each pipeline or regulated stream, irrespective of the customer. However, an allocation can be sourced anywhere along the nominated source infrastructure (based on available capacity), i.e. any access point on a pipeline, regulated stream or channel/pipeline distribution system.

Unallocated water is water identified under the WMP as being potentially available for consumptive use without compromising the security of existing supplies or environmental flows. Unallocated water can be made available from general and strategic reserves. Associated with any water reserve is the type of entitlement, which includes the conditions applying to tradeable or non-tradeable licences and water allocations. Unallocated water will normally be sold through open tender or at auction, with detailed assessment by DNRME preceding any decision to release water and to set a reserve price.

The Burdekin Basin WMP identifies 150,000 ML strategic water reserve for water infrastructure for the Bowen and Broken sub-catchments. The WMP also specifies the method through which water reserves may be released including the requirement for information on land suitability i.e.:

- A submission for unallocated water where the water is proposed to be used for irrigation must be accompanied by information that demonstrates the potential suitability of the land for irrigation.
- For this section, potential suitability of the land for irrigation means the potential of the land for sustainable irrigation having regard to the following matters that may constrain the extent and location of any irrigation development
- the availability of land without remnant vegetation, including any occurrence of remnant vegetation the occurrence of ecological assets and other high value environmental features such as wetlands
- the suitability of the topography, including the slope of the land intended to be irrigated
- any known cultural heritage sites; and
- the physical and chemical attributes of the soil.

8.7 Water Trading

Water entitlements are able to be converted to tradeable water allocations under provisions of the WP. Limitations and conversions of water allocations are administered under the WMP, which includes the process under which water allocations can be traded and the areas where trading can occur. Entitlements able to be traded are:

- Supplemented water entitlements held by ROL holders
- Un-supplemented entitlements, including water harvesting licences
- The WP includes provisions for the protection of entitlements against operational changes and changes to existing allocations.

The UWS would look to propose changes to the amended Water Plan which will propose options as part of the further Detailed Business Case phase. These options will include the exploration of greater trading opportunities for the BMP contracted volumes between users and the conversion of the Strategic Allocations to a Resources Operations Licence under the BBWSS.

8.8 Australian Government

8.8.1 Australian Infrastructure Plan

The Australian Infrastructure Plan sets out the infrastructure challenges and opportunities Australia faces over the next 15 years and the solutions required to drive productivity growth, maintain and enhance the nation's standard of living and ensure that Australian cities remain world-class. It highlights that infrastructure investment in Northern Australia should enhance our regional productive capacity to take advantage of growing demand for our produce in South-East Asia and China. At the same time, regulatory frameworks and operational arrangements should be aligned with any new infrastructure investments to maximise potential productive capacity.

The Australian Infrastructure Plan notes that successful irrigated agriculture is dependent on producers having access to reliable and secure water resources and that regional water infrastructure that supports irrigated agriculture faces particular challenges because of the increasingly variable climate, growing demand and difference in the ability or willingness to pay. It also notes that the flexibility and autonomy offered by water trading has facilitated the movement of water to higher value uses and increased agricultural production.

Urannah Water Scheme could support the development of a large, irrigated agricultural precinct near Collinsville that would considerably strengthen agricultural production in the region.

8.8.2 Northern Australia Audit – Infrastructure for a Developing North

The Northern Australia Audit: Infrastructure for a Developing North was published in 2015 and assessed critical economic infrastructure gaps and requirements to meet projected Northern Australia population and economic growth through to 2031.

The Northern Australia Audit found that water availability varies dramatically in Northern Australia and highlighted significant challenges, including limited existing infrastructure, which are likely to affect the development of Northern Australia. It concluded that for prospective agricultural developments there may be a range of potential water supply options, by which case-by-case evaluation is important, including water trading, expansion of existing irrigation areas and planning new dams.

This PBC for Urannah Water Scheme complies with the Northern Australian Audit in considering a range of solutions to access new water supplies that provide economic and social benefits to the regions. The Urannah project will allow a much broader network of water trading, linking the Eungella Dam, Peter Faust Dam and BHWSS systems, and will facilitate the expansion of existing agricultural areas.

8.8.3 White Paper on Developing Northern Australia

The Our North, Our Future: White Paper on developing Northern Australia was released in June 2015. The White Paper outlines the Australian Government's vision for the future of Northern Australia and identifies actions over the next 20 years to unlock the North's full potential.

The development of the right water infrastructure in the right areas is considered key to realising the vision set out in the White Paper. The White Paper announced the establishment of the NWIDF and committed up to $3 million from the NWIDF to assess the economic feasibility of Urannah Dam, along with other projects. The White Paper also announced the $5 billion Northern Australia Infrastructure Facility, providing concessional finance to encourage private sector investment in northern Australia.

This PBC represents progress towards realising the vision set out in the White Paper by considering the economic feasibility of Urannah Dam and whether it is the right water infrastructure to help unlock the potential of northern Australia. It also examines other opportunities to address regional needs and promote regional economic investment.

8.8.4 National Water Initiative

The Australian Government and each of the States and Territories are parties to the Intergovernmental Agreement on a National Water Initiative (NWI). The NWI is the national blueprint for water reform and represents a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities, and for the environment. The NWI has driven reforms for better water management and use through changes to planning frameworks, water access entitlements, water markets, water pricing, water use efficiency and the integrated management of water.

Pricing Principles have been agreed pursuant to the NWI Agreement and include 'Principle 1: Cost recovery for new capital expenditure', – which applies to rural surface and groundwater-based systems. For new or replacement assets, Principle 1 generally provides that charges will be set to achieve full cost recovery of capital expenditure (net of transparent deductions/offsets for contributed assets and developer charges and transparent community service obligations) through either:

a return of capital (depreciation of the Regulated Asset Base (RAB)) and return on capital (generally calculated as rate of return on the depreciated RAB)

a renewals annuity and a return on capital (calculated as a rate of return on an undepreciated asset base (Optimised Replacement Cost (ORC))

Options assessed by this PBC consider the NWI Pricing Principles, including the proposed approach to capital investment and lower bound and upper bound pricing.

8.8.5 National Water Infrastructure Development Fund

The objective of the NWIDF is to undertake detailed economic planning to inform water infrastructure investment decisions and expedite the construction of water infrastructure. It aims to help secure the nation's water supplies and deliver regional economic development benefits for Australia by providing access to secure and affordable water to underpin growth in irrigated agriculture, while also protecting our environment. The NWIDF is separated into a feasibility component and a capital component.

Feasibility component

The NWIDF feasibility component is comprised of $59.5 million to fund feasibility studies into new water infrastructure across Australia, with funding available over four years from 1 July 2015 to 30 June 2019.

The feasibility component aims to help governments and industry make decisions based on evidence about the best sites for new water infrastructure and accelerate the completion of thorough business cases. The feasibility assessments also aim to confirm sufficient demand from users to meet the ongoing costs of water supply, so farmers are not burdened with ongoing operational and maintenance costs they cannot afford over the longer term.

Capital Component

The NWIDF capital component is comprised of $440 million to facilitate the construction of new water infrastructure, with funding available over eight years from 1 July 2017 to 30 June 2025.

The Australian Government announced $247.5 million in funding commitments during the 2016 Federal Election. An Expression of Interest (EOI) process was conducted and allocated the remaining $192.5 million, with $40 million available for infrastructure located in Northern Australia.

The EOI Guidelines exclude some activities from receiving funding, including dam safety upgrades and water infrastructure primarily for urban and potable use.

It is considered the shortlisted options align with the objectives of the NWIDF to undertake detailed economic planning to inform water infrastructure investment decisions and stimulate regional economic development benefits.

At this time, it is expected that further allocations to the Capital Component will be made. If the Urannah Dam project proceeds and the fund is extended, the option may be to seek funding consideration from the Australian Government for a portion of the capital component of the NWIDF, subject to meeting the relevant conditions.

8.8.6 National Water Infrastructure Loan Facility

The $2 billion NWILF provides State and Territory governments with concessional loans to co-fund the construction of water infrastructure.

The NWILF is designed to assist State and Territory governments to co-invest in vital water infrastructure. Funding aims to accelerate the construction of major water infrastructure projects such as dams, weirs, pipelines and managed aquifer recharge projects to provide affordable and secure water supplies to support the growth of regional economies and communities across Australia.

The NWILF Investment Guidelines set out the investment priorities for the loan facility which closely align with the eligibility criteria for the NWIDF: at least a 51 per cent funding commitment approved by the State; and preference is given to water storage infrastructure, including the construction of dams and weirs that deliver broad public benefits, including through increasing regional water availability and security for water users.

8.8.7 Reef 2050 Plan

The Reef 2050 Plan was released by the Australian and Queensland Governments in March 2015. The plan is the overarching framework for protecting and managing the Great Barrier Reef until 2050 and outlines management measures for the next 35 years to ensure the outstanding universal value of the Reef is preserved now and for generations to come.

Options assessed by this PBC considered the objectives of the Reef 2050 Plan.

8.9 Queensland Government

8.9.1 State Infrastructure Plan

The SIP outlines the strategic direction for the planning, investment and delivery of infrastructure in Queensland. The SIP identifies what the government ultimately wants from its infrastructure and how this can best be achieved and is designed to provide confidence and certainty to business, industry and the community.

The SIP outlines the following outcomes the Queensland Government is seeking to achieve in relation to investment in the 'water' asset class:

- water supply infrastructure is in place or in train where there is a sound business case and water resources are available
- appropriate solutions, including demand management, are evaluated and implemented after the water needs of local government have been assessed in partnership with the state
- greater use of recycled water has been encouraged by state policies, where it is fit-for-purpose and economically viable
- water demand and the effects of stormwater and sewerage discharge on the environment has been minimised, the effects of flooding mitigated and reuse of water maximised through urban design
- State dams are safe during extreme climate events
- water is regarded as a valuable finite resource and the impact on availability and cost of water use behaviours is recognised by Queenslanders
- the water management and trading framework maximises the efficient use of water and water infrastructure.

The SIP also sets out an approach to options assessment and prioritising further infrastructure projects which has been observed in the development of this PBC.

8.9.2 Mackay, Isaac and Whitsunday Regional Plan

The Mackay, Isaac and Whitsunday Regional Plan establishes a vision and direction for the region to 2031. Published in 2012, it details the economic foundation of the region and outlines key strategies to sustain future economic development.

The plan highlights economic diversification as both a challenge and focus for the region. While the region will continue to extract and export resources, principally coal, there is potential to diversify into sub-industries with value-adding potential. The plan emphasises the value of the agricultural sector to the regional economy.

8.9.3 Queensland Bulk Water Opportunities Statement

In July 2017, the former Department of Energy and Water Supply (now DNRME) published the QBWOS. The QBWOS established a framework of new proposals for water storage to be considered and conducted a high-level audit of water supply and availability (allocated water, uncommitted, committed and used / unused water).

The objectives of the QBWOS for bulk water supply are:

1. safety & reliability of dams and urban water supplies
2. use existing water resources more efficiently
3. support infrastructure development that provides a commercial return to bulk water providers
4. consider projects that will provide regional economic benefits

The UWS is in contrast to the QBWOS as the decision tree listed in policy outlines that financial analysis is conducted based on secure demand.

The study team notes that the QBWOS is a document for the development of state sponsored water infrastructure and that the UWS is adopting an approach more consistent with the Project Assurance Framework (PAF) and the BQDF. By using the higher order policy documents, a commercial approach can be developed where secure demand is sourced during later phases of study. The Study team also notes the best practice guidelines justifying this approach by Infrastructure Australia and the respective frameworks of New South Wales and Victoria.

8.9.4 Central Queensland Regional Water Supply Strategy 2006

The resource operations plan (ROP) for the Fitzroy Basin, released in January 2004, acknowledged that the final determination of the quantities of unallocated water available for release in different catchments would be subject to the completion of a water resource plan (**WRP**) amendment to include overland flow water and a Central Queensland Regional Water Supply Study. Development of the Central Queensland Regional Water Supply Strategy was initiated through the Central Queensland Regional Water Supply Study.

Primary drivers for the study included:

- urban and industrial growth around the Capricorn and Curtis coasts
- mining and associated urban growth in the Bowen Basin and northern Surat coalfields
- performance of existing supply schemes in combination with dry conditions in recent years
- a call by local government to chart a cooperative approach towards the development of a long-term strategy for meeting the water needs of the region.

Key water infrastructure covered by the Central Queensland Regional Water Supply Strategy included potential projects and options including:

- raising Eden Bann Weir in the Fitzroy and Livingstone Shires
- constructing Rookwood Weir in the Fitzroy Shire
- developing the Connors River Dam in the Broadsound Shire
- undertaking design work on, and construction of, the Nathan Dam in the Taroom Shire (subject to obtaining Commonwealth approval under the Environmental Protection and Biodiversity Conservation Act 1999)

- pipelines to connect the new Connors River Dam with Broadsound and possibly Nebo and Belyando Shires
- pipelines to connect Rockhampton to Gladstone
- a pipeline for the Capricorn Coast connecting Rockhampton to Yeppoon
- a pipeline from the Burdekin River to Moranbah with potential other extensions.

Some projects have been progressed since the strategy was released.

8.9.5 SunWater

SunWater is responsible for Queensland's regional network of bulk water supply infrastructure outside South East Queensland. SunWater infrastructure supports around 5,000 customers across the mining, power generation, industrial, local government and irrigated agriculture sectors.

Within the SunWater network, there are currently a number of areas throughout Queensland which have unallocated supplemented water (ie available for purchase). In particular, Paradise Dam (constructed in 2005) in the Bundaberg Water Supply Scheme has underutilised capacity and uptake of water usage has not reached anticipated levels.

Figure 8-1 SunWater Operations & Schemes

8.9.6 Queensland's Agricultural Strategy: A 2040 vision to double agricultural production

Queensland's agricultural strategy (2013) highlights the importance of agricultural industries to the state economy and the social fabric of rural and regional communities. Queensland has the largest area of agricultural land of any state, with almost 144 million hectares (83 per cent) of the state used for agriculture.

Statistics from the Australian Bureau of Statistics (ABS) show that about 88 per cent of jobs in agriculture and 53 per cent of jobs in food processing industries are regionally based (as at 2011). Agricultural industries support many secondary industries across the food supply chain that add value to Queensland's base produce and enhance regional economies.

The strategy identifies four key pathways to grow agricultural production in Queensland. The first pathway – securing and increasing resource availability – focuses on enabling agricultural growth through optimal use of critical resources including land and water. The strategy outlines the government's intention to improve access to, and reliability of, water supplies for agricultural producers. Delivering secure and defined water entitlements for agriculture was identified as a key initiative to achieve this aim.

The fourth pathway – reducing production costs – is considered essential to improving the profitability and viability of Queensland's producers. Water was identified as a critical input for the agricultural sector.

8.9.7 Queensland Agricultural Land Audit

The Queensland Agricultural Land Audit was released in May 2013. The Queensland Agriculture Land Audit identifies land important to current and future agricultural production and the constraints to development; and helps to guide investment in the agricultural sector and inform decision making to ensure the best use of our agricultural land in the future.

The PBC details the impact of the audit and undertook a detailed study on the Collinsville Agricultural precinct as defined in the 1996 Hyder Soils Report.

8.10 Policy Considerations

8.10.1 Urannah Water Scheme policy context

QBWOS outlined key principles for the Queensland Government to consider in new bulk water assets and a guide towards proponents seeking to establish new storage.

The objectives are serviced from the common issues relating to the development of new dams, new water harvesting storages and augmentation (raising) of existing storages. Foremost is the funding of such projects for development. To enable these types of projects to proceed, the proponent currently needs to have commitment from foundation customers to take the water that will be made available. This allows long-term contracts to be put in place ensuring that construction costs will be recouped and revenue will be ongoing.

For the development of bulk storage assets by the Queensland Government (SunWater is the default proponent in this catchment) and it should be noted that the SunWater quoted headworks costs for new opportunities are only relevant if all allocation can be sold. Under this approach if the projects are not 100 percent committed, either the cost per megalitre would need to increase, or options should be investigated as to the viability of a smaller storage. Under a changing operating model of third- party utilities in Queensland (where there is no current third-party utility model regulation), the Urannah project Water Scheme could be operated outside of SunWater.

Alternatively, staged construction is used for options assessment, but components would need to be oversized to accommodate the ultimate system demands. While foundation customers of the initial stage of development may not need this additional capacity and should not be obligated to pay the additional capital costs, the source of any funds over and above the minimum must be considered.

The Queensland Government has previously been able to invest in these types of projects, but now requires all developments to be independently funded (due to the change in government and its policy on privatisation). Experience to date has indicated that private investment in provisioning for potential future demands is limited without links to the land uplift (commonly called value capture). This is a key consideration to the viability of a Urannah Water Scheme.

A change of policy would be required, allowing the Queensland Government to essentially become involved as a foundation customer to fund the portion of works required for future demands and allow such developments to proceed with the view to supplying the ultimate needs of the Bowen and Galilee Basin coal mining developments.

This policy framework allows for assessment of third parties, such as the Urannah Dam, to be assessed with broader considerations to the level of foundation customers required for a feasible project. Further, the agricultural focus of the Australian Government allows for deeper consideration and weighting of the agricultural impact for the regional economy.

For most of these options, approvals required for development are yet to be achieved. These approvals would include all those clearances, licences, permits and exemptions required for the environmental, cultural heritage and native title, infrastructure development and land tenure aspects of the project.

The WRPs and ROPs have been developed over the past decade. In general, ROP requirements have been refined since their implementation. The rules regarding allocations are accepted by stakeholders as underpinning the reliability of the current water allocations and, generally speaking, do not impede scheme operation.

Within the Burdekin Basin and Fitzroy Basin ROPs, there are some restrictions on the transfer of water between zones. If water allocations were to be realised through the implementation of water efficiency savings, the flexibility may need to be present within the ROP water trading rules to allow allocations to be transferred out of the channel systems and into the river or headworks (depending on from where the demand is to be met).

This PBC considers water demand outside of the Burdekin Basin ROP and includes a needs assessment of the broader region.

There may need to be some review or change of water trading rules to allow for additional flexibility for water trading within a scheme. Additional allocation made available through scheme efficiency savings may be optimised through the relaxation of water trading rules within ROPs to allow delivery to external (cluster) demands.

This PBC is produced in accordance with the Building Queensland frameworks for business cases. Whilst the framework is best practice it should be noted that the traditional approach to development of business cases is heavily reliant on assessments conducted by the monopoly provider, SunWater.

SunWater by its statutory role, must preserve taxpayer's funds and hold a low tolerance of risk. SunWater has over 5000 customers. That said, the company has only recently moved to advance corporate customers (which currently sit at 11%) to be more customer centric. This change in strategy has related to the policy drive of the National Water Initiative to seek independent pricing (economic regulator) that furthers most of the recommendations made by the Queensland Competition Authority (**QCA**).

SunWater has faced significant challenges in bringing new bulk assets to market due to its historical customer approach primarily a limited tolerance for volume risk.

This PBC is a privately led base case developed outside the traditional SunWater approach therefore the price cap can be changed in agricultural demand assessments. The service demand assumed is that will be provided during the PBC will be outside of the Network Service Plans as it reflects the Australian Government's focus on developing greater agricultural activity in the region.

The major differences in this approach is the treatment of risk in consideration of potential customers. The QCA notes SunWater's risks are:

- Short Term Volume Risk
- Long Term Volume Risk (Planning & Infrastructure)
- Market Cost Risks
- Risk of Government Imposts

While the movement of modern water (irrigation) is to ensure modernisation of investments to reach full potential, customer engagement beyond the scope of the risks above is critical to ensuring a whole- of -life approach (and the economy) of the asset is taken. This will include modelling and measuring water budgets, technologies to reduce infrastructure transport costs and provide flexibility, on-farm change management, early planning processes for soil management and crop financing. These approaches sit apart of the monopoly's provision of service and networks plans in the development of the Service Need.

9 DAM DESIGN & GEOLOGY

9.1 Chapter Summary

It is recommended that the Urannah Dam be designed as a Concrete Face Rockfill Dam (CFRD) for a large dam of 290 Full Supply Level, which would allow the project to be staged. The Roller Compacted Concrete (RCC) gravity dam with earth and rockfill dam flanks is preferred at levels below 280 FSL, however does not allow for staged construction unless gates are used.

Key characteristics of the site include:

- stream comprises rock bars which divide up the low flows into two main channels
- alluvial terraces exist on both banks with rocky escarpment above
- on the right bank, the slope varies but continues to rise towards the crest of Mount Cauley
- on the left bank the slope flattens to form a saddle which continues towards the Broken River range

The proposed Urannah Dam is capable of providing a mean annual diversion (yield) ranging from 100,000 ML/a to 195,000 ML/a and could support an irrigation area ranging from 8,000 ha to 15,000 ha depending on the FSL and mix of water priorities.

If hydropower is considered in addition to the development of the water infrastructure, the generated energy through the hydropower option is 1.8 times the pumping energy, so there is a positive net energy recovery.

9.2 Purpose

This chapter summarises the feasibility design of the dam, outlet works and spillway and reviews the dam arrangements with an FSL from 280m to 295m AHD. Varying dam options were reviewed over a range of reservoir levels and the feasibility level cost estimates were calculated.

The feasibility level details of the following elements were reviewed:

- geological aspects of the site as observed from previous and current investigations
- hydrology and failure consequence assessment of the dam
- dam options to assess type and height
- quantities and cost estimate
- evaluation of the preferred options

9.3 Historical Studies

A number of reports have been developed historically in relation to the Urannah Dam site. The reports undertook various feasibility studies and investigations.

9.3.1 Preliminary investigations into the Broken River Dam

This report, completed by Snowy Mountains Hydro Electric Authority in 1969 (SMHEA Report 1969), investigated a proposed dam on the Broken River at 36km with a storage capacity of up to 863,000 ML. It concluded that the proposed dam was feasible.

9.3.2 Pre-feasibility Study for the enlargement of Urannah Dam

This report, completed by Snowy Mountains Hydro Electric Authority in 1976 (SMHEA Report 1976), undertook further studies for a Urannah Dam site based on reviewing the feasibility of a larger capacity of 1,500,000 ML. The report assessed three options including:

- a single stage project with the full storage capacity of 1,500,000 ML
- a staged project with the initial 863,000 ML dam completed, and then a project to raise the embankment and install spillway gates
- a staged project with the initial 1,500,000 ML capacity, and then a project to install spillway gates

The report confirmed all three options were feasible, however staging the projects did not amount to significantly lower first stage costs. The report established that a 1,500,000 ML dam would provide substantial flood mitigation benefits.

9.3.3 Staged Construction of Urannah Dam

This report, completed by Snowy Mountains Hydro Electric Authority in 1978, undertook further studies to build on the Pre-feasibility Study, particularly examining staging the construction to minimise costs.

The report recommended staging of construction with a concrete faced rockfill dam due to lower costs and the allowance that the stage 1 crest would not need to be lowered to complete the raising in stage 2. It also recommended an ungated spillway for both stages.

9.4 Geology

The dam site is located on the Broken River, approximately 3.4 km downstream of the confluence of the Urannah Creek. The regional and site geology is discussed in the SMEC geological report[13] and is summarised here in relation to dam construction aspects.

The SMHEA Report 1969 and subsequent field studies indicated:

- The Broken River is generally parallel to the eastern boundary of the Bowen Basin. The oldest rocks on the Eastern limb of this basin is the lower Bowen Volcanics of Lower Permian age, and these are exposed for approximately seven kilometres along the Broken River upstream of its confluence with the Bowen River.
- The rocks at the dam site belong to the Carboniferous to Mesozoic aged Urannah Complex, consisting of various igneous intrusions, including diorite, granodiorite, adamellite and granite, with some basic to ultra-basic components, all of which have been intruded by several generations of acid to basic dykes.
- Most dykes strike NNW with steep to vertical dips, but some strike normal to the majority.

[13] SMEC, Geology Report: Urannah Dam Feasibility Study, 2018

- Aerial photographs show a distinct NNW trending pattern of lineaments in the Urannah Complex.
- Evidently the dykes are more resistant to chemical weathering or much younger than the rocks they intrude, and therefore have produced ribs or ridges in the topography. The dykes seem to be less resistant to mechanical wear, as is evidenced by the relatively deep channels along their strike in the riverbed.
- The Urannah Complex has been subdivided into several geological units, with the dam site being underlain by rocks of the Early Permian aged Mount Cauley Granite.

9.4.1 Geotechnical considerations

The rock strength, based on the outcrop observed on site during the current investigation, appeared to range between very high to extremely high with weathering between fresh to slightly weathered. In addition, the rock permeability was high with moderately jointed rocks and shear zones.

A major fault passes obliquely through the downstream section of the proposed left abutment spillway and downstream toe area of the dam, and this may lead to hydraulic scouring during or post construction. This raises the risk of downstream scouring if a central concrete spillway is adopted.

The dissipator structure would need careful design to ensure that the discharge energy is sufficiently reduced to prevent scour of the downstream rock or a concrete dissipator be considered.

9.4.2 Foundation preparation

A Concrete Faced Rockfill Dam or zoned rockfill dam is feasible with adequate stripping of the foundation. An alternative to these dam types may be a composite RCC/embankment dam, with RCC in the central channel area and embankment dams on each of the abutments. There are two major faults at the site that will need to be excavated to their full extent for all dam types and likely require treatment.

The SMEC Geology Report (refer Appendix 1) estimates that stripping depths range from 2m in some sections up to 25m, with additional required for the faults noted above.

9.4.3 Construction materials

Previous investigations have suggested that sufficient quantities of materials should be available locally around the site to construct a Roller Compacted Concrete (**RCC**), Concrete Faced Rockfill Dam (**CFRD**) or Earth and Rockfill Dam (**ERD**).

9.5 Hydrological Considerations

A hydrological assessment was conducted by SMEC[14] and was undertaken using a hydrological run-off model with data obtained from stream flow gauging stations located within the Urannah Dam catchment and historical rainfall data.

The results of the model indicate that the flows estimated for the one per cent (1 in 100 AEP) are relatively high however this does not impact upon the accuracy of the Probable Maximum Precipitation Flood (PMPF) estimate (1 in 1,000,000). It does however impact upon the intermediate events including the design discharge estimate. As such, it is recommended that future stages of design further investigate the elevation discharge relationship at the stream gauging stations.

[14] SMEC, Flood Hydrology Report: Urannah Dam Feasibility Study, 2018

9.5.1 Storage volume

The storage volume for the FSL at RL 280, RL 285, RL 290 and RL 295m is shown in Table 9-1 below, using the data from the SMHEA Report 1976 and more recent computations.

Table 9-1 Storage Volumes

Full Supply Level (m AHD)	Reservoir Volume ('000 ML)
EL 280	1,060
EL 285	1,180
EL 290	1,390
EL 295	1,660

9.5.2 Consequence assessment

An initial consequence assessment was undertaken as per Australian National Committee on Large Dams Guidelines on the Consequence Categories for Dams (ANCOLD Guidelines) and is based on reconnaissance of infrastructure downstream of the dam and conservative use of data such as topographic maps and hydrographic data.

From the assessment, the following observations were made:

- From approximately 50 km downstream of the dam, the topographical and aerial imagery indicate that the estimated 40 m depth of the dam break flood overtops the riverbanks and spreads out onto open country on either side of the river. This region comprises mostly infrastructure i.e. mine ponds, lagoons and quarries
- From approximately 80 km downstream of the dam, the river profile comprises mostly an incised channel with raised banks on both sides of the river. The water is likely to be flowing on either side of the raised riverbanks at low to moderate velocities. Some properties in this zone are estimated to have several metres of inundation, although the velocities are expected to be low
- From approximately 100 km the left side of the river rises in elevation with the right side comprising a relatively flat plateau area, which would further attenuate the flow
- Approximately 110 km downstream, the profile reverses and the right bank rises, and the left bank flattens out. The estimated dam break depth of 25 m overtops the left riverbank for the next 30 km, impacting properties including the Bowen River Hotel with possibly low to moderate velocity flows
- At approximately 140 km downstream of the dam the estimated dam break waters overtop the right bank and inundate a group of properties on this bank. The severity of flows away from the main river channel are again expected to be low
- Further downstream the river turns west inundation of several properties of the left bank is expected.
- At the confluence of the Burdekin River and further downstream of this location, the depth of flow above river bed level has been estimated to be 10 m. The topographical data indicates that the river channel profile transitions to a deeply incised channel with steep banks higher than 10 m. Therefore, most of the flow is judged to be contained within this river channel

- Several stream lines flow into the river downstream of Urannah Dam, many with substantial catchments. Coincidental flooding from these catchments would likely result in higher flood waters downstream of the dam during a major flood event in the Urannah Dam catchment. As such, it is expected that the incremental contribution from failure of Urannah Dam during flood would be lessened and the dam failure scenario with the highest consequences would be the Sunny Day Failure

Based on the Queensland Guidelines on Acceptable Flood Capacity for Water Dams, with reference to the ANCOLD Guidelines, the Consequence Category for Urannah dam is estimated to be High B. It is highly recommended that a detailed dam break assessment be completed to ensure implications to the costs of the dam are considered appropriately during the detailed design phase.

9.6 Hydrological Yield

An assessment was made of the yield from Urannah Dam for a range of embankment heights and storage volumes.[15] A daily water balance model was developed to assess the yield and was configured to provide full demand for high priority allocations, being industrial, urban and perennial crops most years, with a reduction to 80% in particularly dry years.

The proposed Urannah Dam is capable of providing a mean annual diversion (yield) ranging from 120,000 ML/a to 195,000 ML/a and could support an irrigation area ranging from 8,000 ha to 30,000 ha depending on the FSL and mix of water priorities. For example, a dam with an FSL of 295m will support up to a 40% larger area of irrigation over a dam with an FSL of 280m.

It is anticipated that Urannah Dam can provide water supply for a mix of uses and improve availability and reliability of water across the region.

9.7 Dam Design

Dam arrangements with a Full Supply Level (FSL) from RL 255 to RL 295 m Australian Height Datum (AHD) have been reviewed. The following methodology has been employed to develop and evaluate the dam design:

- Previous feasibility reports and geotechnical investigations were reviewed
- A site visit was undertaken to carry out a general walkover to inform the project team of the conditions at site, as well as confirming the layout as proposed in the previous studies and collect material samples
- The dam location was selected to be the 36km site as per the previous feasibility assessments
- Dam options were identified based on the site-specific conditions, materials available and schemes of similar nature
- Alternative dam options were evaluated qualitatively based on comparative criteria and quantitatively based on preliminary engineering estimates to identify a preferred dam type and configuration

Four dam types were considered:

- Option 1: Roller compacted concrete (**RCC**) gravity dam with earth and rockfill dam flanks

[15] SMEC, Yield Hydrology Report: Urannah Dam Feasibility Study, 2018

- Option 2: Concrete face rockfill dam (**CFRD**)
- Option 3: Earth and rockfill dam - central core (**ERD**)
- Option 3A: Earth and rockfill dam - sloping core (**ERD**)
- Option 4: Zoned earth dam

Based on the materials available and constructability issues, Option 4: Zoned earth dam was considered far less economical for the site and therefore was not progressed.

The remaining four dam types considered are believed to be feasible at the Urannah Dam site. Suitable materials are likely to be located within close proximity to the site for construction of all the dam types reviewed, so no major cost discrepancies exist between the types.

When weighing up the costs of the various options and considering the geology in the area, the CFRD option is the preferred option for a large dam, which would allow the project to be staged. The RCC option is preferred at levels of 280 FSL or lower, however does not allow for a staged project unless gates are used.

9.8 Hydropower

Hydropower is a form of renewable energy that uses the force of moving water, particularly water stored in dams to create electricity. Like other forms of electricity generation, hydropower uses a turbine to help generate electricity using the energy of falling or flowing water to turn the blades.

The amount of electricity generated from each power plant depends on the quantity of the flowing water and the height from which it falls. The hydropower plants are typically located in areas with high rainfall and elevation, similar to the Urannah region.

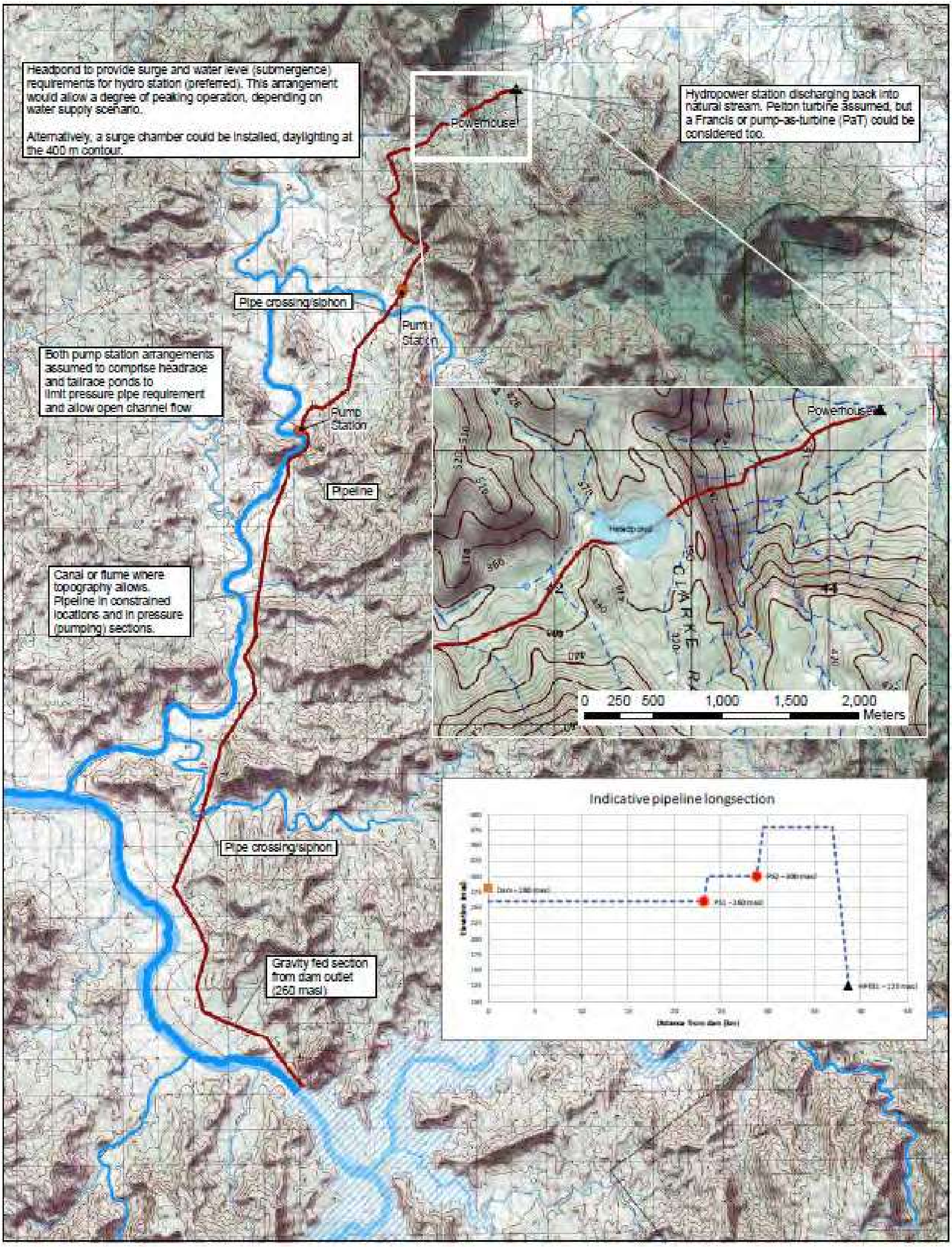
One hydropower option that can be incorporated into the overall arrangement is for the Urannah to Peter Faust Dam water supply pipeline option, making use of the topography and supply from the Urannah reservoir.

9.8.1 Hydropower with UWS

The alignment of the Urannah to Peter Faust Pipeline at Proserpine can be used to generate hydropower where elevations range from 260m AHD to 400m AHD at the highest point. The topography means the pipeline would have around 120 m of available head (being the vertical distance from intake to turbine and resulting pressure). To allow water to flow, pumping stations are proposed to provide pressure between pipeline sections.

Head is water pressure, created by the difference in elevation between the intake of the pipeline and water turbine. Higher head will produce greater pressure and higher output at the turbine. The highest point of the alignment is 380 m AHD, located in a small depression at the top of the escarpment. The headpond would be located here to allow the hydropower station to operate with sufficient water volume for turbine start-up and provision for surges from flow changes and station trips. From the headpond area, there is a large escarpment which drops from 400 m AHD to the Andromache River at approximately 50 m. The approximate selected location of the powerhouse is shown at 125 m AHD, which corresponds to an area above Birds Nest Creek near to existing tracks useful for construction access. See Figure 9-1 for the full proposed layout

Figure 9-1 Hydropower concept and layout



9.8.2 Benefits

Together with the UWS project, the hydropower project will include a number of benefits. The hydropower project does require additional penstock from the headpond to the powerhouse, otherwise the required pipelines are part of the existing Urannah Water Scheme project.

There are no environmental considerations that are unique to the hydropower option, as the considerations are common to both the proposed dam and this option.

An economic analysis completed by SMEC[16] indicated that there is a positive economic benefit for water supply demands of 15,000 ML per annum and above, using 75% and 95% capacity to produce power. The following table shows the positives benefits:

Table 9-2 Benefits of Hydropower

Annual water demand ML/a)	Output power KW	Annual energy	CAPX	Revenue $/A @$75/MWH	OPEX $/A	NPV DISC =7%
75% Capacity						
15,000	1,021	6,208	$4.10 M	$466,000	$102,000	$0.24 M
20,000	1,361	8,256	$4.53 M	$619,000	$113,000	$1.38M
25,000	1,701	10,368	$4.94 M	$778,000	$124,000	$2.62 M
95% Capacity						
15,000	1,021	7,863	$4.10 M	$590,000	$102,000	$1.58 M
20,000	1,361	10,458	$4.53 M	$784,000	$113,000	$3.17 M
25,000	1,701	13,133	$4.94 M	$985,000	$124,000	$4.87 M

9.8.3 Hydropower summary

For all demand scenarios, the ratio of generated to pump energy will be 1.8 times as this is a function of the gross head to overcome and subsequently recover energy.

The features of the project include:

- hydropower scheme comprising two pump stations to raise the water approximately 122 m to a head pond (or surge chamber or similar) at 380 m AHD
- low-pressure pipeline with pump rising mains assumed for most of the alignment
- pump stations are fed from, or empty into, ponds to regulate pressures in pipes
- penstock and power station located at 125m AHD, for a gross head of 255 m
- Pelton turbine assumed

[16] SMEC, Hydropower and Pumped Storage Options Report, 2018

9.9 Pumped Storage Opportunities

The mountainous terrain surrounding the proposed Urannah storage provides the opportunity to assess a range of Pumped Storage opportunities. A total of 5 viable options were identified and assessed. When demand for electricity is low, water is pumped back up into elevated holding dams so it can be released back into the main storage again when electricity demand is higher. These options present an opportunity to provide renewable energy storage options for the existing 450MW Solar Energy Hub at Collinsville

Some of the pumped storage options are separate to the proposed UWS infrastructure and could be pursued as standalone projects. The two options considered in this chapter are high level and provide a basis for further investigation. The following inputs and assumptions were used.

9.9.1 Site selection

Using GIS software, the area was searched for a location with a short waterway and a high head as an ideal location for the project. The inputs used included:

1. National elevation dataset.
2. 1:25000 scale topographic maps from State of Queensland (Department of Natural Resources, Mines and Energy).
3. Protected areas of Queensland shapefile from State of Queensland (Department of Environment and Science).
4. NEM market data.
5. Analysis and experience from other similar projects in Queensland

9.9.2 Assumptions

The following assumptions were made in relation to the two options reviewed:

- The upper storage is either a small dam or a turkeys-nest arrangement
- The lower storage is the Urannah dam reservoir
- A daily cycle of 7 hours for generating and 10 hours to refill via pumping

9.9.3 Options

Two options for pumped storage were preferred after the technical study completed by SMEC.[17] Option 1 (Option 4 in the SMEC report) below is the preferred option, however Option 2 (Option 1 in the SMEC Report) included a number of benefits that need to be investigated further

The key attributes which make these the preferred options are:

- distance to large transmission circuits and loads
- existing lower reservoir with large volume of water
- outside of National Park
- large size (MW) of project to offset required construction costs

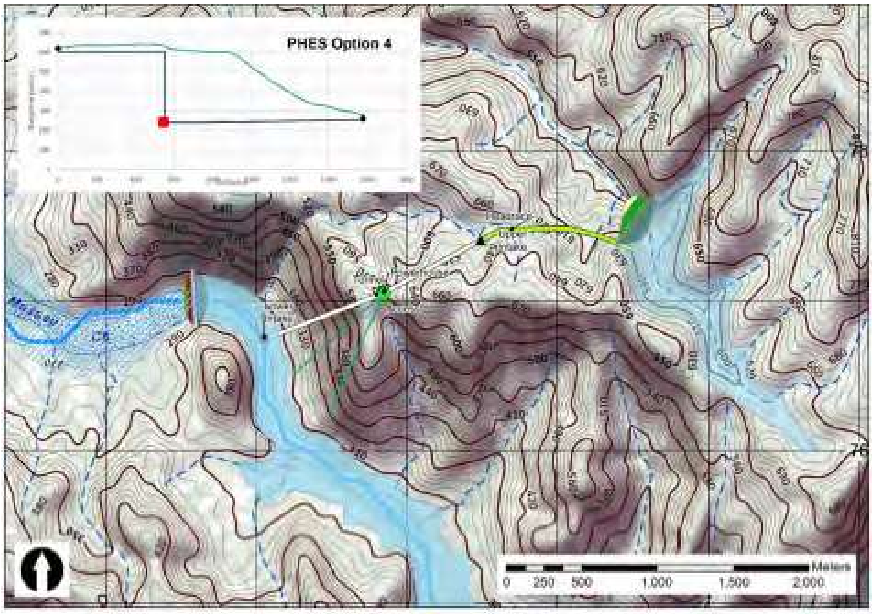
[17] SMEC, Hydropower and Pumped Storage Options Report, 2018

9.9.4 Option 1

This option utilises the upper part of the proposed Urannah reservoir as the lower storage and a medium sized 45 m high concrete faced rock fill dam (CFRD) as the upper storage and reservoir. The assumed 40 m operating range of the upper dam provided 10.0 GL of live storage. Depending on finalised water levels, a small lower dam (28m high) may be required to contain live storage with adequate submergence for intake and turbine setting. The assumed daily cycle is seven hours for generation and the gross head for this arrangement is 306 m.

This option is the preferred option, solely based on the assumed metric, largely due to the high installed capacity (1,020 MW), reasonable head (net head of 291 m) and short waterway length.

Figure 9-2 Option 1 concept (SMEC Option 4)



9.9.5 Option 2

This option includes a 10 m high turkeys-nest dam and excavated reservoir using water pumped from the lower Urannah Reservoir storage for a seven-hour cycle. The operating range of the upper reservoir was assumed to be 20 m resulting in 3.6 GL of live storage. It is likely that a lower storage area with a 30 m operating range would be required due to the large water level fluctuations in Urannah Reservoir. This reservoir is assumed to be constructed as an excavated pond, with a low parapet wall or embankment to enclose the pond. Gross head for this arrangement is assumed to be 425 m.

This option would likely be more easily constructible, with existing roads on the ridge and proximity to the transmission system. Also, it appears to be less environmentally sensitive and undertaking the environmental approval process may be easier.

Figure 9-3 Option 2 concept (SMEC Option 1)

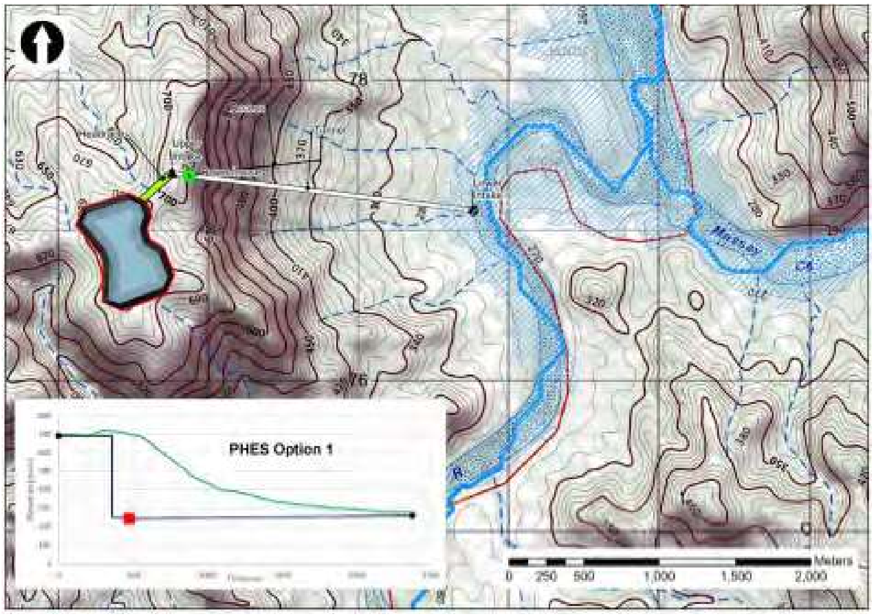
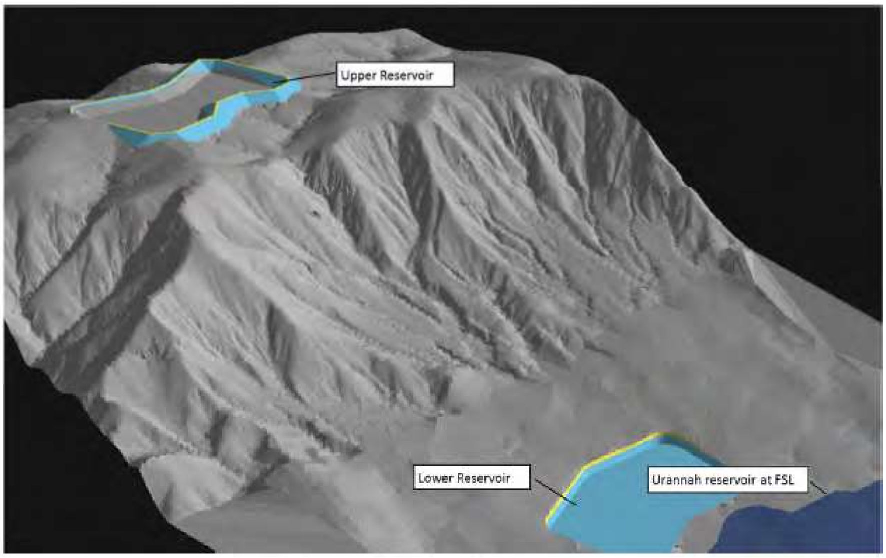


Figure 9-4 Option 2 indicative layout



9.9.6 Pumped storage summary

The economic analysis of the options indicated that Option 1 was the preferred option with Option 2 also an attractive option. The study also indicated that a one-day cycle was preferred over a seven-day cycle.

The Table 9-3 outlines the features of the two options:

Table 9-3 Pumped Storage options

Description	Units	Option 1	Option 2
Upper Dam			
Dam volume	Mm^3	1.7	1.5
Upper dam max height	m	45	10
Upper FSL	mAHD	620	710
Upper MOL	mAHD	580	690
Reservoir Live Storage	GL	10	3.6
Lower Dam			
Lower dam volume	Mm^3	0.37	0.50
Lower dam maximum height	m	28	5
Lower FSL	mAHD	299	290
Lower MOL	mAHD	289	260
Power station			
Cycle time (generation)	Hours	7	7
Waterway length	Km	1.6	2.2
Rated net head	M	291	404
Rate generation flow	m^3/s	398	141
Rated pumping flow	m^3/s	295	104
Rated power	MW	1021	500
Indicative cost	$/kW	$1,380	$1,650

9.10 Hydropower and Pumped Storage Recommendations

The inclusion of a hydropower scheme would be highly beneficial due to the ability to take advantage of the topography and proposed pipeline to Peter Faust. The facility would offset any pumping costs, remove excess pressure head and possibly generate revenue from surplus energy. With the estimated generation of 1.8 times the pumping energy requirements, the hydropower scheme is an attractive option to provide renewable energy to support the project.

The pumped storage options would provide significant additional benefit to the project. The additional power can support regional energy security and prices. Both Shortlist Options 1 and 2 should be investigated to determine their suitability to the project.

10 MARKET CONSIDERATIONS

10.1 Chapter Summary

Market sounding was undertaken from October 2018 to January 2019 with local resource companies, industry groups, potential agricultural investors, urban customers and landholders.

Market sounding aimed to determine regional demand drivers for water; market interest in new water, different supply options and private investment in the region; and market willingness to pay for water.

Participants in the market sounding strongly support the provision of new water sources for the region to diversify the economy and enable the development of resource projects.

Investigations found the regional water balance to be deficient. Existing systems rely on moving water from underused areas to demand nodes through expensive transport options. Poor reliability of supply results in water trading and investment in re-use. Greater reliability of supply would generate greater confidence to invest in the region

10.2 Purpose

This chapter summarises market considerations related to the service need and the shortlisted options. A market sounding process was undertaken to inform the PBC assessment of potential demand (and customers) and the procurement strategy.

10.3 Market Sounding

10.3.1 Objectives

Market sounding for this PBC was undertaken to generate:

- an understanding of the long-term regional water needs
- demand drivers in the region
- the level of market interest in an additional volume of water
- market feedback on potential options for water supply
- the level of interest in private investment for project development
- the wiliness to pay for additional water.

10.3.2 Approach

Market sounding was undertaken by the project team as part of the demand assessment and stakeholder engagement once the shortlist options were developed.

It was used to assess existing demand from existing sources (SunWater) and demand for additional water and other potential options. Early results in relation to water demand assisted the options generation and options filtering activities.

Consultation occurred from October 2018 to January 2019 with local resource companies, industry groups, potential agricultural investors, urban customers and landholders. Activities consisted primarily of one on one meetings and questionnaires.

10.4 Market Feedback

10.4.1 Key drivers for resources

The market feedback indicated the following:

- Increased certainty of water availability would increase financial investment certainty
- Companies will pay premiums for high priority water to have it available when needed
- Customer experiences with SunWater have been varied and some water security allocations are currently not used due to reliability concerns
- Long term supply agreements would aid in securing project finance for water
- Moranbah and Newlands clusters of customers are paying significant premiums and are not trading water due to scarcity
- Companies are optimising water use through re-use and recycling
- Resource companies are paying upwards of three times to the volume weighted trading price
- Operational costs associated with the SunWater connection pipelines are high
- While prices for this water are also high, it is unlikely that costs are being covered
- A number of resource projects would have proceeded when favourable commodity markets returned had secure access to water been available

10.4.2 Key drivers for agriculture

Demand for water is solely reliant on the creation of a new irrigation precinct with large scale on farm infrastructure.

Properties are held by a small number of owners. Many are owned by resource companies for further resource development or to provide buffer areas to existing operations.

New operations to take advantage of the high-quality soils will require a single user approach to manage the full impacts of soil degradation and potential impact on the Great Barrier Reef.

10.4.3 Market feedback on options

Market sounding of participants was separated into resource companies, potential funders / irrigator operators and industry groups.

Overarching themes were as follows:

- New water sources are strongly supported for the long-term health of the Collinsville region and to support the long-term nature of the resources being developed in the region
- Diversifying the local economy through large scale water provision is strongly supported

- Limited trading of water and investment in reuse is a result of no other feasible options being provided by the government

Table 10-1 Market feedback on potential the short listed options for water supply

Option	Market Feedback
General	• The water balance in the region is deficient and relies on moving water from underused areas through expensive transport options. • At source management has been the internal focus. • Limited understanding of SunWater's new direction.
Base Case - New Supply from Burdekin Falls Dam	• Have relied on placing this option into regulatory statements to justify use over time. • Since Connors River decision, there is little faith that SunWater will be given capital allocations to build new infrastructure.
Option 1 – New Urannah Dam supplying Peter Faust and Eungella, supply to Moranbah and Collinsville irrigation precinct with dam yield of 150,000 ML/yr (inclusive of Options 2 & 3 smaller storage)	• New dams of scale are difficult to envisage given the decline in new Dams in Queensland over the past 20 years. • Supply of water should be an economic incentive for regions to invest in exports; demanding high prices for returns to the State is a flawed model. • Federal government focus on the north is positive to deliver large water assets that allow certainly for investment. • Future structures of how the asset could be privately operated is of interest.

11 PUBLIC INTEREST

11.1 Chapter Summary

Initial public interest effectiveness criteria are met through each of the shortlisted options to varying degrees in alignment with stated Australian Government objectives including Developing Northern Australia, the objectives of the National Water Infrastructure Development Fund and providing water security to boost employment and aid regional development.

Additional public interest effectiveness criteria are met through all shortlisted options conforming to the Queensland Government planning objectives including developing water infrastructure/additional supplies in the order of the State Infrastructure Plan hierarchy: reform, better use of existing; and new build.

All three options will have a range from limited to significant impacts on key stakeholders, including customers and the local community (although the significant majority are positive).

Stakeholder consultation identified a clear need for additional water for agricultural growth with many additional benefits identified.

There is significant social licence for all shortlisted options to proceed, however, a limited number of local stakeholders have been consulted at the time of writing this PBC.

The options will mainly have positive impacts on existing urban and industrial customers, through increased reliability of supply.

Each of the options will impact on landholders living in the inundation area, of which there are two, and the Native Title leaseholders Urannah Properties Association (UPA). UPA have been consulted extensively and are keen supporters of the UWS concept. There are many positive impacts on UPA in the form of Ecotourism and management of community activities as a result of a dam.

Shortlist Option 1 will impact mainly on existing landholders in the proposed agricultural precinct, although there are only four main landholders in this area. These owners are all mining companies and the land is currently used for low capacity grazing operations

Shortlist Option 1 is anticipated to increase surrounding land values and have moderate positive flow on effects for local retailers. It is expected to have a moderate impact on local tourism and raise some environmental concerns for the Great Barrier Reef.

Shortlist Option 1 will greatly increase irrigated agricultural production and values in the area and place demands on SunWater (or another proponent) and the Queensland and Australian Government departments as part of their role in seeking, assessing and making planning and other approvals.

- Public access to Urannah Dam for recreational purposes was identified by stakeholders as a legitimate matter for discussion as the community may seek Urannah Dam as a potential source of increased amenity and tourism.

11.2 Purpose

The purpose of this chapter is to assess whether the shortlisted options are in the public interest and to ensure that, on balance they provide equitable outcomes for all stakeholders.

11.3 Defining Public Interest

The Queensland Office of the Information Commissioner states:

Public interest considerations are those affecting the good order and functioning of the community and government affairs, for the well-being of citizens.

Public interest considerations are generally common to all members of, or a substantial segment of, the community, as distinct from matters that concern private or personal interests. However, some public interest considerations can apply for the benefit of an individual.

Public interest considerations are initially based around the effectiveness of the shortlisted options (individually) in meeting government objectives. The shortlisted options each conform to broad government objectives in terms of developing Northern Australia and providing water security to sustain agricultural industries and boost employment and regional economic development.

To further refine the public interest aspects of the options under consideration, this chapter identifies stakeholders with an interest in the project and provides an assessment of:

- Potential impacts of the shortlisted options on these stakeholders
- Public access and equity issues
- Consumer rights
- Security
- Privacy

11.4 Impact on Stakeholders

A stakeholder is defined as any person who may be impacted directly or indirectly by the project and/or who may have an interest or influence over the success of the project. Stakeholders associated with the project have been broadly categorised as shown in Figure 11-1.

Figure 11-1 Stakeholder Group Categories

Table 11-1, Table 11-2 and Table 11-3 outline the potential interests and impacts on stakeholders identified for each option. Table 11-1 outlines regional considerations for each shortlisted option, Table 11-2 outlines state-wide considerations for each shortlisted option and Table 11-3 outlines national considerations for each shortlisted option.

Table 11-1 Regional Considerations

Stakeholder	Description	Interest in or impacts of Project		
		Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Agriculturists	Irrigators and other land holders undertaking agricultural activities in the boundaries of proposed agricultural precinct	Access to reliable long-term supply of water allowing for potential change in land use into irrigated cultivation. Change in land use designation Land resumption	No impact	No impact
Mine owners and operators	Owners of existing mining operations and development leases	Interest in reliable water supply Greater flexibility of use provided to urban customers Relief from potential future water restrictions Ability to expand existing operations or develop new Land resumption	Interest in reliable water supply Greater flexibility of use provided to urban customers Relief from potential future water restrictions Ability to expand existing operations or develop new	Interest in reliable water supply Greater flexibility of use provided to urban customers Relief from potential future water restrictions
Business Owners	Owners of businesses that support regional activities	Minor interest mainly from incremental increase in demand Minor demand from new infrastructure construction activities	Minor interest mainly from incremental increase in demand Minor demand from new infrastructure construction activities	Minor interest mainly from incremental increase in demand Minor demand from new infrastructure construction activities
Town Residents	Residents in towns and surrounding areas	Disruption of normal activities, additional traffic during construction and greater employment opportunities Employment demand from new infrastructure construction activities Changes to flow in local waterways Reliability of urban supply	Employment demand from new infrastructure construction activities Changes to flow in local waterways Reliability of urban supply	Employment demand from new infrastructure construction activities Changes to flow in local waterways Reliability of urban supply
Community Groups	Community groups	Environmental impacts from dam may raise community concerns	Environmental impacts from dam may raise community concerns	Environmental impacts from dam may raise community concerns
Tourism Operators	Tourism operators	Recreational use of Dam may increase opportunity and/or demand	Recreational use of Dam may increase opportunity and/or demand	Recreational use of Dam may increase opportunity and/or demand

		Ecotourism potential	Ecotourism potential	Ecotourism potential
Local Government	Local Governments and Regional Economic Development Groups	Impacts from construction and operational phases of project including impacts on local infrastructure	Impacts from construction and operational phases of project including impacts on local infrastructure	Impacts from construction and operational phases of project including impacts on local infrastructure

Table 11-2 Queensland

Stakeholder	Interest in or impacts of Project		
	Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Queensland community	Potential Queensland Government subsidy Greater production and employment Minor concern over environmental impacts	Potential Queensland Government subsidy Greater production and employment Minor concern over environmental impacts	Potential Queensland Government subsidy Greater production and employment Minor concern over environmental impacts
SunWater	Short-term impacts on staffing and management Need for engagement, equity and transparency in establishing scheme reform	Short-term impacts on staffing and management Need for engagement, equity and transparency in establishing scheme reform	Short-term impacts on staffing and management Need for engagement, equity and transparency in establishing scheme reform
DAF DEWS DNRME DEHW DSDMIP	Alteration of Water Resource Plans Significant role in dam and environmental approvals Regional planning	Alteration of Water Resource Plans Significant role in dam and environmental approvals Regional planning	Alteration of Water Resource Plans Significant role in dam and environmental approvals Regional planning

Table 11-3 National

Stakeholder	Interest in or impacts of Project		
	Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Australian community	Greater production and employment Concern over environmental impacts	Greater production and employment Concern over environmental impacts	Greater production and employment Concern over environmental impacts
Department of Agriculture and Water Resources Department of Energy and Environment	Funding support for construction. Major role in environmental approvals process	Funding support for construction. Major role in environmental approvals process	Funding support for construction. Major role in environmental approvals process

11.5 Stakeholder Consultation and Social Licence

It is not possible to determine a social licence for the shortlisted options from the consultation undertaken for the PBC, however a number of observations can be made:

- There is broad stakeholder acceptance of the identified drivers for regional economic growth. However, the agricultural drivers also need to consider other factors, such as distribution infrastructure, irrigation types and crop types.
- There is an expectation these options be considered as a system rather than in isolation, and that interrelationships between the options are considered.
- There is significant stakeholder support of the Urannah Water System, or other bulk water source.
- There is an appreciation that construction of a bulk water source requires a considerable lead time for impact assessment and approvals processes to occur.

Broader consultation beyond regionally based individuals and organisations will be required to test the wider social licence considerations. Stakeholder consultation has been targeted and conducted at a regional level. A full business case for any of the three shortlisted options would need a far broader scope of consultation.

11.6 Public Access

Issues regarding public access aspects of the shortlisted options are addressed in Table 11-4.

Table 11-4 Public Access Aspects

Option	Public Access Aspects
Option 1 (FSL RL290)	Limited public access impacts identified. Some minor potential impacts during construction phase. New dam may have potential for recreation and enhanced public access when completed.
Option 2 (FSL RL280)	Limited public access impacts identified. Some minor potential impacts during construction phase. New dam may have potential for recreation and enhanced public access when completed.
Option 3 (FSL RL255)	Limited public access impacts identified. Some minor potential impacts during construction phase. New dam may have potential for recreation and enhanced public access when completed.

11.7 Equity

Issues regarding equity aspects of the shortlisted options are addressed in Table 11-5.

Table 11-5 Equity Aspects

Option	Equity Aspects
Option 1 (FSL RL290)	Groups downstream of dam may be from disadvantaged backgrounds and unable to participate fully in the consultation process without additional support. Equity consideration in sale of water to also be considered. Shortlist Option 1 will have the largest group of stakeholders as this option includes an irrigated agricultural area
Option 2 (FSL RL280)	Groups downstream of dam may be from disadvantaged backgrounds and unable to participate fully in the consultation process without additional support. Equity consideration in sale of water to also be considered.
Option 3 (FSL RL255)	Groups downstream of dam may be from disadvantaged backgrounds and unable to participate fully in the consultation process without additional support. Equity consideration in sale of water to also be considered.

11.8 Consumer Rights

Issues regarding consumer rights aspects for each of the options are addressed in Table 11-6

Table 11-6 Consumer Rights Considerations

Option	Consumer Rights Considerations
Option 1 (FSL RL290)	Changes to irrigation patterns because of silt reduction technologies will impact on drainage irrigation patterns. Potential compulsory land acquisition.
Option 2 (FSL RL280)	Potential compulsory land acquisition.
Option 3 (FSL RL255)	Potential compulsory land acquisition.

11.9 Safety and Security

The project will be developed to address applicable security, health and safety requirements. The regulatory and legislative frameworks that may inform the reference project within a detailed business case include:

- *Aboriginal Cultural Heritage Act 2003 (Qld)*
- *Building Act 1975 (Qld)*
- *Environment Protection & Biodiversity Conservation Act 1999 (Cth)*
- *Environmental Protection Act 1994 (Qld)*
- *Fisheries Regulation 2008 (Qld)*
- *Forestry Act 1959 (Qld)*
- *Land Act 1994 (Qld)*
- *Local Government Act 2009 (Qld)*
- *Nature Conservation Act 1992 (Qld)*
- *Regional Planning Interests Act 2014 (Qld)*
- *Sustainable Planning Act 2009 (Qld)*
- *Transport Infrastructure Act 1994 (Qld)*
- *Vegetation Management Act 1999 (Qld)*
- *Water Act 2000 (Qld)*
- *Water Supply (Safety and Reliability) Act 2008 (Qld)*
- *Water Reform and Other Legislation Amendment Act 2014*
- *Water (Local Management Arrangements) Amendment Act 2017*
- *Work Health and Safety Act 2011 (Qld)*

11.10 Privacy

Information received from the public during the PBC stakeholder consultation process will be treated in accordance with the *Information Privacy Act 2009 (Qld)*.

11.11 Conclusion

Initial public interest effectiveness criteria are met through all shortlisted options conforming to Australian Government objectives including developing Northern Australia and increasing agricultural production.

In addition, public interest effectiveness criteria are met through all options conforming to the Queensland Government planning objectives including developing water infrastructure/additional supplies in alignment with the State Infrastructure Plan

All three shortlisted options will have a range from limited to significant impacts on key stakeholders, including customers and the local community (although most are positive).

Stakeholder consultation identified a clear need for additional water for agricultural growth with many additional benefits identified.

It is not possible to determine a social licence for the shortlisted options from the consultation undertaken for the PBC. Stakeholder consultation has been targeted and conducted at a regional level only. A full business case for any of the three shortlisted options would need a far broader scope of consultation.

Public access to Urannah Dam for recreational purposes was identified by stakeholders as a legitimate matter for discussion as the community may seek Urannah Dam as a potential source of increased amenity and tourism.

12 SOCIAL IMPACT

12.1 Chapter Summary

The Dam has the potential to inundate and affect approximately 10,500 hectares of land. However, notable benefits of the project centre on the potential to leverage the development of significant economic infrastructure.

This infrastructure would generate economic growth by providing additional water for new agriculture, mining and urban supply in the Bowen, Collinsville and Whitsunday regions.

The Project largely addresses each of the problems identified in the SIB by addressing the key drivers. A bulk water supply system would provide a secure water supply for urban populations, long term agriculture certainty, a more affordable water supply and economic development through the development of additional community support services

12.2 Purpose

The purpose of this chapter is to present the preliminary social impacts arising from each of the shortlisted options through a Social Impact Evaluation (**SIE**). A regional social profile for the study area is initially presented to establish the operating context for each of the shortlisted options. Following this, a summary of the outcomes of the stakeholder consultation process is presented and the potential social impacts are considered.

12.3 Approach

The SIE focusses on the preliminary social impacts from the proposed Urannah dam project, relative to the Social Impact Baseline (**SIB**). The social impacts which are quantifiable and monetisable will be analysed further in the economic analysis in Chapter 14. A qualitative description of all of the social impacts is included in this chapter.

A three-step process was used to complete the SIE:

- Identify the social impacts through analysing comparable bulk water scheme projects and the social impact of developing new bulk water infrastructure in the study area relative to the SIB.
- Conduct an Impact Risk Assessment (**IRA**) to determine materiality of impacts.
- The results were analysed and summarised to demonstrate comparative performance between the three options.

12.4 Summary of Options

The three options are displayed in Table 12-1 below.

Table 12-1 Summary of shortlist options

Asset	Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Urannah Dam Yield	150,000 ML/year	70,000 ML/year	50,000 ML/year
Instream distribution to Collinsville	✓	✓	✓
Pipeline to Peter Faust Dam	✓	✓	✓
Pipeline to Eungella Dam	✓	✓	✓
Moranbah supply	Urannah to Moranbah pipeline	Urannah to Moranbah pipeline	Burdekin to Moranbah duplication
Agricultural irrigation network	✓	×	×

Fifteen social impacts were identified in the SIE. Those impacts that could not be quantified, owing to the specific nature of the impact, were qualitatively described. The three social impacts that were quantified have been included in the cost benefit analysis (**CBA**) in the economic analysis chapter (Chapter 14). The economic analysis chapter also details the approach to monetising the impacts and the economic analysis results.

12.5 Identified Social Impacts

12.5.1 Stakeholders and communities affected by the project

The study area for the purpose of the SIE is the potential areas of supply from Abbot Point and Bowen area, to Proserpine and down to Moranbah and areas surrounding Eungella Dam. The area is generally referred to as Bowen Basin North.

In the 2016 census[18], conducted by the Australian Bureau of Statistics (**ABS**), the estimated population of Bowen Basin North was 33,494 people. The unemployment rate for the region was 6.1 per cent, compared to 7.6 per cent in Queensland. The main employment industries in the region were mining (49.3 per cent), and agriculture, forestry and fishing (8.6 per cent).

The top occupation groups of employment for the study area were machinery operators and drivers (20.4 per cent), technicians and trades workers (18.5 per cent) and labourers (14.7 per cent).

The construction of the Urannah Water Scheme in the Bowen Basin region is expected to have a positive social impact on surrounding locations and communities. When identifying the social impacts and SIB, there were several key stakeholder groups that were considered, which are outlined in Table 12-2 below.

Table 12-2 Key Stakeholder Groups

Government	Associations	Other
Department of Agriculture & Water Resources	Urannah Properties Association	Media (Mackay Mercury)
Department of State Development, Manufacturing, Infrastructure and Planning	Mackay Conservation Group	Traditional Owners

[18] ABS 2016 Census of Population and Housing

Department of Natural Resources, Mines and Energy	QCoal & Landholders	Bowen-Burdekin Local Marine Advisory Committee
Department of Agriculture and Fisheries	GrowCom	Galilee Coal Miners
Department of Environment and Heritage	Agforce	Bowen Farmers
Regional Development Australia	SunWater	Bowen Coal Miners
Great Barrier Reef Marine Park Authority	Mineral Council of Australia	Local Residents
Other Federal and State Members	Queensland Resources Council	

The Urannah Dam would be built on land that is currently leased by the Queensland Government to the Urannah Properties Association (**UPA**), therefore minimal property resumption would be required as a result of inundation. The land is subject to a native title claim registered by the Wiri people, which covers an area of approximately 5,400 square kilometres. The Traditional Owners of the region and the indigenous land corporation, the UPA, are supportive of the development, and any negative impacts could be mitigated through active communication and involvement. There remains a potential to inundate sensitive Indigenous land, however early identification of such issues and ongoing consultation with Traditional Owners would be conducted to minimise the probability and to mitigate the impacts in the event of this occurring.

The Dam has the potential to inundate and affect approximately 10,500 hectares of land. However, notable benefits of the project centre on the potential to leverage the development of significant economic infrastructure. This infrastructure would generate economic growth by providing additional water for new agriculture, mining and urban supply in the Bowen, Collinsville and Whitsunday regions

12.5.2 Social Impact Baseline

The SIB describes the social environment in the absence of an additional bulk water supply system. Table 12-3 below describes the SIB for this project, which is the benchmark that the social impacts have been compared against.

The current Bowen Broken Water Supply Scheme (**BBWSS**), which comprises Eungella Dam, Bowen River Weir and Gattonvale Off- Stream Storage, are located in a region with notable service demands in the coal mining and agricultural industries, and community (urban) needs. The proposed location for the Dam is on a greenfield site in a deep valley, which is currently used predominantly for grazing purposes.

Table 12-3 Social Impact Baseline

Problems, opportunities, services needs	Key drivers
There is an increasing demand for water for urban and tourism uses (potential new demand is greater than 30,000 mega litres) and agriculture needs (potential new demand is greater than 100,000 ML).	• Limited availability and limited capacity of water supply
The potential agriculture capacity and suitability of high-quality soils (suitable for irrigation) may not be realised because of a lack of water supply in the region.	• Limited access to bulk water supply systems • Requirement for high quality soils suitable for irrigation
Future development in the region is inhibited by a lack of secure and affordable water	• Limited availability and capacity of water • Limited availability of affordable water
There is limited growth potential for mining and resources	• Limited availability and capacity of water supply
There are potential limitations for urban and industrial growth	• Limited availability and capacity of water supply
There are fewer farmers able to work at maximum capacity	• Limited access to bulk water supply systems

The Project largely addresses each of the problems identified in the SIB by addressing the key drivers. A bulk water supply system would provide a secure water supply for urban populations, long term agriculture certainty, a more affordable water supply and economic development through the development of additional community support services.

12.5.3 Social impacts

The positive and negative social impacts identified for the Urannah Dam project, relative to the SIB, are described in Table 12-4 and Table 12-5 below. Each social impact has been allocated a unique IRA code. The positive social impacts, or benefits, have been allocated with a B prefix and the negative social impacts, or costs, have been allocated a C prefix.

Table 12-4 Positive Social Impacts

IRA code	Social Impact	Description
B1	Increase in agricultural production, leading to higher value land use	Access to a bulk water supply storage provides additional water supply sources, in turn increasing regional water availability and security for water users. Increased water accessibility will increase the extent to which producers can improve land activities to increase productivity. Additional output can be allocated to GVP of regional agricultural activities, which includes a change in land use to higher value crops.
B2	Increase in mining expansion and project certainty	Access to a bulk water supply provides additional water supply sources, increasing regional water availability and security for water uses. An increase in reliable high priority water allocations could lead to additional GVP of regional mining activities, including the expansion of existing mines.
B3	Increase in regional employment from enhanced agricultural productivity	Access to a bulk water supply provides additional water supply sources, increasing

		regional water availability and security for water uses. These additional resources will increase agricultural productivity, creating a number of additional agricultural employment opportunities. Additional regional opportunities will aid population growth and vitality
B4	Increase in regional employment from enhanced mining activity	Access to a bulk water supply provides additional water supply sources, increasing regional water availability and security for water uses. These additional resources will increase agricultural productivity, creating a number of additional agricultural employment opportunities. Additional regional opportunities will aid population growth and vitality
B5	Opportunities for Indigenous business development and employment	Investing in Urannah Dam could produce additional short and long term Indigenous employment opportunities. The opportunity for Traditional Owners, residents and locals from the region to gain employment during the construction and operational phases of Urannah Dam would create industry growth and upskill local employees
B6	Increased certainty of long-term water supply to at risk urban areas	Access to a reliable bulk water supply storage system will shift water demand away from the Peter Faust Dam at Proserpine (96 per cent allocated). The connection supply to Peter Faust Dam catchment will provide additional allocations and security for residents and tourists, located in the 'at risk' urban area.
B7	Enhanced confidence to invest in long term business operations and succession opportunities	Access to a bulk water supply provides additional water supply sources, increasing regional water availability and security for water uses. The increase in water security will increase the level of confidence within the agricultural and mining sectors to generate long term investment.
B8	Increase in value and flexibility of existing water allocations	Access to a bulk water supply provides additional water supply sources which could lead to additional water trading and an increase in the value of water traded. The increase in value and flexibility of water allocations could lead to a stronger and more resilient economy.
B9	Increase in tourism to the region	Tourism is an important industry within the region; tourism attractions entice visitors to the area and provide employment opportunity for local residents. Urannah is located proximate to the Whitsunday region and Mackay, which are considered attractive tourism destinations. The region provides natural features and vistas, and the coast is located to the East. An additional water body in the region could lead to increased tourism such as seen in Lake Tinaroo in North Queensland.
B10	Decrease in crime	The unemployment rate potentially correlates with social issues within the region, such as crime. Therefore, a decrease in unemployment resulting from the Project could result in a decrease in crime.

B11	Additional demand on existing services during construction and operational phases	Skilled trade and other professionals will be in high demand in the region throughout the construction and operational phases of Urannah Dam. Given the regional location of the proposed Dam site, an adequately skilled and qualified workforce is potentially limited, hence increasing demand for qualified services.

Table 12-5 Negative Social Impacts

IRA code	Social Impact	Description
C1	Potential loss of areas of cultural significance	Urannah is the traditional land of the Wiri and Birri people of the Birri Gubba Nation. By building in this region, sections of cultural heritage may not be preserved. However, the Traditional Owners of the region and UPA, are supportive of the development, and it is likely that any negative impacts can be mitigated through active communication and involvement.
C2	Displacement of existing land owners and industry	The construction of Urannah Dam and resultant land acquisition could lead to displacement of land owners and current businesses in the Bowen River catchment However, the Traditional Owners of the region and the UPA are supportive of the development and it is likely that any negative impacts should be able to be mitigated through active communication and involvement.
C3	Environmental impact	Any development or infrastructure implementation will inevitably create environmental impacts. These impacts can be attributed to a range of sources including altering a river's flow and sediment transport, blocking fish migration or inundating local flora and fauna habitat. These environmental impacts will be mitigated through the environmental approvals process and adhering to sustainable best practice guidelines
C4	Demand for workers housing during construction phase may impact on regional housing affordability and supply	Given the likely influx of construction workers during the construction phase of the Project, additional demand for nearby housing may increase. As the supply of appropriate living situations declines, the price of housing may be driven up by the excess demand. Additionally, operational workers' demand for housing in the long term will increase, initially reducing housing availability.

12.6 Categorisation of Social Impacts

The identified social impacts were divided into three categories through the application of BQ's SIE decision tree. These categories include:

- Social impacts that can be quantified and monetised (and included in the CBA)
- Social impacts that can be quantified and not monetised

– Social impacts that cannot be quantified or monetised (described qualitatively)

The allocations of social impacts to these categories are summarised in

Table 12-6 below. Overall, only three social impacts were identified as capable of being reliably quantified and monetised for inclusion in the economic analysis (Chapter 14).

Table 12-6 Categorisation of Social Impacts

IRA code	Social Impact	Qualitative	Quantitative	Monetised
B1	Increase in agricultural production, leading to higher value land use			✓
B2	Increase in mining expansion and project certainty			✓
B3	Increase in regional employment from enhanced agricultural productivity	✓		
B4	Increase in regional employment from enhanced mining activity	✓		
B5	Opportunities for Indigenous business development and employment	✓		
B6	Increased certainty of long-term water supply to at risk urban areas			✓
B7	Enhanced confidence to invest in long term business operations and succession opportunities	✓		
B8	Increase in value and flexibility of existing water allocations	✓		
B9	Increase in tourism to the region	✓		
B10	Decrease in crime	✓		
B11	Additional demand on existing services during construction and operational phases	✓		
C1	Potential loss of areas of cultural significance	✓		
C2	Displacement of existing land owners and industry	✓		
C3	Environmental impact	✓		
C4	Demand for workers housing during construction phase may impact on regional housing affordability and supply	✓		

12.7 Impact Risk Assessment

An IRA was used to assess and determine which social impacts are material in terms of their significance and relevance to stakeholders. As per the BQ guidelines, material social impacts have been defined as those that could alter the circumstances of stakeholders. Each social impact has been assessed in the IRA matrix as displayed in Table 12-7 below.

Table 12-7 Impact Risk Assessment Matrix

		Consequence				
		Insignificant	Minor	Moderate	Major	Significant
Likelihood	Almost certain					
	Likely					
	Possible					
	Unlikely					
	Rare					
Positive Impacts		*Minimal positive change on social characteristics or values of the communities of interest and communities marginally benefit from the change*	*Short-term positive changes to social characteristics or values of the communities of interest and communities have limited benefit from the change.*	*Medium-term positive changes to social characteristics or values of the communities of interest and communities have some benefit from the change.*	*Long-term positive changes to social characteristics and values of the communities of interest or community have substantial benefit from the change.*	*Permanent positive changes to social characteristics and values of the communities of interest or community easily has benefit from the change.*
Negative Impacts		*Local, small, easily reversible change on social characteristics or values of the communities of interest or communities can easily adapt or cope with change.*	*Short-term recoverable changes to social characteristics and values of the communities of interest or community have substantial capacity to adapt and cope with change.*	*Medium-term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change.*	*Long-term recoverable changes to social characteristics and values of the communities of interest or community have limited capacity to adapt and cope with change.*	*Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt to cope with change.*

Benefits that are rated in the dark red boxes are considered to provide the greatest benefit (positive social impact), whilst benefits that score in the red boxes provide minimal benefit. For the negative social impacts, a rating in the dark red boxes is considered to provide a greater negative impact and a rating in the red boxes provides a small negative impact.

The expected likelihood and consequence for each of the social impacts has been assessed for each of the project options and these are described in Table 12-8 below.

Table 12-8 Likelihood and Consequence of Social Impacts

IRA code	Social Impact	Allocation	Assessment of Impacts
B1	Increase in agricultural production, leading to higher value land use	Option 1: almost certain/significant Option 2: rare/insignificant Option 3: rare/insignificant	As Option 1 is the only option that would provide agricultural benefits and have a material impact, this option was scored positively. The other two options would have an immaterial impact. Provided that water demands meet projections, Urannah Dam will have sufficient supply to allow for the expansion of irrigated agriculture in the Bowen Collinsville region under Option 1. It is projected that Urannah Dam should be sufficient to meet water demand for the Whitsunday and Bowen communities for the foreseeable future It is projected that the Collinsville region has over 40,000 hectares of suitable lands for irrigated agriculture, and the largest option for the Scheme could reliably irrigate approximately 10,000 to 15,000 hectares of higher value crops. Should land use change to produce higher value crops (if land owners and operators decide to), this would lead to an increase in regional economic value and potential industry growth. Such a decision would consider the suitability of soils and demand for such crops in the different farming areas. Preliminary analysis suggests that there is a financial driver to convert to the higher value crops once a secure water supply is provided. The economic analysis has assumed that an additional 11,000 hectares of agricultural land is expected to be developed under Option 1.
B2	Increase in mining expansion and project certainty	Option 1: almost certain/significant Option 2: almost certain /significant Option 3: possible /moderate	Options 1 and 2 include the development of a pipeline from Urannah to Moranbah which will increase the provision of water to mining users. This pipeline is not proposed for Option 3. The BBWSS states that one of the primary uses of water from this scheme is for mining. High priority water allocations are very likely to be required for mining uses, providing opportunity for coal mining

			developments and expansions. Mines located in Collinsville and Moranbah are currently completing advanced development plans, with a total of 11 coal projects waiting to be developed.[19] Sufficient and reliable water access could increase the likelihood of these mines being developed. Increased water supply to mining users would allow for the region's major resource companies to make long term decisions, which is crucial to a region that is highly exposed to international commodity price challenges.
B3	Increase in regional employment from enhanced agricultural productivity	Option 1: almost certain/major Option 2: unlikely/minor Option 3:unlikely/minor	If Option 1 was developed, which includes construction of an irrigation scheme to supply agricultural demand, agricultural production would likely increase, and consequently provide increased employment opportunities in the region. The Whitsunday region is currently experiencing unemployment issues and an aging population; the introduction of an additional agricultural output in the region could potentially increase employment The other two options are not expected to impact agricultural demand and productivity and therefore, the impact is expected to be immaterial.
B4	Increase in regional employment from enhanced mining activity	Option 1: almost certain/major Option 2: almost certain/major Option 3: likely/major	If water demand projections for mining align with actual water demand, mining productivity could increase, leading to an increase in employment opportunities in the region. High priority water allocations are very likely to be required for mining uses, providing opportunity for coal mining developments and expansion. Given the anticipated increase in mining activity if any of the options were to be developed, regional employment opportunities would directly increase and these options have been rated accordingly. Potential employment opportunities could be found in the Collinsville and Moranbah mines that are currently completing advanced development plans, with a total of eleven coal projects waiting to be developed.
B5	Opportunities for Indigenous business development and employment	Option 1: likely/moderate Option 2: possible /minor Option 3: possible/minor	Potential urban, industrial, agricultural mining growth provide an investment opportunity for both Indigenous business development and employment. The growth and vibrancy of mining in the Bowen Basin region continues to offer opportunities to increase Indigenous employment and economic participation, in particular within the Coal Seam Gas developments. These

[19] Bowen Collinsville Enterprise Inc, Strategic Business Case, 2018

			developments will place additional demand on the available Indigenous labour pool. Additionally, employment opportunities could become available in the short term (construction) and long term (operational) phases of constructing Urannah Dam. All options have the same potential to generate this benefit as employment and business development opportunities would result from any of the three options, however, as Option 3 is a larger project, it would be expected to have a greater impact.
B6	Increased certainty of long-term water supply to at risk urban areas	Option 1: almost certain/significant Option 2: almost certain/significant Option 3: almost certain/significant	All three dam options include providing water to the Proserpine region for urban water supply. The water storage will be available to 'at risk' urban areas via a connecting pipeline to Proserpine via the Peter Faust Dam (Whitsundays) catchment, providing additional water supply for residents and tourists in the region. It is anticipated that the total Whitsunday population will increase from approximately 35,000 in 2016 to over 46,000 people by 2041[20], significantly increasing general water demand and high priority allocation demand. The Peter Faust Dam at Proserpine is 96 per cent allocated and therefore, additional allocations need to be considered to improve the security and certainty of long-term water supply.
B7	Enhanced confidence to invest in long term business operations and succession opportunities	Option 1: unlikely/moderate Option 2: unlikely/moderate Option 3: unlikely/moderate	An increase in infrastructure and agricultural productivity should enhance business confidence given the enhanced reliability of output streams. However, certainty of long-term business investment is not possible. It cannot be determined with confidence that the future level of business investment will increase, as it is not known with certainty that productivity levels and the output of mining and agricultural activities will reach maximum capacity. If near maximum output potential is reached, confidence to invest in business operations would be expected to increase, in turn, increasing regional economic value. Therefore, the likelihood and consequence of this social impact has been scored moderately for all options.
B8	Increase in value and flexibility of existing water allocations	Option 1: possible /minor Option 2: unlikely/	Greater agricultural and mining productivity would be expected lead to higher water demand in the region, potentially increasing the value of water allocations. If

20 Queensland Government Statistician's Office, 2019, Projected population, by local government area, Queensland, 2016 to 2041, Accessed at: http://www.qgso.qld.gov.au/subjects/demography/population-projections/tables/proj-pop-lga-qld/index.php

		minor Option 3: unlikely/ minor	mining expansion or higher value crops are desirable in the region, demand for high priority water allocations would specifically increase, increasing the value of existing water allocations. The increase in value and flexibility of water allocations is based on the assumption that high priority water demand will increase substantially greater than the high priority water allocations offered by the Scheme's supply. Therefore, the impact of this benefit is expected to be immaterial under all three options. Option 1 would have a slightly greater impact than the other two options as it will provide water to urban, mining and agriculture, whereas the other options would not supply agricultural demand.
B9	Increase in tourism to the region	Option 1: possible /major Option 2: possible /major Option 3: possible /major.	All options were rated consistently as all three options involve the development of the Dam. This has the potential to increase tourism by attracting more tourists to the region and increasing tourists' average length of stays, by offering a boating use area, water sports area and camping grounds.
B10	Decrease in crime	Option 1: possible/moderate Option 2: possible/minor Option 3: possible/minor	A lack of economic opportunities can lead to an increase in the rate of crime. However, as the Dam will generate employment and economic opportunities within the region, the crime rate is expected to decrease. As Option 1 is the largest project, the anticipated benefit for this project is expected to be greater than the other three options and has been scored to have a slightly greater impact than the other options.
B11	Additional demand on existing services during construction and operational phases	Option 1: possible /minor Option 2: possible /minor Option 3: possible /minor	In a rural region, the services demanded during the construction and operational phases of Urannah Dam would provide greatest impact to specific businesses, such as hospitality, tourism, retail and trade. The specific sectors identified above that are not functioning at full capacity would benefit from the additional demand, and those struggling services / businesses in the region could significantly benefit from the increase in potential business. The additional demand may lead to new investment opportunities in the region or the expansion of existing service lines. There is the potential that an increased demand for businesses operating at full capacity would place increased pressure on employees, and these businesses might not be able to employ additional workers with the necessary qualifications to meet demand requirements. However, as construction for the Dam will be temporary

			and the long-term operational demands will be minimal (operating a dam is far less resource intensive), the impact of this social impact is not anticipated to be material for any of the options.
C1	Potential loss of areas of cultural significance	Option 1: possible/moderate Option 2: possible/moderate Option 3: possible/moderate	Indigenous groups have land tenure and reside within the proposed development area. UPA are the owners of the land and will continue to be actively engaged throughout Urannah Dam's development. UPA is supportive of the Project and should be consulted with to overcome any issues that may arise. If the Project was to proceed, it would be required to complete a cultural heritage field assessment of the entire project area, ensuring that consultations with local landholders took place to identify and manage potential site issues. The Project will need to establish a Cultural Heritage Management Plan, including management of early works such as geotechnical investigations. All of the options would cause a moderate impact and have been assessed accordingly.
C2	Displacement of existing land owners and industry	Option 1: unlikely/ minor Option 2: unlikely/ minor Option 3: unlikely/ minor	The proposed site location for Urannah Dam is a greenfield site in a deep valley, which is currently used predominantly only for grazing purposes. Initiation grounds, among other cultural heritage values of Traditional Owners, are located within the proposed Dam site, however, the Birri Gubba people have been actively engaged throughout the proposal to date and support the Dam proposal, together with the associated employment opportunities that it is expected to generate for their people. Therefore, the impact at all of the sites would be immaterial
C3	Environmental impact	Option 1: likely/ minor Option 2: likely/ minor Option 3: likely/ minor	The construction of the Dam has the potential to cause negative environmental impacts. It could impact threatened flora and fauna, including the habitat of the native Irwin's Turtle, it has the potential to inundate 10,500 hectares of grazing land and Indigenous cultural sites, and it could increase sediment and agricultural pollutants entering the Great Barrier Reef. To ensure that adverse economic and financial impacts are avoided, new water supply infrastructure is required to comply with Queensland Treasury Guidelines and the Council of Australian Governments (COAG) Water Resource Policy Principles. Additionally, environmental impacts have been adequately incorporated within the

			construction and operating costs of existing water supply infrastructure. All three options have been scored moderately.
C4	Demand for workers housing during construction phase may impact on regional housing affordability and supply	Option 1: unlikely/ minor Option 2: unlikely/ minor Option 3: unlikely/ minor	It is projected that a short-term influx of construction workers is not likely to materially influence the housing market in the region over the longer term. In the short term, if a large proportion of construction workers were not local, it could contribute to reduced housing affordability and supply issues, given the short-term nature of the construction program. Labourers, technicians and trade workers, and machinery operators and drivers, make up 53.6 per cent of regional employment, therefore it is likely that a large percentage of employees during the construction period will be able to be sourced locally. Therefore, these workers would already have permanent housing in the area, and would remain largely unaffected by, and not contribute to, the possible change in housing affordability. The impact on housing affordability and supply is not expected to be material for any of the options.

This assessment has been summarised for each of the sites, and is illustrated in Table 12-9 below for Option 1, Table 12-10 for Option 2 and Table 12-11 for Option 3.

Table 12-9 Option 1

		Consequence				
		Insignificant	Minor	Moderate	Major	Significant
Likelihood	Almost certain				B3, B4	B1, B2, B6
	Likely		C3	B5		
	Possible		B8, B11	C1, B10	B9	
	Unlikely		C2, C4	B7		
	Rare					

Table 12-10 Option 2

		Consequence				
		Insignificant	Minor	Moderate	Major	Significant
Likelihood	Almost certain				B4	B2, B6
	Likely		C3			
	Possible		B5, B10, B11	C1	B9	
	Unlikely		B3, B8, C2, C4	B7		
	Rare	B1				

Table 12-11 Option 3

		Consequence				
		Insignificant	Minor	Moderate	Major	Significant
Likelihood	Almost certain					B6
	Likely		C3		B4	
	Possible		B5, B10, B11	B2, C1	B9	
	Unlikely		B3, B8, C2, C4	B7		
	Rare	B1				

12.8 Summary

Based on the assessment of the social impacts in there were eleven positive social impacts (benefits) and four negative social impacts (costs).

As the positive social impacts outweigh the negative impacts, it can be concluded that the Urannah Dam is likely to bring significant social benefits to the Bowen Basin community and existing industries and businesses in the region. To realise the full benefit of these positive social impacts they should be enhanced, in future phases of the project, through a range of measures such as targeted and authentic engagement with the Traditional Owners.

13 ENVIRONMENT

13.1 Chapter summary and conclusions

A preliminary environmental assessment was undertaken for the three options shortlisted through the PBC assessment process, all of which include a dam at Urannah.

The assessment did not consider the impact of proposed pipelines including duplicating the Burdekin to Moranbah pipeline, which is included in Shortlist Option 3.

The development of a new dam and the consequential agricultural expansion within a Great Barrier Reef catchment may require approval under the *Environmental Protection and Biodiversity Conservation Act 1999* (**EPBC Act**).

An environmental impact statement (**EIS**) and environmental offsets to the value of $15.2 million are likely to be required.

The likely impacts of all options include:

- reduced habitat due to vegetation clearing
- changes to surface water quality and potentially, groundwater
- altered hydrology, impacting aquatic flora and fauna
- creation of barriers to movement of aquatic life
- impacts to cultural heritage.

An estimated 2,763 hectares of 'of concern' regional ecosystems and 3,336 hectares of 'least concern' regional ecosystems would be inundated by all dam options. Matters of state environmental significance (**MSES**) may also be affected downstream.

Native title is held over a portion of the dam site and the proposed agricultural irrigation precinct. A native title claim has been lodged over the remaining portion of the dam site. Additional assessment of Aboriginal cultural heritage is required.

13.2 Purpose

The purpose of this chapter is to present the initial findings of environmental impacts that relate to each of the shortlisted options. The first part of the chapter provides an environmental profile for the region to compare to each of the shortlisted options. The remaining sections address the environmental assessment of each option, including any potential environmental impacts.

13.3 Establishing the Environmental Base Case

The shortlisted options occur in the Burdekin region in Central Queensland, predominantly the Bowen sub-catchments of Broken, Bowen and Bogie Rivers. The proposed project is located in the Mackay Hinterland (36km AMTD) on the Broken River downstream of the junction with Urannah Creek approximately 64km South East of Collinsville and 63km South West of Proserpine. The site is in the southern section of the Whitsunday Local Government Area bordering Mackay Regional Council and information about each region will be included. It is noted that this chapter of the PBC does not consider the requirements of the proposed duplicated pipelines.

There are a number of national parks in the area and the dam is proposed to be located on Urannah Station, which is located next to Eungella National Park and Macartney State Forest.

The existing environment of the immediate region in relation to planning, land use, topography, geology and soils, water quality, hydrology, flora and fauna, climate, noise and vibration, landscape and amenity and cultural heritage are outlined below.

13.3.1 Planning and Land Use

Land use in the Bowen catchments includes extensive cattle grazing of native pastures, coal mining and limited urban development, generally around mines and agriculture. The Burdekin Falls Dam has provided opportunities to support expansion and diversification, however there are a number of constraints that exist and further planning around water availability is needed.

Regional goals for the area include securing water for the environment, communities and industry, while ensuring the Great Barrier Reef (**GBR**), watercourses, wetlands and marine ecosystems are protected.[21]

13.3.2 Topography, Geology and Soils

The Burdekin region topography is variable including mountain ranges, low lying hills and flood plains spread across 134,000 square metres. The Bowen Broken Bogie catchments receive a large amount of rainfall and there are steep, thickly forested hills. The Bowen and Broken Rivers are tributaries of the Burdekin River. They start 50 km from the coast and combine to flow north-west for 100 km. The Broken River flows from Mount Bruce, through a valley to Eungella Dam and then joins the Bowen River.

The graph below shows the variable topography in the region and reflects the potential for gravity fed water and reduced energy requirements to pump water around the water system.

[21] NQ Dry Tropics, 2016, *Burdekin Dry Tropics Natural Resource Management Plan*

Figure 13-1 Topography of the region

The confluence of the Broken and Bowen Rivers is approximately 35 km southeast of Collinsville. The Broken River has a total catchment area of approximately 2,300 km2 and drains some of the high rainfall country in the Clarke Range to the northeast, and the lower rainfall country in the Broken River Range to the southwest.

The river flows for about 113 km in a generally north westerly direction. Approximately 8 km upstream of its confluence with the Bowen River, the Broken River cuts through the Broken River Range and enters relatively mature, gently undulating country. Upstream of this point the topography is much younger, mountainous and highly dissected.

13.3.2.1 Regional geology

The Broken River is generally parallel to the eastern boundary of the Bowen Basin. The oldest rocks on the eastern limb of this basin are the lower Bowen Volcanics of Lower Permian age, and these are exposed for approximately seven kilometres along the Broken River upstream of its confluence with the Bowen River.

The rocks belong to the Carboniferous to Mesozoic aged Urannah Igneous Complex, consisting of various intrusions, including diorite, granodiorite, adamellite and granite, with some basic to ultra-basic components, all intruded by several generations of acid to basic dykes. Most dykes strike North-North-West with steep to vertical dips, but some strike normal to that direction.[22]

[22] SMEC, 2018, *Geology Report: Urannah Dam Feasibility Study*

13.3.2.2 Soils

The soils in the Burdekin are varied, with extensive areas of moderately productive but fairly erodible red duplex soils, widespread highly productive black and red clays derived from basalt, and large areas of poor to moderately fertile sands and earths.[23]

Large areas also have highly erodible dispersive soils. The Bowen sub-catchments have the highest rate of erosion due to exposed subsoils, indicating a significant loss of topsoil into the waterways as indicated by tracing data.[24]

13.3.3 Water Quality

The Burdekin basin has a history of agricultural and grazing use, resulting in almost the entire catchment area being impacted by land clearing and agriculture to some degree. The Burdekin Region contains five river basins (Black, Ross, Burdekin, Haughton and Don basins) and nine major catchments (Black, Ross, Upper Burdekin, Cape Campaspe, Belyando, Suttor, Bowen Bogie Broken, Lower Burdekin and Don). Extensive grazing of native pastures is the dominant land use (90 per cent), with dryland cropping and mining in the upper catchments and areas of sugarcane, horticulture and urban centres in the coastal areas.[25]

The Burdekin Region Water Quality Improvement Plan 2016 (**WQIP**) is a strategy developed in a partnership between NQ Dry Tropics, and the Australian and Queensland Governments. The WQIP aims to improve the water quality in the Burdekin region (and ultimately the GBR) by reducing the loss of sediment, nutrients and pesticides from the Burdekin catchments. It recognises that for agricultural lands, sediment run-off, nutrients, and pesticides affect productivity and contribute to environmental degradation.

In the Burdekin Basin, major sources of sediment appear to be affecting water quality, with the sediment originating from hill slope erosion along with gully and stream bank erosion. The WQIP notes that the bulk of fine sediment delivered from the Burdekin Basin to the GBR is derived from a small portion of the basin, primarily the Bowen, Broken, Bogie and Upper Burdekin catchments, with a large proportion of this load from grazing lands.

The WQIP estimates the annual average load from grazing lands from the region that could be taken up by the GBR is

- 2.8 million tonnes of Total Suspended Sediments (**TSS**)
- 2,322 tonnes of Particulate Nitrogen (**PN**)
- 2,173 tonnes of Particulate Phosphorus (**PP**)

13.3.3.1 Surface Water

Suspended sediments and associated particulate nutrients are a major contributor to water quality issues in regions dominated by grazing. It is estimated that The Bowen Broken Bogie catchment contributes 46 per cent of the TSS load from grazing lands (1.3 million tonnes/year).[26]

Monitoring and modelling indicates that the bulk of fine sediment delivered to the Great Barrier Reef from the Burdekin comes from the Bowen Broken Bogie and Upper Burdekin catchments, due to the high levels of grazing in those regions. The Burdekin Falls Dam traps a large portion of the course

[23] NQ Dry Tropics, 2016, *Burdekin Dry Tropics Natural Resource Management Plan*
[24] Lewis et al, 2015, *Burdekin sediment story*
[25] NQ Dry Tropics, 2016, *Burdekin Region Water Quality Improvement Plan*
[26] NQ Dry Tropics, 2016, *Burdekin Region Water Quality Improvement Plan*

particles and some of the fine particles, however the Bowen Broken Bogie catchments contribute the highest loads of fine material due to gully erosion.

13.3.3.2 Groundwater

Accessible information on groundwater in the vicinity of the proposed inundation area, and the Broken River sub-catchment, is limited. Past assessment of groundwater in the Bowen sub-basin is generally localised to irrigation, mining, or domestic use areas.

The Bureau of Meteorology's Groundwater Dependant Ecosystem (**GDE**) Atlas identifies the Broken River and Urannah Creek as having high potential for terrestrial and aquatic GDEs in the inundation area. Massey Creek also has a high potential for aquatic GDEs. The GDE Atlas does not identify any subterranean GDEs in the inundation area.

13.3.4 Hydrology

The Burdekin Basin is the second-largest river basin in Australia; it has the largest mean annual discharge (8,327,681 ML mean annual flow at Clare gauge 1976–2016) and flows into the GBR.

The project area is located in the Burdekin Water Resource Plan Area, particularly the Bowen River, Broken River and Pelican Creek sub-catchments. The Broken River sub-catchment represents seven per cent of the Burdekin Basin and has an average annual flow of 942,374 ML. Currently only 5% of the flows in the Bowen/Broken River sub-catchment are diverted. Streamflow is highly seasonal, with most flow occurring during a three-month period, from January to March. Flows also vary considerably from year to year, and high flows may be followed by extended dry periods.

During the wet season (December to April), the Broken River headwaters receive annual rainfall of between 1,300-2,000 mm. However, the river is impounded by the Eungella Dam upstream of the Urannah Dam site. Eungella Dam combines with the tributaries from the east to form an almost permanently flowing clear-water system in the Broken River. This system also drives the Bowen River catchment.

The waterways in the basin vary from largely sandy, dry ephemeral creek systems to permanently flowing clear-water rivers and creeks originating in mountain rainforest.

13.3.5 Flora and Fauna

There are no high-risk flora trigger areas mapped in the vicinity of the dam inundation area, but some are mapped within the agricultural development area. The Project will affect vegetation managed under the *Vegetation Management Act 1999*.

MSES that may occur in the area downstream of the dam site and that may be affected by the construction of the dam include:

- Category B, C, and R regulated vegetation
- regulated vegetation (defined watercourse)
- wildlife habitat (threatened and special least concern animal)
- regulated vegetation (essential habitat)

There are also some high-risk areas on the flora survey trigger map, wetlands of high ecological significance, and wetland protection areas mapped in the downstream area. All but a very small portion of the downstream area is currently classified as being of high or medium riverine conservation significance. There are no legally-secured offset areas in the downstream area.

The downstream area includes a number of areas designated as Class A agricultural land under the *Regional Planning Interests Act 2014* and some areas designated as Class B agricultural land.

Three federally listed Threatened Ecological Communities (**TEC**) were identified as potentially occurring in the area:

- Brigalow (*Acacia harpophylla* dominant and codominant) – three of the endangered regional ecosystems that comprise this TEC are present in the irrigation area
- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin – one of the endangered regional ecosystems that correspond with this TEC is present in the irrigation area
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

Twenty-three threatened species listed in the EPBC Act may occur in the area with eight bird species, one frog species, five mammal species, two reptile species, and seven plant species. There are also fifteen listed migratory birds that may use the area. The macroinvertebrate fauna of the Broken River sub-catchment has generally been poorly studied, but the catchment has high diversity overall. More than 100 families have been recorded, likely representing several hundred species.

13.3.6 Climate

The Burdekin area has tropical sub-humid climates with high temperatures and a distinct wet and dry season[27] and the area is affected by variable inter-annual rainfall, with droughts and tropical cyclones (and associated flooding) approximately once every four years.[28]

The Burdekin region has an average annual rainfall range from 500mm to 1500mm. The higher altitude coastal ranges have wet tropical climate and rainfall is distributed across the seasons. Further inland the rainfall gets progressively lower and becomes more variable.

Table 13-1 below shows the average rainfall and temperatures for the region, by major centres.

Table 13-1 Average Rainfall

Locality	Altitude (m)	Average annual rainfall (mm)	Average temperature range (°C)	
			January	July
Bowen	6	988	24-31.5	14.2-24.3
Collinsville	196	674	22-33.5	9.1-25.1
Eungella National Park	704	1699	22.7-33	11.6-25.8
Gatton Vale	130	652	22-33.5	9.1-25.1
Mackay	5	1349	23.1-30.4	11.4-22.7
Proserpine	136	1146	22.5-32	11.5-23.5

Source: Bureau of Meteorology

13.3.7 Noise and Vibration

Within the study area there are a range of land uses that generate noise. Noise sources are generally from mining and agricultural uses and traffic. Within areas more remote from permanent man-made

[27] Inglis & Howell, 2009, *Aquatic Conservation Assessments: riverine wetlands of the Great Barrier Reef*
[28] Australian Centre for Tropical Freshwater Research, 2002, *Burdekin Basin WRP Phase 1: Riparian and Aquatic Vegetation*

noise sources, the only ongoing noise present would be wind blowing over vegetation and noises from insects, birds and other local wildlife.

13.3.8 Landscape and Visual Amenity

The landscape within the Burdekin basin includes grazing lands, native forests, mining and industry with limited urban centres. The native forests on state lands are either managed for forestry, recreation and/or quarry material, including sand, gravel, road base, crushed aggregate and landscaping rock.

The immediate region supports a substantial mining industry, which produces coal, gold, silver and copper. There are about 330 granted mining leases in the region. Mining operations have occurred for the last 150 years with around 2,472 abandoned mine sites in the region.[29]

13.3.9 Cultural Heritage

The assessment of cultural heritage was based on the review of the nature of the proposed activity, past land use, consideration of known Aboriginal cultural heritage and archaeological and historical evidence located within and in proximity to the proposed project area.

Areas of heritage interest include

- Strathmore Homestead (QHR 602683) at the intersection of Strathmore Road and Myuna Road, Springlands. The homestead and associated pastoral complex represent the evolution of a pastoral station through the 19th and 20th Centuries. The homestead was established in 1862 and the original slab hut remains in use as staff quarters.
- Bowen River Hotel (QHR 600042) on Strathmore Road, just south of the Bowen River, at Mount Wyatt. The hotel, also known as the Heidelberg Inn, was constructed in 1865. The hotel is one of the last standing country hotels constructed using ‘bush-carpentry’ skills.

13.3.9.1 Dam and inundation area

Native title over the western portion of Urannah Station has been determined in favour of the Birriah People. The Wiri People have lodged a native claim over the eastern portion.

There are no recorded cultural heritage sites or registered places with in the project area.[30] There are high risk Landscape Features present and such features commonly identified as places of importance to Aboriginal people.

13.3.9.2 Proposed Irrigation Area

The proposed downstream irrigation area is within the area of the Birriah People, and the cultural heritage body for the area is Birriah Cultural Heritage Services Pty Ltd. There are approximately 3,000 previously recorded Aboriginal cultural heritage sites or registered places identified in the project area.[31] There are also landscape features present.

13.4 Preliminary Environmental Assessment of Shortlist Option 1

Shortlist Option 1 includes the construction of a dam with the capacity of 150,000 ML/year with an FSL of 290m AHD and associated pipelines and irrigated agricultural area on the Bowen River. The proposed dam site is approximately 3.5 km downstream of the confluence between Urannah Creek

[29] Queensland Department of Natural Resources and Mines, 2015
[30] 2018, DATSIP search #41136
[31] 2018, DATSIP searches # 41139; #41142; #41146; #41147; #41148; #41149; #41150

and the Broken River. It straddles the Broken and Bowen River sub-catchments in the Bowen River sub-basin of the Burdekin River Basin.

The Urannah Dam inundation area will primarily affect Urannah Creek, the Broken River and Dicks Creek. Sections of Massey Creek and Ernest Creek will also be affected by the proposed inundation, as will a number of lower order streams and creeks. The irrigation area is contained within the Bowen River sub-basin, in the Brigalow Belt North, before joining the Burdekin River approximately 160 km downstream of the proposed dam site.

Thirty threatened species and three threatened ecological communities may occur in the area. These include eight bird species, one frog species, seven mammal species, three reptile species, one shark species (freshwater sawfish – *Pristis pristis*), and ten plant species. There are no world heritage properties, national heritage places, or wetlands of international importance and it is not within the Great Barrier Reef Marine Park or a Commonwealth marine park. There are 18 listed migratory species, including saltwater crocodile (*Crocodylus porosus*) and the freshwater sawfish, that may also use the inundation area.

13.4.1 Environmental Issues Associated with Shortlist Option 1

Key environmental issues identified for the Project include:

- All land in the proposed dam inundation area is currently used for grazing in native vegetation. Approximately 80 per cent of the Broken River sub-catchment is currently designated for conservation[32] and classified as a Matter of State Environmental Significance (**MSES**) protected area.
- An estimated 2,763 ha of 'of concern' regional ecosystems and 3,336 ha of 'least concern' regional ecosystems, would be inundated by the dam proposed in Shortlist Option 1. Additional vegetation would be cleared for the construction of the dam wall and accompanying infrastructure. This has the potential to remove or affect the habitats of endangered, vulnerable, and near-threatened terrestrial species. While some of these species may be highly mobile (such as birds), others do not travel significant distances (such as frogs, reptiles, and some mammals). Any proposed development would require management and mitigation measures.
- No areas of endangered regional ecosystems or any TECs would be affected by the proposed dam or its inundation area. However three TECs may occur in the irrigation area along with existence of three nationally important wetlands that will need to be assessed before agricultural development can proceed.
- The project needs to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures.
- Ongoing development and expansion of the development footprint in the region (such as changing grazing land to intensive agriculture, or industrial or urban development) may lead to a decline in water quality. New agricultural expansion must begin at B-class practice (best practice) to minimise the risk of adding to the problem.
- Consideration of secondary or consequential impacts such as changes to water quality may arise from increased areas of irrigated land within the catchment.
- It is predicted that the Urannah Dam Project would create broad social and economic value through irrigated agriculture in the Collinsville and Bowen areas, along with the support provided to mining and industrial projects across the region. This encourages existing and new agricultural industries and opportunities in the region.
- Urannah Station is held by Urannah Properties Association (**UPA**) as registered lessees, with the lease being granted by the Indigenous Land Corporation (**ILC**) with conditions. UPA is

[32] NQ Dry Tropics, 2015, *Broken River: Sub catchments*

unable to deal with the land without the consent of the ILC. Any disposal of the land must be surrendered back to the ILC to be transferred rather than straight to a third party.

- Construction of the dam and related agricultural infrastructure area will require acquisition of land with various tenures, and exploration and mining leases.

13.4.2 Legislation and Permit Requirements

Key approvals likely to be required for the proposed Project include, but are not limited to:

- an *Environment Protection and Biodiversity Act 1999* Referral
- an Environmental Impact Statement (**EIS**), if declared a coordinated project under the *State Development and Public Works Organisation Act 1971*. An application may be made for the Project to be declared a 'coordinated project' to allow the preparation of an EIS under the SDPWO Act, largely due to the scale and complexity of potential impacts and potential approvals.
- development approvals for matters identified in the relevant planning schemes as well as matters of state significance, including material change of use, operational works (eg referable dam, taking or interfering with water, waterway barrier works, vegetation clearing, high impact earthworks) and building works. An amendment to the Planning Scheme may be required for land use changes associated with the inundation area and for the transportation of water.
- an Environmental Authority for a prescribed Environmentally Relevant Activities
- an amendment to the Water Plan (Burdekin Basin) 2007 or inclusion of a specified allocation in the revised plan

13.4.2.1 Environmental Offsets

The estimate of potential offset costs has been calculated for the Urannah Dam inundation area with a wall height of 290m AHD, using the DES Financial Offset Settlement Calculator. The estimate is presented in Table 13-2.

Table 13-2 Estimate of Environmental Offset Costs

Offset Category	Type	Impact Area	Estimated Offset Area
MSES			
Regulated vegetation	Endangered RE	None*	-
	Of concern RE	2,763 ha*	11,052 ha
	Wetland RE	None*	-
	Essential habitat	None*	-
	Watercourse RE	701 ha^	2,806 ha
Connectivity areas	-	Unable to determine at this stage of assessment	-
Wetlands and watercourses	Wetland in wetland protection area	None*	-
	HES wetlands	None*	-

Designated precincts of strategic environmental areas	-	None#	-
Protected wildlife habitat	Habitat for threatened plants (flora survey trigger map)	None#	-
	Habitat for threatened plants	Unable to determine at this stage of assessment	-
	Koala habitat (south-east Queensland)	None	-
	Habitat for threatened animals	None*	-
Protected areas	-	None#	-
Fish habitat areas	-	None#	-
Waterway providing for fish passage	-	Yes	Aquatic fauna passage costed in dam design
Marine plants	-	None*	-
Legally secured offset areas	-	None*	-
MNES			
Listed TECs and threatened species	-	None*	Included in of concern RE
Migratory species protected under international agreements	-	None*	-
Wetlands of international importance	-	None#	-
World heritage properties	-	None#	-
National heritage places	-	None#	-

Commonwealth marine areas	-	None[#]	-
Great Barrier Reef Marine Park	-	None[#]	-
TOTAL cost estimate			**$15,185,767**

* Based on publicly available records reported on in this report. Further detailed field studies may reveal the presence/greater impact of this offset matter

^ Based on coarse assessment of stream lengths inundated by FSL

[#] Direct impacts only. Further detailed assessment may identify significant residual impacts to this offset matter as a result of indirect and consequential actions

13.4.3 Planning and Land Use

The land to be inundated by the development of Urannah Dam is held by UPA. The land was transferred to UPA from the Indigenous Land Corporation in 1999 and is held as a leasehold title, consisting of a rolling term lease which expires in 2047. Land likely to be developed for irrigated agriculture includes approximately 28,600 hectares in the Lower Broken River Catchment that stretches south west of the town of Collinsville. The development area will affect a total of 23 land parcels of which 17 are lands lease tenures and 6 are freehold tenures.

All land in the downstream area is mapped as a category 4 high-value agriculture land suitability area. Most of the proposed irrigation area is within the Central Highlands Isaac Western Strategic Cropping Area, with a small area in the Mackay Whitsunday Coastal Queensland area. The area includes Class A and Class B agricultural land. An amendment to the Planning Scheme may be required for land use changes associated with the inundation area and for the transportation of water.

The land expected to be inundated by the Urannah Dam is currently predominantly used for dryland cattle grazing. More than 80% of the Bowen Broken Bogie catchment is grazing land.[33] The area that would be potentially developed for irrigated agriculture adjacent the downstream Bowen River currently supports dryland cattle grazing. The affected land is predominantly categorised as being low to medium pasture production potential (1500-3500kg/ha). There will be a loss of grazing land due to the project and compatibility with existing and future land use will be assessed as part of an EIS.

13.4.4 Property Impacts

Land within the footprint of the proposed inundation area for the dam will require acquisition. As discussed, the land tenure is a leasehold title that contains conditions of transfer. UPA cannot dispose of an interest in the land without first obtaining ILC consent, and the disposal must be surrendered back to ILC on terms that they negotiate between themselves. The land cannot be transferred straight to a third party.

[33] NQ Dry Tropics, 2016, *Burdekin Dry Tropics Natural Resource Management Plan*

The development of an additional Dam in the region will increase water security generally in the area due to the reliability issues of Eungella Dam. The inclusion of 150,000 ML of water within the water system per year will assist with regional goals around water security and provision of water to industry.

Shortlist Option 1 includes the development of an irrigated agricultural system and would require additional infrastructure to be placed on the land adjacent the Bowen River along the proposed irrigated agriculture precinct. Expansion of the agriculture industry in the Collinsville region is consistent with the goals of diversification of industry set by the Mackay Regional Council.

13.4.5 Water Quality

The WQIP concludes that ongoing development and expansion of the development footprint in the region (such as changing grazing land to intensive agriculture, or industrial or urban development) will lead to a decline in water quality. New agricultural expansion must begin at B-class practice (best practice) to minimise the risk of adding to the problem.

A previous assessment of dams in the Burdekin Basin noted that as the proposed Urannah Dam site is high in the catchment and the surrounding land is in good condition, erosion was unlikely to affect water clarity and the dam impoundment would likely be clear.[34]

Model results[35] for the Broken River sub-catchment are summarised as follows:

Sub-catchment modelled area	2,193 square km
Source contributions	Hillslope: 83% Gully: 6% Streambank: 11%
Area of sub-catchment with <50% ground cover	86 square km or 4% of sub-catchment
Hillslope sediment supply	853 kg/ha/yr
Total suspended sediment (flow weighted) supply	224 kt/yr
Total suspended sediment supply (flow weighted; normalised to area)	1,023kg/ha/yr
Total suspended sediment end-of-sub-catchment (flow weighted) yield	215 kt/yr
Event Mean Concentration (EMC - flow weighted)	228 mg/L
Mean Annual Flow	942,374 ML

[34] Australian Centre for Tropical Freshwater Research, 1998, *Burdekin Catchment Study*
[35] NQ Dry Tropics 2018, *Sednet Modelling of Water Quality: Broken River*

Model results[36] for the Bowen River sub-catchment are summarised as follows:

Sub-catchment modelled area	1,227 square km
Source contributions	Hillslope: 47% Gully: 29% Streambank: 24%
Area of sub-catchment with <50% ground cover	445 square km or 36% of sub-catchment
Hillslope sediment supply	665 kg/ha/yr
Total suspended sediment (flow weighted) supply	173 kt/yr
Total suspended sediment supply (flow weighted; normalised to area)	1,414kg/ha/yr
Mean Annual Flow	1,618,299 ML

Any interruption of water flow in waterways has the potential to significantly impact on water quality. The proposed dam project will undertake ecologically sustainable planning to protect the health of the natural ecosystems.

13.4.5.1 Surface Water

The primary water quality issues identified in the basin are sediment loads and particulate nutrients. As the delivery of water for irrigation is one of the proposed purposes of the Project, an assessment of the consequential impacts on water quality in the Bowen River sub-catchment will be required as the Project progresses and for an EIS.

13.4.5.2 Groundwater

There are no registered groundwater monitoring bores in the vicinity of Urannah Dam and the proposed inundation area, nor is it within a groundwater management area. Further assessment of potential impacts to groundwater quality and quantity, as well as GDEs, will be required if the Project progresses. This may require the installation of monitoring bores.

In a scoping study of water infrastructure options and related issues for the region, the former Department of Natural Resources noted that the Bowen and Broken catchments have a very limited potential for groundwater sourced irrigation.[37]

Before undertaking irrigated agriculture in these areas, landholders may be required to assess potential impacts to groundwater quality and quantity, as well as GDEs. This includes consideration of the potential for salinity associated with irrigation. Some areas along the Bowen River have been classified as having a medium salinity hazard, though the mapping is not sufficiently detailed to support decisions at a property level[38]. Salinity associated with irrigation practices can contribute to a

[36] NQ Dry Tropics 2018, *Sednet Modelling of Water Quality: Bowen River*
[37] Australian Centre for Tropical Freshwater Research, 1999, *An initial environmental assessment of water Infrastructure options in the Burdekin Catchment*
[38] Roth et al, 2002, *Overview of key Natural Resource Management Issues in the Burdekin Basin*,

rising water table, but may also be related to leaky water delivery systems and barriers to flow such as weirs.[39]

13.4.6 Topography, Geology and Soils

The topography of the region supports a gravity fed water supply and the potential for reduced energy requirements to pump water to Peter Faust Dam and Eungella Dam.

Land clearing, increased pressure on the wetlands to perform filtering ecosystem functions and increased water flow could affect erosion in the region. An EIS would be required to analyse and assess the impact of the dam and related water infrastructure.

13.4.7 Hydrology

Urannah Dam and its proposed inundation area are in the Broken River sub-catchment of the Bowen sub-basin. The Broken River, which is the main river that will run through the proposed Urannah Dam, joins the Bowen River at Bowen Weir, approximately 35.6 km downstream of the dam site. The Bowen River joins the Burdekin River at Blue Valley Weir and the Burdekin River then flows north and east into the GBR.

The Broken River and its tributaries are major contributors to the flow of water and water quality into the Bowen and lower Burdekin rivers. There is a substantial rainfall gradient in the sub-catchment, from more than 4,000 mm a year at the top of Clarke Range (which encompasses Eungella National Park and is upstream of Urannah Dam), to less than 600 mm a year near the junction of the Bowen and Broken Rivers. The mean annual rainfall at Urannah is 690 mm.[40]

In the Birralee – Pelican Aggregation, the mean annual discharge at the downstream end of the major waterhole (Myuna stream gauge) is 820,694 ML, with highest monthly discharges occurring in January, February, March and April, the lowest in September, October and November.[41]

The construction of Urannah Dam and subsequent supply of water for irrigation on the Bowen and Broken Rivers would have a direct impact on the regional hydrology and detailed modelling and assessment of these impacts will be conducted as the Project progresses.

13.4.8 Flora and Fauna

13.4.8.1 Flora

Current mapping indicates that much of the inundation area includes MSES regulated vegetation that comprises category B, C and R regulated vegetation and regulated vegetation (defined watercourse) (see Figure 13-2). An estimated 6,000 ha of remnant vegetation would be inundated with a dam wall of 292m AHD. The regional ecosystems that would be directly affected by the inundation area include 'of concern' and 'least concern' regional ecosystems (see Figure 13-3).

The inundation area along Urannah Creek, Dicks Creek, Ernest Creek and Massey Creek is also mapped as being of very high riverine conservation significance, and the inundation area along the Broken River is mapped as being of high riverine conservation significance. This is because these creeks and rivers form part of the Broken River, Urannah Creek and Massey Creek Aggregation (see

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[39] Roth et al, 2002, *Overview of key Natural Resource Management Issues in the Burdekin Basin*
[40] Department of Environment and Energy, 2010, *Directory of Important Wetlands*
[41] Department of Environment and Energy, 2010, *Directory of Important Wetlands*

Figure 13-4) which is currently listed in the Directory of Nationally Important Wetlands and includes some of the least disturbed examples of riverine wetland in Central Queensland. The proposed development of a dam in this area will likely need to demonstrate consideration of options to minimise potential impacts on the Aggregation through proposed management and mitigation measures.

A total of 15 threatened plant species (or their habitat) listed under state and/or Commonwealth legislation may occur in the proposed inundation area[42] There are no high-risk areas on the flora survey trigger map for threatened plant species in the proposed inundation area.

There are no areas of essential habitat, wetland protection areas, wetlands of high ecological significance, legally secured offset areas, or designated precincts of strategic environmental importance under the *Regional Planning Interests Act 2014* mapped within the inundation area. A number of aquatic or semi-aquatic plant species, including wetland indicator species, are known to or may occur in the Bowen River basin and/or the Broken River, Urannah Creek and Massey Creek Aggregation. None of these species are listed under Commonwealth or state legislation.

With respect to other Matters of National Environmental Significance (**MNES**), there are no wetlands of international importance or threatened ecological communities identified in the inundation area, and it is not within the Great Barrier Reef Marine Park or a Commonwealth marine park. However, consequential impacts from the proposed dam on the GBR will likely need to be considered as it is within a GBR catchment.

Thirty threatened species and three TECs that are listed in the EPBC Act (**MNES**) may occur in the downstream area. These include eight bird species, one frog species, seven mammal species, three reptile species, one shark species (freshwater sawfish – *Pristis pristis*), and 10 plant species. There are no world heritage properties, national heritage places, or wetlands of international importance mapped in the downstream area, and it is not within the GBRMP or a Commonwealth marine park.

Three nationally important wetlands occur in the downstream area

- Bowen River: Birralee - Pelican Creek Aggregation – 15 kilometre section of the Bowen River upstream of the confluence with Pelican Creek, approximately 27 km west of Collinsville.
- Broken River, Urannah Creek and Massey Creek Aggregation – extends along the Broken River, downstream of the dam site, to approximately 6.5 km upstream of the confluence with the Bowen River.
- Burdekin-Bowen Junction and Blue Valley Weir Aggregation – incorporates the junction of the Burdekin and Bowen Rivers and segments of those rivers, including the impoundment behind Blue Valley Weir on the Burdekin River

The Urannah Creek, Broken River, Dicks Creek, Ernest Creek, and Massey Creek waterways, are all mapped as state or regional ecological corridors of significance and would be directly impacted by the proposed inundation.

An assessment of condition in the Bowen River sub-catchment by NQ Dry Tropics in 2015 determined that no wetlands in the sub-catchment, including the Birralee – Pelican and Burdekin-Bowen Junction and Blue Valley Weir Aggregations, were considered effectively unmodified.

Clearing within areas mapped as regulated vegetation will trigger approval to clear native vegetation. Clearing is potentially permitted if the clearing is within the parameters of an accepted development code. Land mapped as Category R is subject to an accepted development clearing code that allows landholders to undertake vegetation clearing without the need for a development approval if the clearing code can be complied with. Landholders are required to give notice to the DNRME before the

[42] SMEC, Review of Environmental Factors: Urannah Dam Feasibility Study, 2018

commencement of clearing. If the code cannot be complied with, a development approval will be required.

13.4.8.2 Fauna

There are 18 listed migratory species, including saltwater crocodile (*Crocodylus porosus*) and freshwater sawfish, that may use the inundation area. Nineteen threatened fauna species (or their habitats) are either known to occur or may occur in the vicinity of the dam inundation area (five mammals, two reptiles, one frog, and 11 birds). Appendix 2 lists all species that may occur in the inundation area.

The two turtle species that have been recorded in the Bowen River sub-basin are the saw-shelled turtle (*Wollumbinia latisternum*) and the Irwin's turtle (*Elseya irwini*). Neither species is a listed threatened species under Commonwealth or state legislation. However, due to its limited distribution, the Irwin's turtle is currently listed as a high priority on the Queensland government's Back on Track species priority framework. Due to the limited information on the distribution of the Irwin's turtle, its known occurrence in the Broken River, and the presence of suitable habitat in the inundation area, field surveys will be required for the environmental impact assessment process as the Project progresses.

Upstream of the proposed dam site, in the upper reaches of the Broken sub-catchment is the spawning habitat for a number of fish species including the Sooty Grunter (*Hephaestud fuliginosus*). Fish movement will need to be a consideration in the development of the dam wall. A fish barrier survey will be undertaken to evaluate the existing fish passage conditions in the proposed dam area.

Migratory, marine, and/or special least concern species may also occur in the inundation area. These include birds such as common sandpiper (*Actitis hypoleucos*) and yellow wagtail (*Motacilla flava*), and butterflies such as the black-faced monarch butterfly (*Monarcha melanopsis*). A full list of all non-migratory and migratory threatened fauna species that may occur in the inundation area is also provided in Appendix 2.

The presence of these species would need to be assessed before any agricultural development on a property proceeds, and this would likely be the responsibility of the landholder.

Figure 13-2 Protected areas in the inundation area

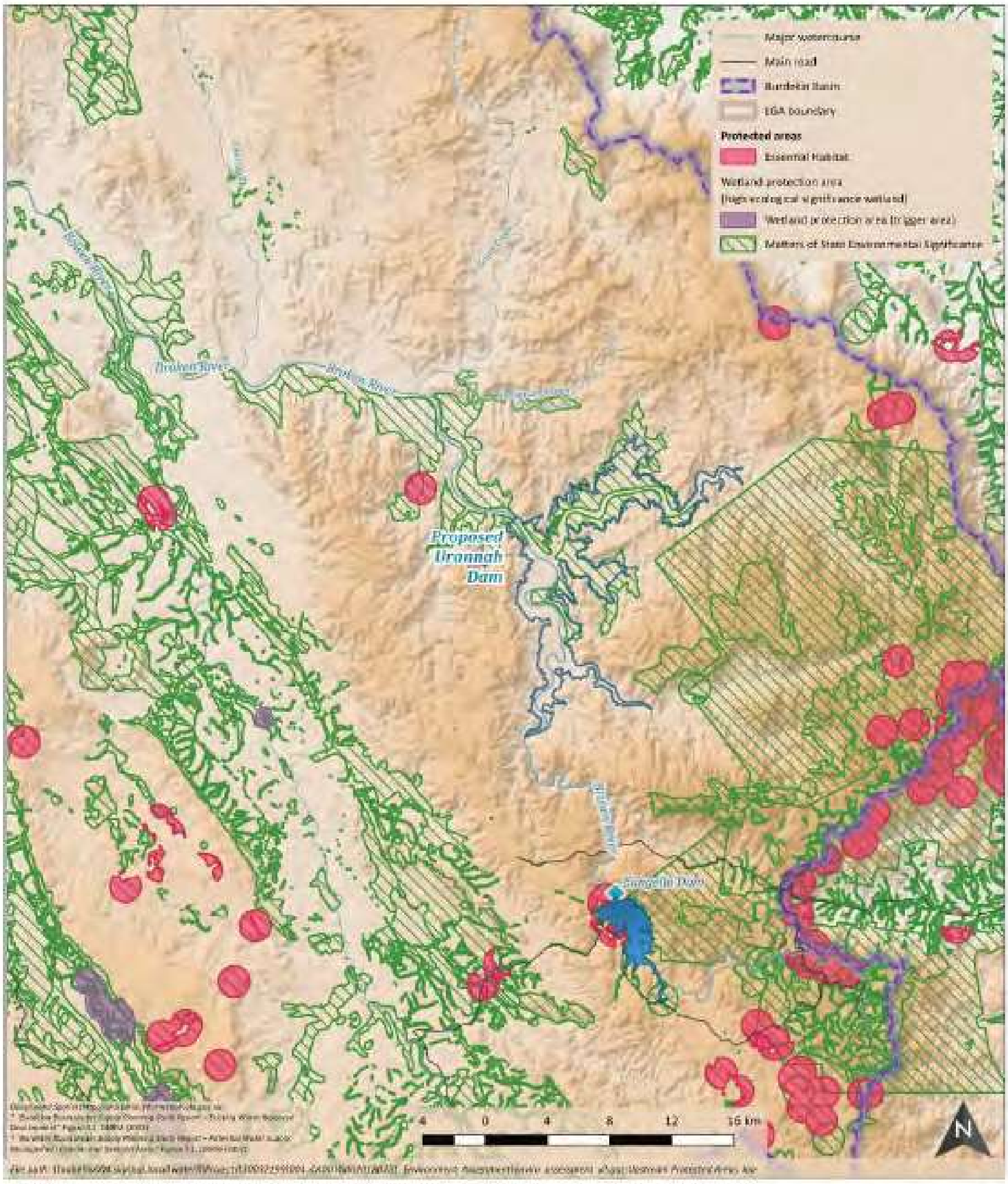


Figure 13-3 Regional ecosystems in the inundation area

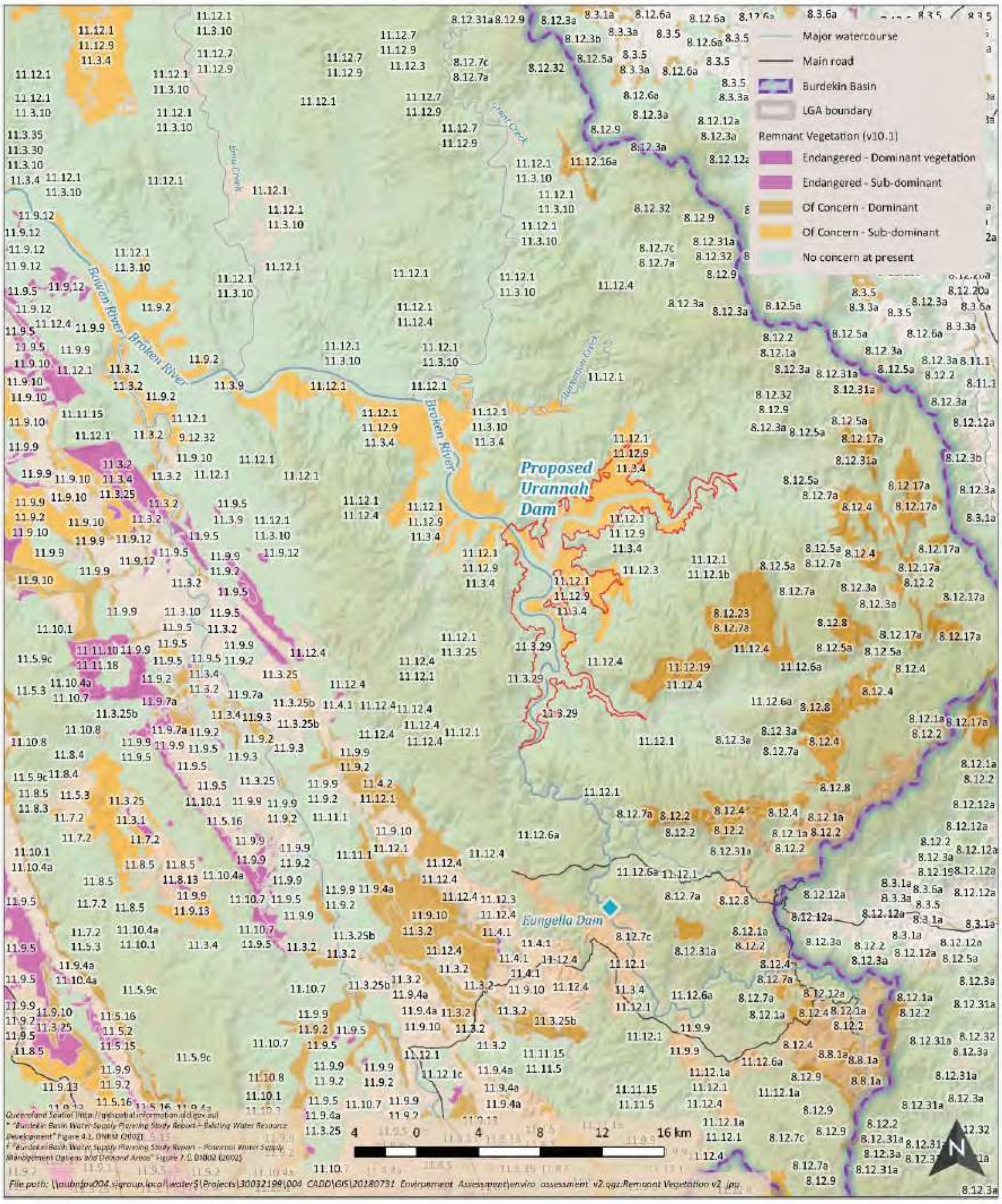


Figure 13-4 Nationally Important Wetlands in the inundation area

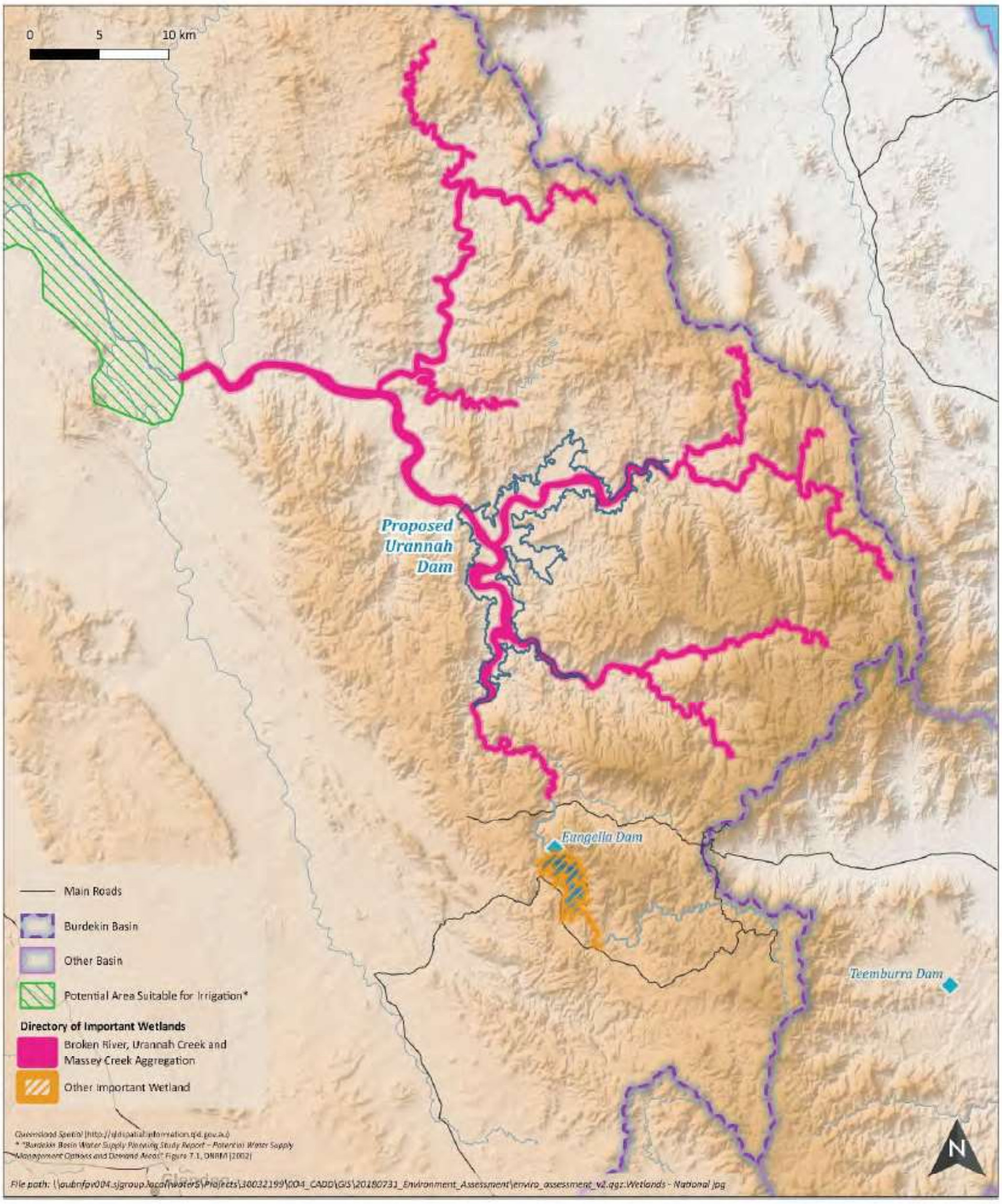


Figure 13-5 Protected areas in the irrigation area

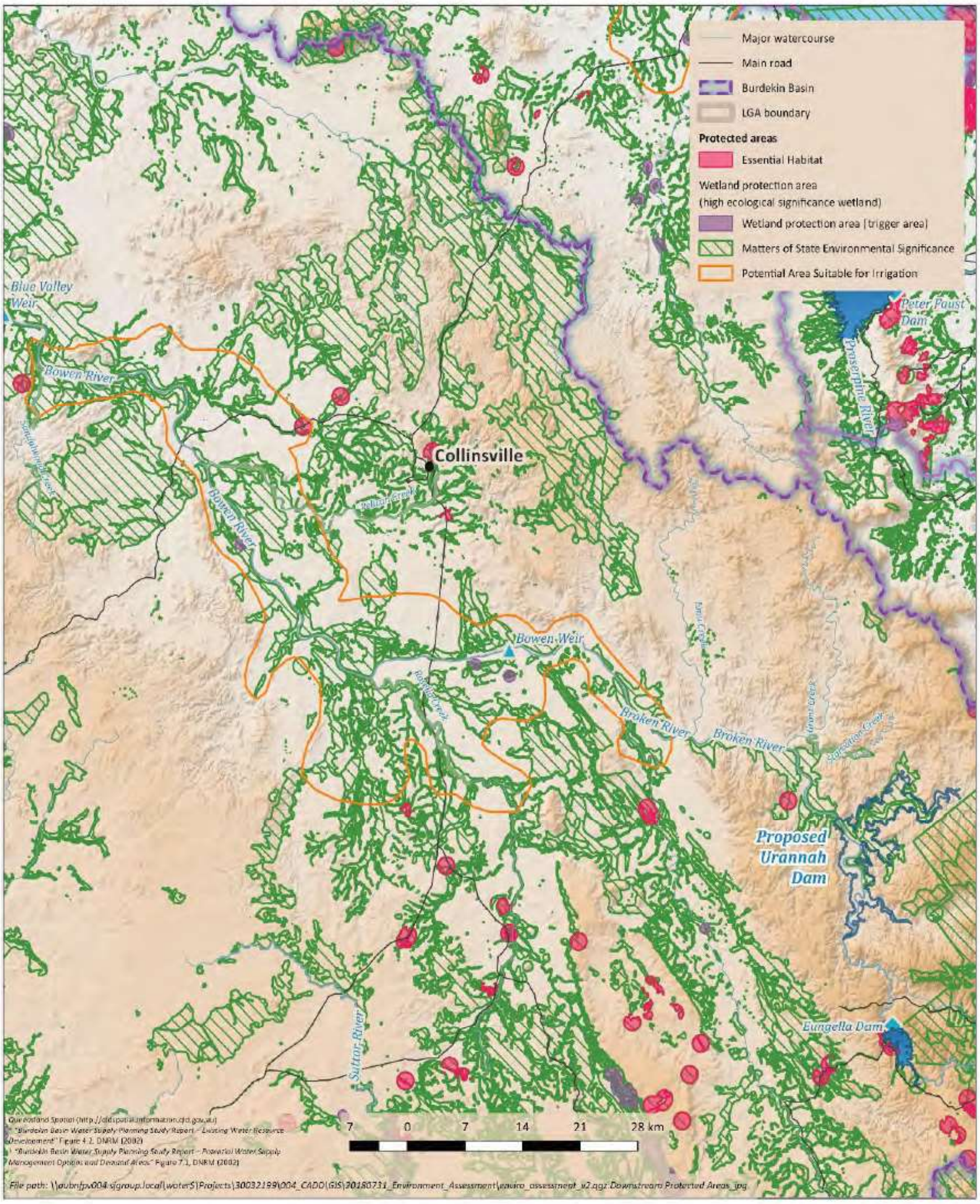


Figure 13-6 Regional ecosystems for irrigation area (1)

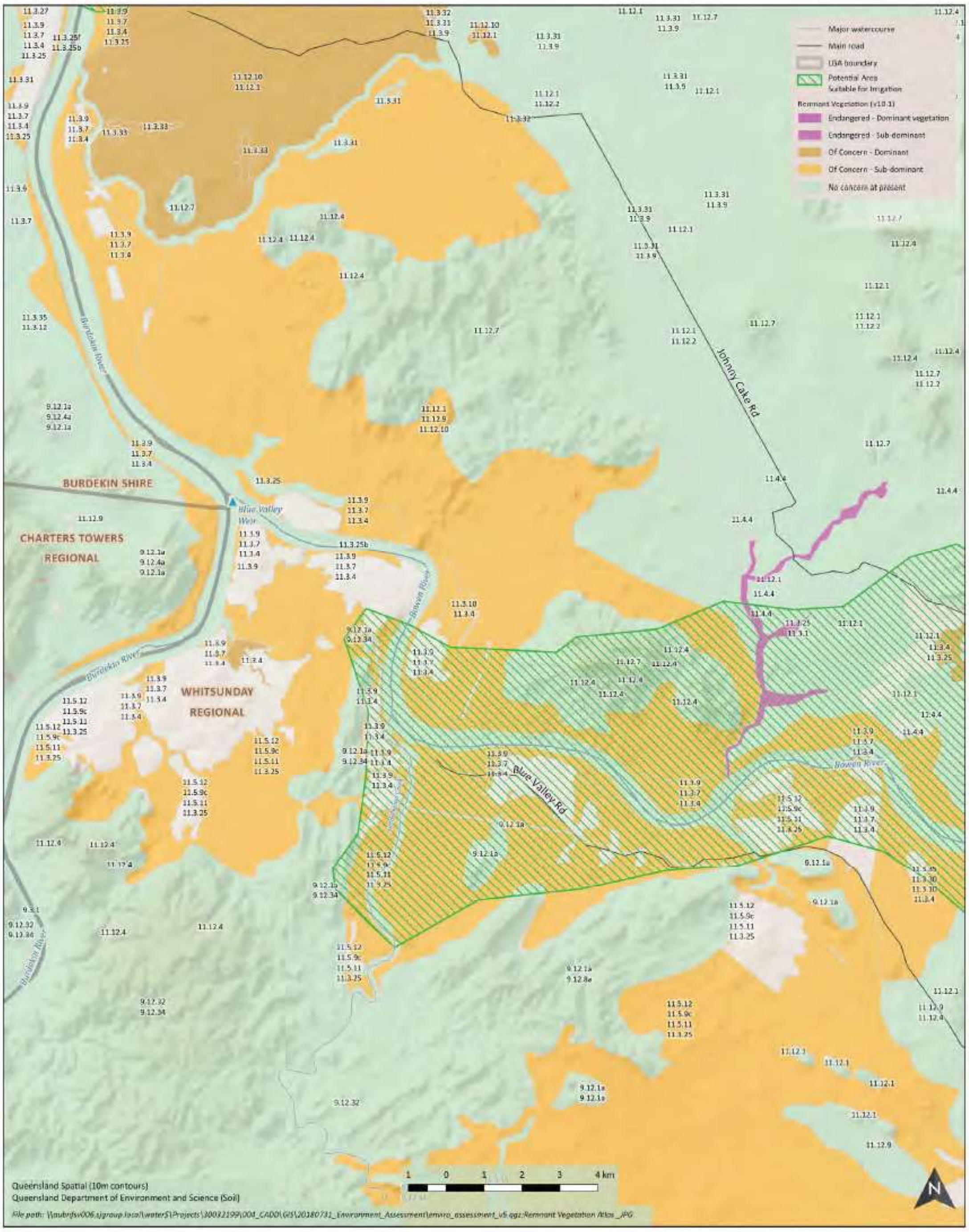


Figure 13-7 Regional ecosystems for irrigation area (2)

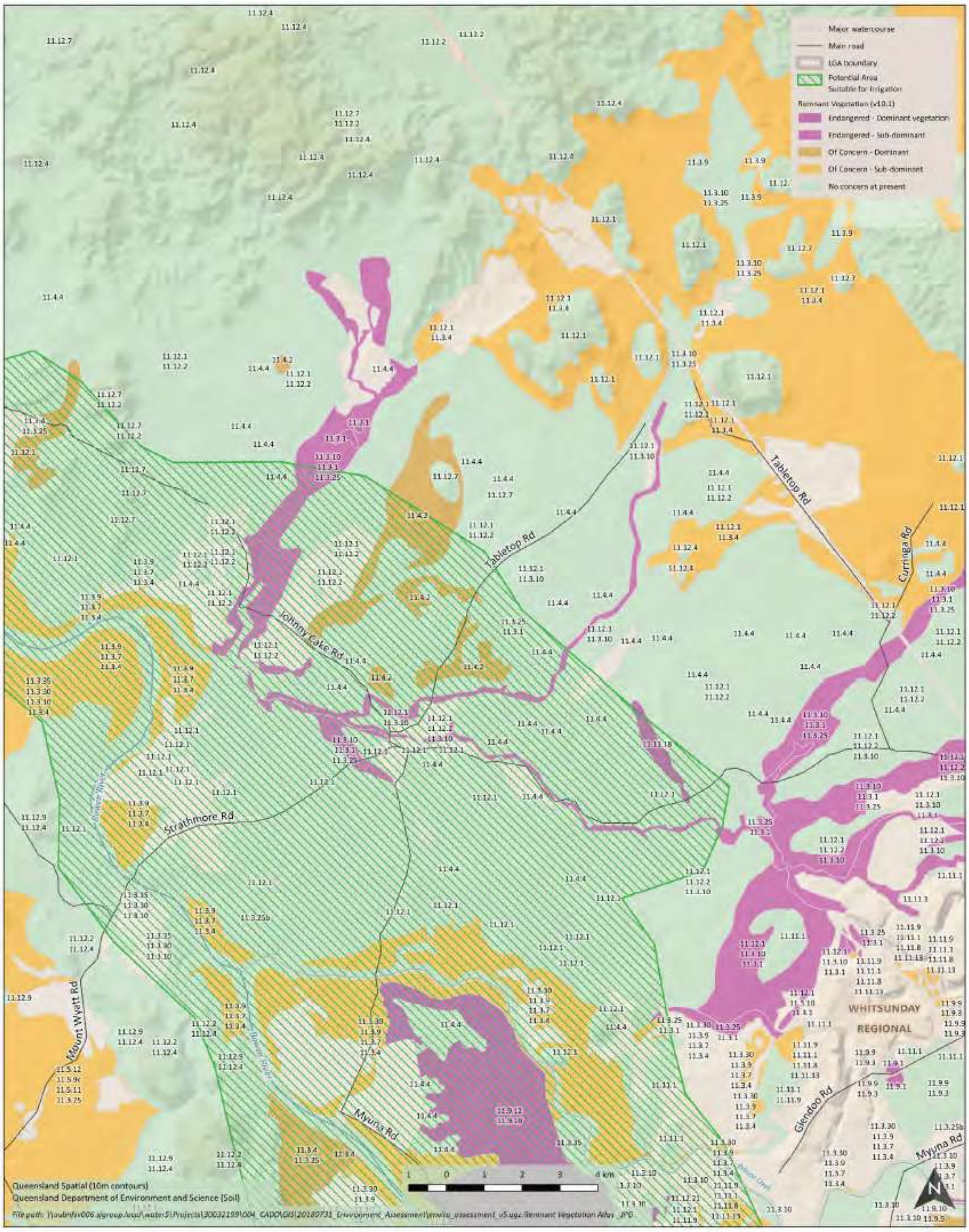


Figure 13-8 Regional ecosystems for irrigation area (3)

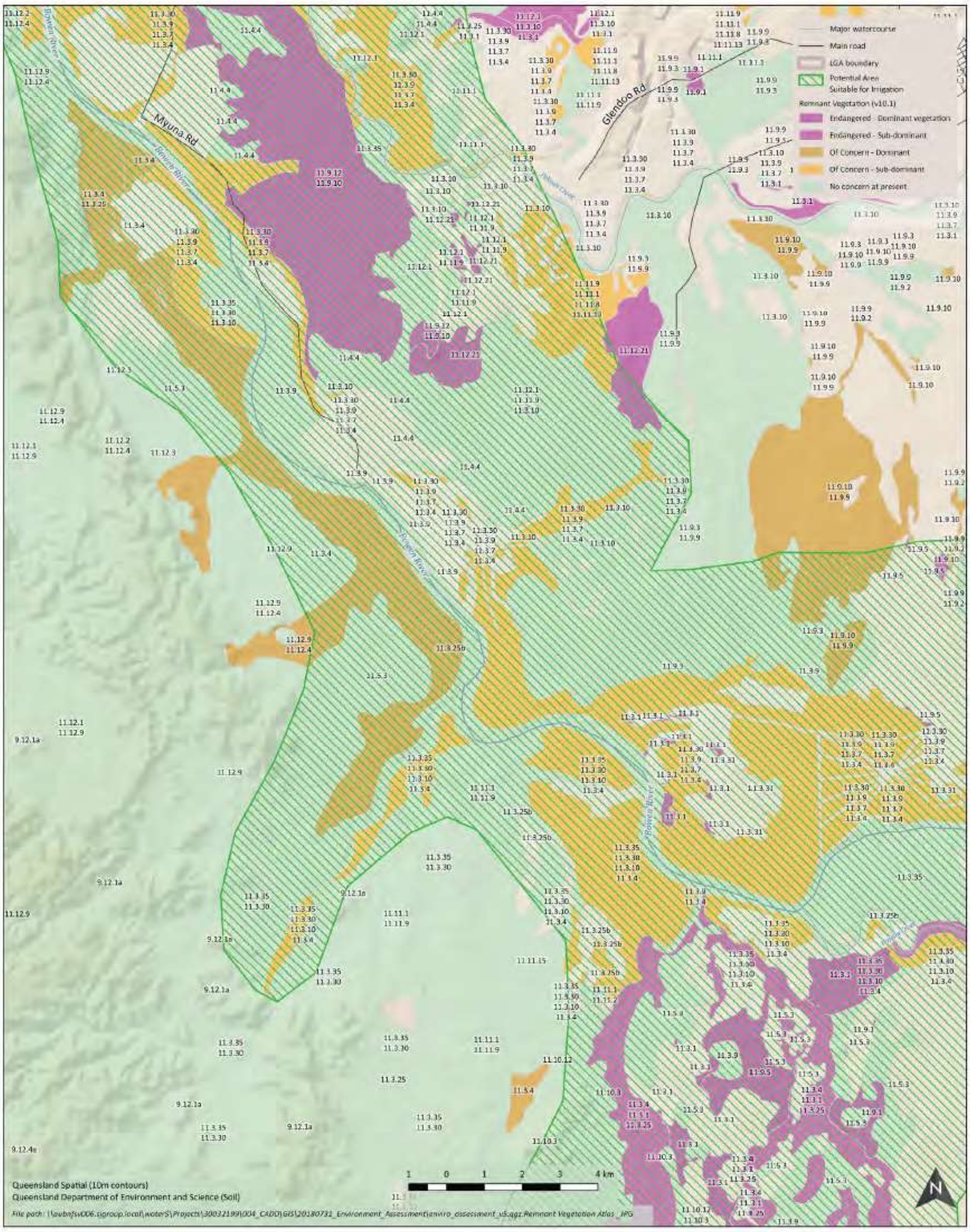


Figure 13-9 Regional ecosystems for irrigation area (4)

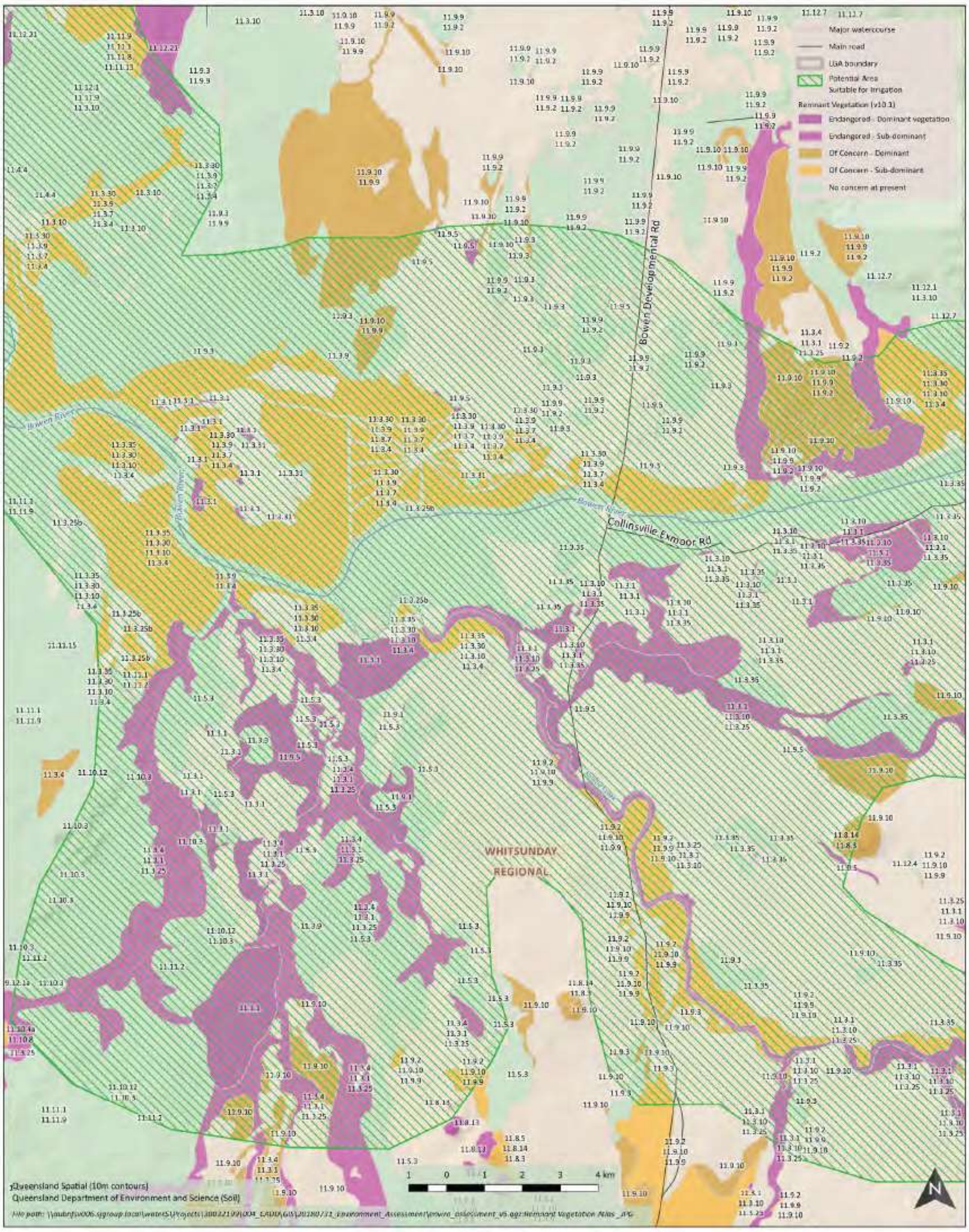
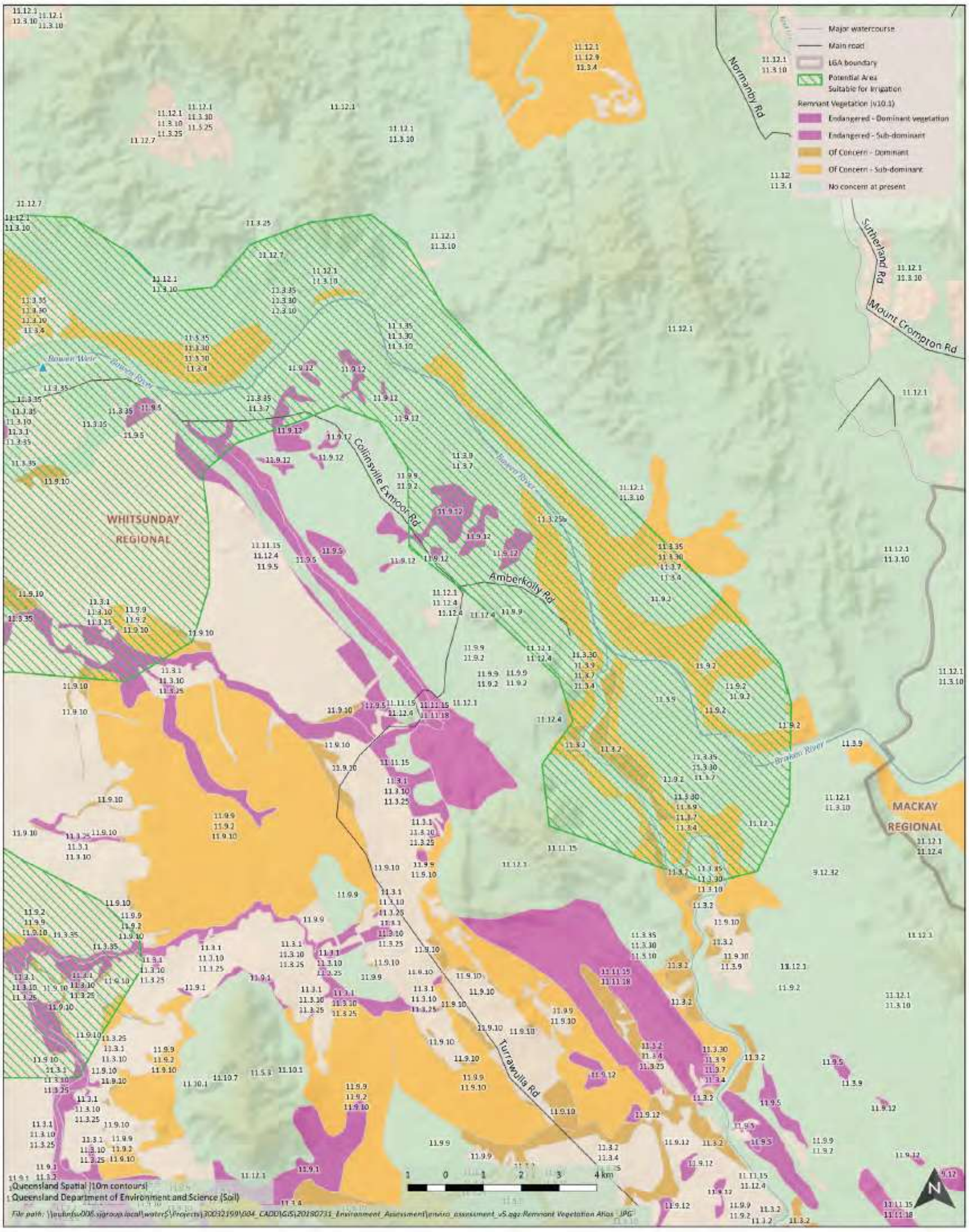


Figure 13-10 Regional ecosystems for irrigation area (5)



13.4.9 Climate and Air Quality

Shortlist Option 1 includes the proposed irrigation area and this increased soil exposure may lead to additional gully erosion, unless correct control measures such as drainage inlets are incorporated into the design. This could increase dust generated in the area however the potential decrease in air quality is likely to be insignificant.

13.4.10 Climate Change and Emissions

The following projections were provided by the CSIRO Climate Change in Australia modelling for the Monsoonal North East subcluster.

Changes to rainfall are possible but unclear as year to year variability is strongly influenced by the El Niño Southern Oscillation. While changes to rainfall are unclear, the increased intensity of extreme rainfall is projected with more certainty.[43] This has the potential to change the water availability including timing and frequency in the region.

In addition, the inclusion of new agricultural activities will result in land clearing and potentially increase the use of fossil fuels which can contribute to carbon dioxide emissions. However, the addition of hydropower will go towards offsetting any emissions.

13.4.11 Noise and Vibration

Shortlist Option 1 will involve a large scale dam and related water infrastructure so during construction there will be additional noise and vibration experienced in the local area. Sensitive receptors will be monitored during the construction phase to ensure residential dwellings are minimally impacted.

13.4.12 Landscape and Visual Amenity

The immediate vicinity is currently being used for grazing and agriculture. The introduction of irrigated agriculture is consistent with the existing use and is unlikely to change the visual amenity.

The construction of the dam may initially reduce the visual amenity of the area as areas of natural vegetation will be removed or inundated. The landscape has a high likelihood of change.

The Bowen River and surrounds has been modified with land clearing to allow for grazing and agriculture. However, the Bowen River banks have been used for recreation, including camping for a number of years. The addition of the dam once complete will allow for increased viewing opportunities with the potential for additional recreation spaces in the region.

13.4.13 Cultural Heritage

There are no registered world heritage properties or national heritage places in the area.

Dam and Inundation Area

The extent of past ground and surface disturbance across the project area was determined through analysis of aerial imagery available from 1953, 1984, 1997 and 2006. Vegetation clearance has occurred in very limited areas within the project area causing Significant Ground Disturbance. There are a limited number of tracks/firebreaks across the area that have also caused Surface Disturbance, and some dwellings and farm infrastructure at the junction of Broken River and Massey Creek. Elsewhere, the project area is largely undisturbed, with remnant vegetation communities on the banks of creeks and the river, flanks of the hills and mountains surrounding the dam area.

There is a likelihood that objects or places will be located within the area due to landscape features including remnant vegetation that covers large parts of the proposed project area and the presence of ephemeral water sources which are strongly correlated with Aboriginal camping and occupation areas.

[43] NQ Dry Tropics, 2018, Climate Change Projections

Under the Duty of Care Guidelines[44], the majority of the project area meets the definition of Category 5 meaning there is generally a high risk that it could harm Aboriginal cultural heritage. A Cultural Heritage Field Assessment will be conducted with the representatives of the Wiri Community Ltd and Birriah Cultural Heritage Services Pty Ltd.

Proposed Irrigation Area

Review of the historic aerial images shows that vegetation clearance has occurred across large areas within the proposed irrigation area causing Significant Ground Disturbance. There are also roads, rail line and tracks, some dwellings and farm infrastructure, as well as mines and small dams across the area that have caused Surface Disturbance. There are parts of the proposed irrigation area that are largely undisturbed, with remnant vegetation along the rivers and creeks, and associated with hills and mountains. The level of previous ground disturbance in the proposed irrigation area is highly variable. The proposed activities will cause ground surface interference through the clearance of vegetation and the establishment of farming and irrigation infrastructure.

Due to the high number of registered cultural heritage objects and places, the potential for Aboriginal cultural heritage remains high. The sites are spread across both previously disturbed and undisturbed areas and occur across a range of land forms. This broad distribution would suggest a high likelihood that more Aboriginal cultural heritage objects and places will be identified in the proposed irrigation area. Due to this high likelihood and the presence of Category 4 and 5 areas a Cultural Heritage Field Assessment will be conducted with the Birriah Cultural Heritage Services Pty Ltd.

13.5 Preliminary Environmental Assessment of Shortlist Option 2

Shortlist Option 2 includes the construction of a dam with the capacity of 70,000 ML/year with an FSL of 280 m AHD and augmenting the water supply to Peter Faust Dam and Eungella Dam to provide incremental supply to industry in Moranbah. This option increases the water reliability to the industrial supply required in Collinsville and Moranbah.

13.5.1 Environmental Issues Associated with Shortlist Option 2

Key environmental issues identified for the Project include:

- As per Shortlist Option 1, all land in the proposed dam inundation area is currently used for grazing in native vegetation; with approximately 80 per cent of the Broken River sub-catchment is currently designated for conservation[45] and classified as an MSES protected area.
- As per Shortlist Option 1 areas of 'of concern' and 'least concern' regional ecosystems would be inundated. No areas of endangered regional ecosystems or any TECs would be affected by the proposed dam or its inundation area.
- As per Shortlist Option 1 the project needs to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures

13.5.2 Legislation and Permit Requirements

As per Shortlist Option 1, there will be a requirement to obtain environmental permits and development approvals for construction and operational works.

[44] Department of Aboriginal and Torres Strait Islander Partnerships, 2004, *Aboriginal Cultural Heritage Act 2003: Duty of Care Guidelines*
[45] NQ Dry Tropics, 2015, *Broken River: Sub catchments*

13.5.3 Planning and Land Use

Planning and land use issues will be similar to Shortlist Option 1, on a reduced scale due to the removal of the irrigated agriculture from Shortlist Option 2.

13.5.4 Property Impacts

Property impacts will be confined to the issues relating to the inundation area discussed in Shortlist Option 1. Shortlist Option 2 includes the augmentation of water supply to Peter Faust Dam and Eungella Dam and property impacts would be considered low.

13.5.5 Water Quality

As Shortlist Option 2 does not include the irrigated agriculture, the water quality issues will be reduced. As discussed in Shortlist Option 1 previous assessment of dams in the Burdekin Basin noted that as the proposed Urannah Dam site is high in the catchment and the surrounding land is in good condition, erosion was unlikely to affect water clarity and the dam impoundment would likely be clear.

13.5.6 Topography, Geology and Soils

Any associated opportunities, impacts and issues with topography, geology and soils would be similar to Shortlist Option 1.

13.5.7 Hydrology

As per Shortlist Option 1, the construction of Urannah Dam would have a direct impact on the regional hydrology and detailed modelling and assessment of these impacts will be conducted as the Project progresses.

13.5.8 Flora and Fauna

Shortlist Option 2 would be restricted to the Dam and inundation area (see Figure 13-2 to Figure 13-4). As discussed in 13.3.5 the MSES regulated vegetation in area comprises category B, C and R regulated vegetation and regulated vegetation. In addition, the inundation area along Urannah Creek, Dicks Creek, Ernest Creek and Massey Creek is also mapped as being of very high riverine conservation significance, and the inundation area along the Broken River is mapped as being of high riverine conservation significance.

As per Shortlist Option 1, the clearing of vegetation may impact flora and fauna in the area and the necessary approvals and management will be required.

13.5.9 Climate and Air Quality

Seasonal rainfall currently affects the water availability in the region, including the reduced reliability of Eungella Dam. Shortlist Option 2 includes supplementing the water supply to Eungella Dam and the related water system.

13.5.10 Climate Change and Emissions

As discussed in Shortlist Option 1, climate change may negatively affect water supply in the region and Shortlist Option 2 provides less water than Shortlist Option 1, with 70,000 ML of annual supply compared to 150,000 ML available with Shortlist Option 1.

13.5.11 Noise and Vibration

As per Shortlist Option 1, noise and vibration will increase during the construction of the dam. This will be limited to the construction period and as Shortlist Option 2 does not have associated irrigated agriculture there is unlikely to result in significant impacts on noise and vibration in the area.

13.5.12 Landscape and Visual Amenity

As discussed in Shortlist Option 1, there will be a change to the landscape of the area however the dam will offer the opportunity for additional public recreation space.

13.5.13 Cultural Heritage

As per Shortlist Option 1, there are no registered world heritage properties or national heritage places in the area.

However, as per Shortlist Option 1 there is a likelihood that objects or places will be located within the area due to landscape features including remnant vegetation that covers large parts of the proposed project area and the presence of ephemeral water sources which are strongly correlated with Aboriginal camping and occupation areas. A Cultural Heritage Field Assessment will be conducted with the representatives of the Wiri Community Ltd and Birriah Cultural Heritage Services Pty Ltd.

13.6 Preliminary Environmental Assessment of Shortlist Option 3

Shortlist Option 3 includes the construction of a dam with the capacity of 50,000 ML/year with an FSL of 255 m AHD and augmenting the water supply to Peter Faust Dam and Eungella Dam, increasing water security in the region.

13.6.1 Environmental Issues Associated with Shortlist Option 3

Key environmental issues identified for the Project include:

- As per Shortlist Options 1 and 2, all land in the proposed dam inundation area is currently used for grazing in native vegetation; with approximately 80 per cent of the Broken River sub-catchment is currently designated for conservation and classified as an MSES protected area.
- As per Shortlist Options 1 and 2 areas of 'of concern' and 'least concern' regional ecosystems would be inundated. No areas of endangered regional ecosystems or any TECs would be affected by the proposed dam or its inundation area.
- As per Shortlist Options 1 and 2 the project needs to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures.

13.6.2 Legislation and Permit Requirements

As per Shortlist Option 1, there will be a requirement to obtain environmental permits and development approvals for construction and operational works.

13.6.3 Planning and Land Use

Planning and land use issues will be similar to Shortlist Option 1, on a reduced scale due to the removal of the irrigated agriculture from Shortlist Option 3.

13.6.4 Property Impacts

Property impacts will be confined to the issues relating to the inundation area discussed in Shortlist Option 1. Shortlist Option 3 includes the duplication of water supply to Peter Faust Dam and Eungella Dam and augmentation of the supply to Collinsville and Moranbah. The property impacts would be considered low.

13.6.5 Water Quality

Again, as Shortlist Option 3 does not include the irrigated agriculture, the water quality issues will be reduced. As discussed in Shortlist Option 1 previous assessment of dams in the Burdekin Basin noted that as the proposed Urannah Dam site is high in the catchment and the surrounding land is in good condition, erosion was unlikely to affect water clarity and the dam impoundment would likely be clear.

13.6.6 Topography, Geology and Soils

Any associated opportunities, impacts and issues with topography, geology and soils would be similar to Shortlist Option 1.

13.6.7 Hydrology

As per Shortlist Option 1, the construction of Urannah Dam would have a direct impact on the regional hydrology and detailed modelling and assessment of these impacts will be conducted as the Project progresses.

13.6.8 Flora and Fauna

Shortlist Option 3 would be restricted to the Dam and inundation area (see *Figures 14.1 – 14.3*). As discussed in 14.3.8 the MSES regulated vegetation in area comprises category B, C and R regulated vegetation and regulated vegetation. In addition, the inundation area along Urannah Creek, Dicks Creek, Ernest Creek and Massey Creek is also mapped as being of very high riverine conservation significance, and the inundation area along the Broken River is mapped as being of high riverine conservation significance.

13.6.9 Climate and Air Quality

Seasonal rainfall currently affects the water availability in the region, including the reduced reliability of Eungella Dam. Shortlist Option 3 includes augmenting the water supply to Eungella Dam, the Whitsundays and Moranbah.

13.6.10 Climate Change and Emissions

As discussed in Shortlist Option 1, climate change may negatively affect water supply in region and Shortlist Option 3 provides less water than Shortlist Option 1, with 50,000 ML of annual supply compared to 150,000 ML available with Shortlist Option 1.

13.6.11 Noise and Vibration

As per Shortlist Option 1, noise and vibration will increase during the construction of the dam. This will be limited to the construction period and as Shortlist Option 3 does not have associated irrigated agriculture there is unlikely to result in significant impacts on noise and vibration in the area.

13.6.12 Landscape and Visual Amenity

As discussed in Shortlist Option 1, there will be a change to the landscape of the area however the dam will offer the opportunity for additional public recreation space.

13.6.13 Cultural Heritage

As per Shortlist Option 1, there are no registered world heritage properties or national heritage places in the area.

However, as per Shortlist Option 1 there is a likelihood that objects or places will be located within the area due to landscape features including remnant vegetation that covers large parts of the proposed project area and the presence of ephemeral water sources which are strongly correlated with Aboriginal camping and occupation areas. A Cultural Heritage Field Assessment will be conducted with the representatives of the Wiri Community Ltd and Birriah Cultural Heritage Services Pty Ltd.

13.7 Conclusion

As all shortlisted options include a dam of a reasonable size, the legislative and permitting requirements to implement Shortlist Options 2 and 3 will be very similar, and the addition of the irrigated agriculture in Shortlist Option 1 will add tenure and planning considerations.

The implementation of Shortlist Option 1 is likely to enable the application to be declared as a coordinated project under the SDPWO Act, allowing for a more streamlined approvals process.

Shortlist Option 1 also increases the area of land under irrigation and the environmental impacts will be greater than Shortlist Option 2 and 3. The likely impacts for all options will include:

- A reduction in habitat due to vegetation clearing
- Change in surface water quality and potential to effect groundwater
- Change to the hydrology of the area with the related impacts on aquatic flora and fauna
- Loss of land due to inundation meaning loss of riparian areas and habitats
- Barrier to movement of aquatic life
- Impact to cultural heritage

All three options are likely to require an EIS process at the State and/or Commonwealth level and environmental offsets will be required. Any proposed development of a dam in this area would likely need to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures. The potential environmental impacts would be addressed during that process.

The social benefits of the large scale project are also noted as the dam and irrigated agriculture would create broad social and economic value in the Collinsville and Bowen areas, along with the support provided to mining and industrial projects across the region. This encourages existing and new agricultural industries and opportunities in the region.

14 ECONOMICS

14.1 Chapter Summary

The economic analysis was undertaken using a CBA framework that applies discounted cash flow techniques.

The development of the Dam and associated infrastructure will generate a number of benefits to the Queensland community. The benefits included in the economic appraisal are those which were identified as monetisable.

Based on the outcomes of the CBA, and when compared against a 'Do Minimum' base case, it was determined that Shortlist Option 1, a 150,000 ML per annum dam with instream distribution to Collinsville, pipeline to Peter Faust Dam, a pipeline to Eungella Dam and to Moranbah and the provision of an agricultural irrigation network, is the most viable option with a BCR of 1.7.

During consultation with DNRME, a consensus was not achieved that demonstrated intent was evident for the formulation of the 'Do Minimum' base case. Therefore, a supplementary addendum (Refer Addendum A) was developed to evaluate the shortlisted options against an alternative base case of 'Do Nothing' to explore the effect on economic outcomes.

14.2 Purpose

Economic analysis is vital in assessing the economic viability of a project. It evaluates the economic and social worth of a project over its economic life. The economic analysis contained within this chapter builds on the analysis undertaken in the Social Impact Evaluation (**SIE**) and considers the potential costs associated with, and benefits generated from, the development of the Urannah Dam (Dam). This chapter evaluates the relative economic viability of the different project options, incremental to the Base Case, to identify the preferred option for the development of the Dam.

The chapter is structured as follows:

- Section 2: Approach to the economic appraisal
- Section 3: Demand profile
- Section 4: Costs
- Section 5: Benefits
- Section 6: Economic assessment results

A detailed economics technical paper providing further information supporting this chapter is located at Appendix 11.

14.3 Approach

14.3.1 Economic appraisal methodology

Investment in large scale infrastructure leads to changes in the economic environment. The economic analysis looks to capture all of the economic benefits and costs that may impact on the Queensland community. The economic and financial analysis utilises different discount rates to calculate the NPV of the project options and therefore the NPV results differ between both sets of analysis.

The economic analysis undertakes an economy wide analysis which therefore considers the avoided costs from not progressing with projects included in the Base Case, whereas the financial analysis will only consider the cost of this project.

A CBA methodology was utilised to allow a comparison between of the economic benefits of each project option to be undertaken.

14.3.2 Cost Benefit Analysis

The economic analysis was undertaken using a CBA framework that applies discounted cash flow techniques. CBA is an economic valuation of the costs and benefits of a project with reference to the broader community. The CBA seeks, where possible and feasible, to quantify and monetise all of the benefits and costs that will accrue to the region.

The methodology for this CBA was undertaken at a State level, reflecting the scope of impact that the Dam is expected to have. The key steps undertaken in developing the economic appraisal are summarised below:

1. Set out the economic appraisal framework
2. Define the options
3. Cost estimates
4. Benefit quantification
5. Undertake economic modelling

14.3.3 Key assumption and parameters

Key assumptions for this analysis are consistent with those set out in the Building Queensland BCDF and Infrastructure Australia's (**IA**) Assessment Framework. The key assumptions for the Project are outlined in Table 14-1 below.

Table 14-1 Economic analysis key assumptions

Assumption	Note	Justification
Discount rate	7% (real) with sensitivities conducted at 4% and 10%	Infrastructure Australia
Appraisal period	30 years	Building Queensland and Infrastructure Australia
Base year	2019	PwC
Construction start	01/01/2020	Urannah Water
Construction end	31/12/2023	Urannah Water
Operations start	01/01/2024	Urannah Water
Residual value	$788 million	Estimated using straight line depreciation based on an asset life of 100 years for dam infrastructure and 50 years for pipelines.
Base Case		The Base Case for the Project includes the current water infrastructure in the region, with the development of a new 25,000 ML/yr pipeline by SunWater from Burdekin to Moranbah.

14.3.4 Project Case

During the options assessment process, (described in Chapter 6: Options Filter), three options were identified for further analysis through the economic assessment. A brief description of each of the options is provided in Table 14-2 below.

Table 14-2 Project Case option infrastructure assets developed

Asset	Base case	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Construction Method	-	CFRD	RCC	RCC
Urannah Dam Yield	X	150,000 ML	70,000 ML	50,000 ML
Instream distribution to Collinsville	X	√	√	√
Pipeline to Peter Faust Dam	X	√	√	√
Pipeline to Eungella Dam	X	√	√	√
Moranbah supply	Burdekin to Moranbah duplication	Urannah to Moranbah pipeline	Urannah to Moranbah pipeline	Burdekin to Moranbah duplication
Agricultural irrigation network	X	√	X	X

14.4 Demand Profile

The demand forecasts under the Options for the Dam reflect the current best estimate for the potential expected future demand from urban, industrial, mining and agricultural users and the price they could be expected to pay. A detailed justification on the levels of demand assumed for the economic assessment is included in the detailed economic paper at Appendix 11.

The overall increase in water demand is expected to be met by three different sources under the project Options, either via Urannah Dam, Peter Faust Dam or the development of the pipeline to Moranbah.

Table 14-3 below outlines the total demand from each driver, and the source of each under each of the options and the Base Case.

Table 14-3 Demand profile (ML)

Driver	Base case	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Industrial demand				
Abbot Point industrial demand	-	3,000ML	3,000ML	3,000ML
Collinsville industrial demand	-	5,000ML	5,000ML	5,000ML
Moranbah demand – reliability augmentation	-	5,000ML	5,000ML	5,000ML
Moranbah demand – additional supply from BMP duplication	25,000ML	-	-	25,000ML
Moranbah demand – additional supply from Urannah and Eungella Dams	-	20,000ML	20,000ML	-
Proserpine demand	-	5,000ML	5,000ML	5,000ML
Urban demand				
Bowen urban demand	-	2,000ML	2,000ML	2,000ML
Agricultural demand				
High reliability	-	25,000ML	-	-
Medium reliability	-	85,000ML	-	-
TOTAL DEMAND	25,000ML	150,000ML	40,000ML	45,000ML

14.4.1 Agricultural crop mix

The agricultural demand has been estimated based on the expected additional water to be made available for agricultural production (80,000 ML per annum), the water application rate per hectare for the crops identified, the expected market take up of additional water and the ramp up of production by agricultural producers. It is only under Shortlist Option 1 that there is sufficient water capacity and infrastructure provided to generate and satisfy increased agricultural demand and production.

Table 14-4 outlines the identified crop mix for the region, and the pricing and water usage assumptions that underpin the economic analysis. Justification, including soil and vegetation analysis, in included in the detailed economic appendix.

Table 14-4 Agricultural demand assumptions

Driver	Total ha developed	Tonne/ha or bales/ha (cotton)	Value ($/tonne) or bale (cotton)	Ramp up
Field crop				
Cotton	6,660	10	550	8 years
Sorghum	1,110	8	330	8 years
Small crops (tomatoes, capsicum etc.)	1,110	20	956	8 years
Tree crop				
Avocado	1,110	12	4,500	8 years
Mango	1,110	15	3,000	8 years
Total	**11,100**			

Source: PSI Delta

14.5 Costs

This section sets out the costs applied in the economic appraisal, including capital and operating costs associated with the construction, ongoing operation and maintenance of each project option. On farm costs associated with increases in production resulting from the development of the Project have been captured as part of the estimation of the increase in Industry Value Add (**IVA**) from agricultural production.

14.5.1 Delivery phase costs

The total real costs estimated by SMEC (represented in $2019) are presented in Table 14-5 below. The total discounted delivery phase costs are presented in Table 14-6 below. These include the direct and indirect construction costs to deliver the Project. Costs are discounted at 7 per cent real.

All costs are incremental to the Base Case. Under Shortlist Options 1 and 2, the Burdekin to Moranbah pipeline duplication is not required to be constructed and therefore the CAPEX of that project is included as an avoided cost, consistent with standard CBA appraisal methodology. Shortlist Option 3 does not include the cost of the Burdekin to Moranbah pipeline as the cost incremental to the Base Case is zero.

Table 14-5 Capital cost ($ million, real, $2018)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Dam & Spillway	673.0	629.0	258.0
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML)	210.0	210.0	210.0
Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML)	-	-	22.4
Pipeline Urannah Dam to Eungella Dam	382.2	382.2	-
Irrigation network	200.0	-	-
Avoided Cost (Burdekin Moranbah Pipeline Duplication)	-756.7	-756.7	-
Total	**708.5**	**464.5**	**490.4**

Table 14-6 Capital cost ($ million, discounted at 7% real)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Dam and spillway	532.6	497.8	204.2
Urannah – Peter Faust, with Abbot Point extension	166.2	166.2	166.2
Urannah – Eungella pipeline	-	-	17.7
Urannah – Moranbah pipeline	302.5	302.5	-
Irrigation network	158.3	-	-
Avoided cost	-598.8	-598.8	-
Total	**560.7**	**367.6**	**388.1**

14.5.2 Operating phase costs

Operating cost estimates have been developed by SMEC and include all relevant costs for the operation of each option over the 30-year appraisal period.

Table 14-7 displays the annual operating costs. Table 14-8 below presents the operating and maintenance costs for each project option, discounted at 7% real. Shortlist Options 1 and 2 both include the OPEX cost associated with the operation of the Burdekin to Moranbah pipeline as an avoided cost. This cost is not included in Shortlist Option 3 as costs are incremental to the Base Case.

Table 14-7 Annual operating phase costs ($ million, real, $2018)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Urannah – Peter Faust Dam	3.1	3.1	3.1
Urannah – Eungella	-	-	2.0
Urannah – Moranbah	9.7	9.7	-
Irrigation distribution	2.5	-	-
Avoided cost (BMP duplication)	-27.1	-27.1	-
Total annual opex	**-11.8**	**-14.3**	**5.2**

Table 14-8 Operating phase costs ($ million, discounted 7% real)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Dam and spillway	-	-	-
Urannah – Peter Faust Pipeline	27.3	27.3	27.3
Urannah – Eungella	-	-	17.7
Urannah – Moranbah	85.8	85.8	
Irrigation distribution	22.1	-	
Avoided cost (BMP duplication)	-240.0	-240.0	
Total	**-104.7**	**-126.8**	**45.0**

14.6 Benefits

The development of the Dam will generate a number of benefits to the Queensland community. The benefits included in the economic appraisal are those which were identified as monetisable in the Social Impact Evaluation in Chapter 12. In addition to the identified monetisable benefits identified there is also likely to be a range of other benefits generated by the Project that are not captured by the CBA framework. These should be considered alongside the outcomes of the CBA.

The benefits monetised for inclusion in the CBA are:

- **Benefits to urban users**: increased certainty of long-term water supply to at risk urban areas
- **Benefits to agricultural users**: increase in agricultural production
- **Benefits to industrial and mining users**: increase in mining expansion and project certainty

Provided in this section is a summary of each of the benefits included in the analysis. Full detail on the calculation methods and inputs is included in the economic technical appendix.

14.6.1 Benefits to urban users

Urban users of the water supply will receive a benefit from the development of the Dam due to the additional water supply water supply and storage created. For urban users, the development of the Dam will result in a reduction in the expected frequency and duration of demand management water restrictions.

To estimate the economic cost of water restrictions it was necessary to apply estimates for the following:

- The benefits monetised for inclusion in the CBA
- Benefits to urban users occurs under all options

Table 14-9 Urban demand assumptions

Driver	Consumption
Incidence of severe water restrictions	2.5% per year
WTP to avoid severe water restrictions	$200 per household

14.6.2 Benefits to agricultural users

An increase in supply and storage of water is a valuable resource to the agricultural industry, and an increase in the availability and security of the supply of water is expected to result in an increase in the productivity and value of agricultural output in the region. It is only under option 1 that sufficient water, and the development of irrigation infrastructure, is provided to enable an increase in agricultural output

This increase in production related to the Project was estimated through the IVA from changes in the gross production minus any on farm costs required to establish and realise increased production (including cost of irrigation infrastructure and the cost of establishing new crops). The change in the value of production for each crop, and the additional on farm costs are all incremental to the Base Case. Identification of soil types and native vegetation was undertaken to determine the appropriateness of the region for various crop types. Further analysis on the actual quality of soil conditions of the identified agricultural sites will need to be undertaken during the Detailed Business

Case phase to ensure that conditions are appropriate for the selected crop types. Table 14-10 outlines the benefit streams from each crop type that underpin the economic analysis.

Table 14-10 Agricultural demand benefit streams ($ million)

Crop	Gross Value (Real)	Industry value added (Real)	On farm costs (Real)	Total (Real)	Total (Discounted to 7% real)
Cotton	984.4	570.9	66.6	504.3	**112.0**
Sorghum	118.1	68.5	16.7	51.9	**8.7**
Small crops	285.2	165.4	5.6	159.9	**39.9**
Avocados	1,610.8	934.3	50.0	884.3	**215.3**
Mangoes	1,342.4	778.6	50.0	728.6	**174.9**
Total					**550.9**

Source: PSI Delta, PwC

14.6.3 Benefits to industrial and mining users

The estimation of the impact of the Project and the benefits generated from the increased water provided to industrial and mining users is more complex than other benefit streams. This is due to the limited information availability and demand profile due to the sensitive commercial in confidence nature of this information and the unknown future plans of private enterprises.

The value of the benefit to industrial and mining users is assumed to be the price that they are willing to pay for securing additional water supply that is enabled by the delivery of the Project. The price that these users are willing to pay is considered a proxy for the marginal benefit that they perceive to be generated and attributable to the Project. Table 14-11 below outlines the price assumptions used in the economic analysis. Benefits to industrial and mining users occurs under all options.

While there is an acknowledged and recognised demand for water to industrial and irrigation users in the Proserpine area, the exact uses of this water and the price that could be charged are more uncertain than other areas and therefore the benefit from this has not been monetised in this analysis.

Table 14-11 Price paid by industrial and mining users

User	Ongoing price ($/ML/yr)	NPV of Benefit ($ million, discounted at 7% real)
Abbot Point demand	2,000	$53.1
Moranbah demand*	2,000	-
Collinsville demand	2,000	$88.5
Proserpine demand	N/A	-

* Incremental benefit to the base case for the demand from Moranbah is zero under all Options

14.7 Economic assessment results

The results of the economic appraisal in Net Present Value (NPV) and Benefit Cost Ratio (BCR) terms of each option is presented in Table 14-12.

Table 14-12 Summary of CBA results ($ million, discounted)

CBA Results	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
NPV	311.6	-34.5	-264.6
BCR	1.7	0.9	0.4

Table 14-13 below presents the outcomes of the CBA for Shortlist Options 1, 2 and 3.

Table 14-13 Options CBA results ($ million, discounted at 7% real)

	Option 1 (FSL 290)		Option 2 (FSL 280)		Option 3 (FSL 255)	
CBA Results	NPV	BCR build up	NPV	BCR build up	NPV	BCR build up
Costs						
Capital costs	560.7		367.6		388.1	
Operations costs	-104.7		-126.8		45.0	
Total costs	**456.0**		**240.8**		**433.1**	
Benefits						
Urban user	1.3	0.0	1.3	0.0	1.3	0
Industrial user	53.1	0.1	53.1	0.1	53.1	0.1
Mining user	88.5	0.3	88.5	0.3	88.5	0.4
Agricultural user	550.9	1.5	0.0	0.3	0	0.4
Residual value	73.8	1.7	63.4	0.9	25.6	0.4
Total benefits	**767.6**		**206.3**		**168.5**	
Results						
Total Benefit - Cost	**311.6**	**1.7**	**-34.5**	**0.9**	**-264.6**	**0.4**

14.7.1 Sensitivity testing and scenario analysis

Sensitivity and scenario testing was undertaken of the key inputs and drivers of the CBA in order to determine the robustness of the results, and the sensitivity to changes in key parameters. Table 14-14 outlines the results from the sensitivity testing undertaken.

Table 14-14 CBA sensitivity testing results

	Option 1 (FSL 290)		Option 2 (FSL 280)		Option 3 (FSL 255)	
Sensitivity	NPV	BCR	NPV	BCR	NPV	BCR
Core	**311.6**	**1.7**	**-34.5**	**0.9**	**-264.6**	**0.4**
10% real discount rate	6.8	1.0	-132.0	0.5	-278.7	0.3
4% real discount rate	961.0	3.1	199.4	2.0	-201.6	0.6
CAPEX +40%	87.3	1.1	-181.5	0.5	-419.9	0.3
CAPEX -40%	535.8	3.3	112.6	2.2	-109.4	0.6
Benefits -20%	158.0	1.3	-75.8	0.7	-298.3	0.3
Benefits +20%	465.1	2.0	6.8	1.0	-230.9	0.5
Water price -20%	-23.4	1.0	-6.2	1.0	-236.3	0.5

Water price +20%	339.9	1.7	-6.2	1.0	-236.3	0.5
Cotton crop only	339.9	1.7	-6.2	1.0	-236.3	0.5
Base case – Do nothing[46]	-173.4	0.9	-519.4	0.5	-632.7	0.5

14.8 Limitations and assumptions

Consistent with the PBC stage of the project, there are some uncertainties around the water demand and price assumptions included in this analysis. The development of the demand and price assumptions by the Project team are based on current market conditions and the expert industry knowledge of the project advisers. A market sounding process was undertaken with industry to test the demand and price assumptions. The outcomes of this market sounding remain confidential, however they confirmed that there would likely be sufficient demand from the market to achieve the assumptions developed for the PBC and used in the economics appraisal.

Overall it is considered that the assumptions made around agricultural production, demand and price are reasonable and indicative of what could be achieved. This is re-enforced by the outcomes of market engagement undertaken for the project. As per usual process, these assumptions will be required to undergo significant testing and re-confirming through the Detailed Business Case (DBC) Phase which provides the opportunity to fully confirm the demand and price that could be achieved by the project.

14.9 Conclusion

Based on the outcomes of the CBA it was determined that Shortlist Option 1, a 150,000 ML per annum dam with instream distribution to Collinsville, pipeline to Peter Faust Dam, a pipeline to Eungella Dam and to Moranbah and the provision of an agricultural irrigation network, is the most viable option.

This option has a BCR of 1.7 indicating that the monetisable benefits outweigh the costs. The BCR should be considered alongside the benefits that were identified in the SIE that were not able to be monetised for inclusion in the CBA framework and the boarder economic impact of the development of the Scheme to ascertain the economic viability of the project.

It is recommended that this option be further considered in a Detailed Business Case (**DBC**) with further analysis undertaken. The DBC should further confirm the potential agricultural and industrial demand that would be generated by the project, the price that would be paid for water, along with further testing and soil analysis to confirm appropriate crop types that can be grown. The analysis done for the PBC was undertaken on a conservative basis and should be further tested during a DBC, along with considering the broader economic impacts of the project to the region. The DBC should also undertake value engineering to ensure the design and operations are optimised.

[46] Assumes the Base Case is a do nothing approach i.e. no BMP Duplication. Under this scenario there is no avoided cost for Option 1 and 2 and the full capital cost of the BMP duplication is included in Option 3. The benefits from mining demand at Moranbah is included as a benefit under all three options in this sensitivity, whereas it is not included in the Core economic project case.

15 FINANCIAL AND COMMERCIAL

15.1 Chapter Summary

Base case

- The base case assumes that the Urannah Dam is not constructed, and that incremental demand in the Moranbah region is met from duplication of the Burdekin Moranbah Pipeline

Shortlist Option 1

- New Urannah Dam yielding 150,000 ML per annum with instream distribution to Collinsville and designated agricultural precinct, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah

Shortlist Option 2

- New Urannah Dam yielding 70,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah

Shortlist Option 3

- New Urannah Dam yielding 50,000 ML per annum with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, augmentation of the existing pipeline to Moranbah to improve reliability at Moranbah and duplication of the Burdekin to Moranbah pipeline

Financial Net Present Value

- The Financial Net Present Value (**FNPV**) of the shortlisted options presented in this chapter is based on assumptions relating to construction costs, operating costs, discount rates and the sale of new water allocations (in the case of agricultural users) and new water supply contracts (in the case of industrial and urban users); these assumptions are documented in detail through the chapter.
- In each of the options considered, the project FNPV is greater than zero, and for each of the options considered the project FNPV exceeds that of the base case. Accordingly, based on the assumptions included in this chapter, development of the Urannah Dam is a financially valuable investment.

15.2 Purpose

This chapter outlines the financial implications and budgetary impact of the short-listed options. Consistent with the BQ framework, it describes the cashflows of each option from an internal financing perspective, showing the net financial impact to government on a net present value (**NPV**) basis, along with cashflow implications. The chapter is supported by a detailed financial model.

This financial analysis is important because, under the Queensland Bulk Water Opportunities Statement (2017), projects that provide a commercial return are a state priority.

Where subsidies are required because the project is not commercially viable, these subsidies should be transparent and should support the objectives of the subsidy provider (in this case, economic development in the Mackay-Isaac-Whitsunday region).

The risks associated with each option are identified and quantified, and sensitivity analysis is presented for each of the shortlisted options.

15.3 Methodology

The financial and commercial viability of each of the shortlisted options is assessed by:

- Identifying the capital cost of each shortlisted option based on engineering input, as described in Chapter 9: Dam Design & Geology of this PBC.
- Identifying the expected revenue and operating expenses for each shortlisted option, based on engineering input (in the case of operating expenses) and market testing (in the case of revenues, as described in more detail in sections 15.8 and 15.12 below).
- Determining a discount rate based on a weighted average cost of capital (**WACC**), derived using parameters consistent with SunWater's cost of capital.
- Generating a summary table of all revenues and costs on a NPV basis with commentary that compares the key financial and commercial aspects of each option.
- Consideration of budgetary impacts, including potential federal, state and local government funding sources.
- Calculating Financial Net Present Values (**FNPVs**) for each shortlisted option and presenting FNPVs separately based on raw costs and revenues (i.e. not adjusted for risk).
- Identifying key risks and undertaking sensitivity analysis.

15.4 Water demand

15.4.1 Approach to demand forecasting

A key input into the financial and commercial analysis of water infrastructure projects is a robust estimate of the demand for water. Revenue from water infrastructure projects consists of payments from customers, falling into three categories:

- A one-off payment by customers to acquire water allocations. These allocations represent the right to extract water from a water resource (subject to the terms of the allocation), and payments for allocations contribute to the capital costs of the infrastructure.
- An annual fixed charge that is paid for each ML of water allocation held by a customer.
- An annual variable charge that is paid for each ML of water used.

Accordingly, robust revenue estimates require well-informed estimates of demand for both allocations and ongoing water usage.

The relative mix of revenue streams varies by customer segment. For example, agricultural users access water by buying allocations from the water resource in question, and then extracting water on an annual basis, at a relatively low charge; in contrast, industrial customers are more likely to enter into individually negotiated long-term take-or-pay contracts with infrastructure owners.

In assessing the demand for water, this PBC has taken the approach described in sections 15.4.2 to 15.4.5 below.

15.4.2 Industrial users

Estimated demand for water from industrial (predominately mining) users has been based on a combination of previous reviews of Queensland's bulk water infrastructure assets and the market testing described in chapter 4 of this PBC. The result of this review is the following estimate of potential demand from industrial users:

Table 15-1 Industrial demand

Demand node	Potential annual demand
Abbot Point industrial demand	3,000ML
Collinsville industrial demand	5,000ML
Moranbah demand – reliability augmentation	5,000ML
Moranbah demand – additional supply	20,000ML

15.4.3 Urban users

Estimated demand for water from urban users has been derived from the market testing described in Chapter 4: Service Need of this PBC. Expected urban demand is as follows:

Table 15-2 Urban demand

Demand node	Potential annual demand
Proserpine urban demand	5,000ML
Bowen urban demand	2,000ML

15.4.4 Agricultural demand

Under Shortlist Option 1, substantial water resources become available to agricultural users in the Bowen-Broken system. This region is not currently developed for irrigated agriculture; however, previous land use studies and a Desktop Consultancy Report prepared by Herron Todd White for the Urannah Dam Project indicate the suitability of the region for the following crops:

Table 15-3 Cropping suitability

Farming method	Potential crops		
Broad acre			
	Sugar cane	Cotton	Improved pasture & hay
Annual cropping			
	Tomatoes	Bean	Capsicum
	Cucumber	Corn	Pumpkin
	Melon	Chili	Eggplants
	Zucchini	Squash	
Permanent cropping			
	Citrus (lemon/lime)	Mango	Avocado
	Table grapes	Macadamia	Blueberries

Different agricultural production systems require different levels of water reliability: permanent crops require higher reliability water supplies, as lack of water in any given year would result in the death of mature trees/loss of production and the associated destruction of economically valuable assets; in contrast annual cropping and broad acre producers can choose not to plant crops in periods of water scarcity, and can recover quickly when rainfall improves, as a consequence, they are willing to accept lower levels of reliability (i.e. medium reliability allocations).

Under Shortlist Option 1, yield hydrology suggests the following levels of water availability at different levels of reliability, and the associated extent of irrigated development:

Table 15-4 Agricultural demand

Water reliability	Estimated water availability	Estimated irrigated cropping[1]
High reliability	25,000ML	2,400ha
Medium reliability	85,000ML	13,000ha

Note 1: assuming 10 ML/ha/yr for permanent crops and 6.5 ML/ha/yr for annual and broad acre crops

As the availability of suitable agricultural land in the region exceeds the amount that can be serviced by the proposed infrastructure, it is assumed that all allocations available for irrigation would be taken up over time.

15.4.5 Sequencing of demand

Financial modelling assumes that construction commences in 2020 and takes four years to complete. Furthermore, the financial model assumes that:

- From one year after the completion of construction, industrial demand is capable of being sustainably met from inflows over the preceding twelve months.
- From one year after the completion of construction, urban demand is capable of being sustainably met from inflows over the preceding twelve months.
- Allocations for agricultural users become available a year after construction completion, with the number of allocations available growing on a straight-line basis over eight years, and that these allocations are acquired and fully utilised in the year in which they are made available.

15.5 Water pricing

15.5.1 Approach to estimating water prices

Revenue from the sale of water is made up of upfront payments to acquire water allocations (in the case of agricultural users), and ongoing charges for access to and usage of water. Accordingly, it is necessary to estimate the price per ML of water under these different pricing regimes.

The approach to estimating the willingness of potential customers to pay for water varies according to customer segment.

15.5.2 Industrial users

Water pricing arrangements for industrial users are determined by direct negotiation between asset owners and the industrial water users, and the resulting pricing arrangements are usually confidential. Accordingly, market prices for water are not readily available, and pricing estimates have been derived from market testing discussions.

For the purposes of this PBC, it is assumed that industrial users would be willing to enter into long-term take-or-pay contracts for water at a rate of $2,000/ML/yr.

15.5.3 Urban users

As with industrial users, water pricing arrangements for urban water authorities are determined by direct negotiation with asset owners. As a result, market prices are not readily available, and pricing estimates have been derived from market testing discussions.

For the purposes of this PBC, it is assumed that urban water authorities would be willing to enter into long-term take-or-pay contracts for water at a rate of $2,000/ML/yr.

15.5.4 Agricultural users

Agricultural users pay an upfront amount to acquire allocations, and annual charges (fixed and variable) based on their ownership of allocations and usage of water.

Allocation pricing

Water allocations are property rights that allow water users (in this case, irrigators) to access a water resource, subject to the conditions of the allocation. Water allocations have legal title that is separate from land title, and subject to certain conditions can be traded between market participants in an open market. As a consequence, water allocations have a readily observable market price.

The willingness of irrigators to pay for allocations from the Urannah Water Scheme has been determined by reference to readily observable market prices for allocations in similar markets in Queensland. As shown in Table 15-5 prices for medium security allocations range between $296/ML and $3,481/ML, with an average of $1,915/ML.

Table 15-5 Water allocation prices

Water Supply Scheme	Allocation prices ($/ML)
Mareeba – Dimbulah	$3,481
Border Rivers	$1,923
Burdekin	$296

Burnett	$1,036
Condamine – Balonne	$3,158
Nogoa – Mackenzie	$1,596
Average	$1,915

Source: DNRME Permanent Water Trading Interim Report, Dec 2018, Financial YTD figures

For the purposes of this PBC, it is assumed that irrigators would be willing to pay $2,000/ML for medium security allocations, and $3,000/ML for high security allocations (with the 50% premium reflecting the increased economic value of high reliability allocations).

Ongoing and fixed and variable charges

The willingness to purchase a water allocation depends on the up-front cost of the allocation, the annual cost of ownership of the allocation, and the expected economic returns from the use of water.

For the purposes of this PBC, it is assumed that willingness to pay annual costs of ownership for water allocations in the Urannah Water Scheme will be broadly comparable with similar irrigation schemes identified above (as upfront allocation costs, and expected economic returns are expected to be broadly comparable). Table 15-6 below shows the expected annual cost of ownership of water allocations in similar irrigation schemes.

Table 15-6 Annual water charges

Water Supply Scheme	Fixed charges ($/ML/a)	Variable charges ($/ML/a)	Total charges ($/ML/a)
Mareeba – Dimbulah	$26.20	$5.19	$31.39
MacIntyre Brook	$47.43	$4.43	$51.86
Burdekin - Haughton	$41.55	$29.41	$70.96
Bundaberg	$51.34	$58.78	$110.12
St George	$21.38	$1.34	$22.72
Nogoa – Mackenzie	$35.23	$8.00	$43.23
Average			$55.05

Source: SunWater schedule of fees and charges, 2018-19, inclusive of distribution charges

For the purposes of this PBC, it is assumed that irrigators would be willing to pay $55/ML in annual charges (made up of both fixed and variable charges) for both high medium priority allocations.

15.6 Discount Rate

The discount rate is an interest rate used in net present value analysis to convert future cash flows into present value equivalents. Discount rates are derived from an organisation's WACC, which reflects the cost of equity, cost of debt, and the relative mix of equity and debt.

15.6.1 Discount rate assumptions

In this PBC, the WACC is derived using parameters that assume that SunWater is the project proponent. This is consistent with the internal financing methodology within the BQ framework.

Where cash flows assume inflationary increases in costs and/or revenue (ie nominal rather than real cash flows) a nominal discount rate should be used, and that approach has been followed in this PBC.

The assumed parameters used to derive the discount rate are included in Table 15-7below.

Table 15-7 Discount rate inputs

Inputs	Values
Risk free rate [1]	1.95%
Market risk premium [2]	6.50%
Equity beta [3]	0.46
Cost of equity	5.18%
Cost of debt [4]	3.12%
Level of borrowings (debt) [5]	49.0%
Weighted Average Cost of Capital (WACC)	4.03%

Further information on each of the inputs to the WACC are described below.

a. Risk free rate: The expected return on an investment with no risk. Consistent with the Queensland Competition Authority (**QCA**) approach[47], the risk free rate is derived from the five-year government bond rate, averaged over the twenty trading days up to 22 January 2019.

b. Market risk premium: The rate of return in excess of the risk free rate generated by a broadly diversified portfolio. Consistent with the QCA's approach[48] a market risk premium of 6.50% has been adopted.

c. Equity beta: A measure of the riskiness of a project relative to a broadly diversified portfolio. The equity beta for this project was derived from SunWater's asset beta (0.3)[49], adjusted for the proposed mix of equity and debt in the project.

d. Cost of debt: This PBC has adopted the interest rate under the National Water Infrastructure Loan Facility (see section 15.6.2 below).

e. Mix of debt and equity: Under the National Water Infrastructure Loan Facility (see section 15.6.2), 51% of funding must be derived from sources other than the facility. Accordingly, this PBC has adopted a mix of 49% debt and 51% equity.

15.6.2 Funding contributions

A key input in the WACC is the cost of debt. In assessing the cost of debt for this project, consideration has been given to the National Water Infrastructure Loan Facility (**NWILF**). The NWILF provides access to up to $2 billion of loans from the Commonwealth government to co-fund the development of water infrastructure. Access to the loan is limited to state and territory governments and is subject to certain eligibility criteria. In order to be eligible, a project must:

- relate to water infrastructure that is ready to commence construction, or will be ready within 12 months of the loan being granted;
- have all the relevant Commonwealth and state regulatory approvals, or receive them within 12 months of the loan being granted;
- comply with a number of mandatory assessment criteria, including that the project will be of public benefit, will comply with the principles of the National Water Initiative, and is unlikely to proceed without assistance from the Commonwealth;
- not result in the funding from all Commonwealth sources exceeding 49% of total project cost; and

[47] Queensland Competition Authority, SunWater Irrigation Price Review 2012-2017, Volume 1
[48] Queensland Competition Authority, Final Decision - Cost of Capital: Market Parameters, August 2014
[49] Queensland Competition Authority, SunWater Irrigation Price Review 2012-2017, Volume 1

- meet a number of other requirements described below.

15.6.3 Features of National Water Infrastructure Loan Facility

Loans from the NWILF have the following features:

- The minimum loan from the NWILF is $50 million; there is no upper limit to the size of loans, but loans are subject to the availability of capital;
- Loan funding is available from 2017 to 2026 and must be fully repaid within 25 years of the loan being taken;
- Loans can be structured with a construction phase of up to 5 years, with interest able to be capitalised during the construction period; and
- A variable interest rate, based on the 10-year commonwealth government bond rate, with a margin to reflect the cost of administering the loans; the rate is reviewed every six months based on the daily 10-year Commonwealth Government bond rate over the six months leading to the review date.

15.6.4 Summary Assumed Cost of Debt

This PBC has adopted the interest rate under the National Water Infrastructure Loan Facility, currently 3.12%.[50]

15.6.5 Other assumptions

Escalation

Cash flows start in 2017-18 dollars ($2018) and an escalation rate of 2.5% (being the mid-point of the Reserve Bank of Australia's 2-3% inflation target range) has been applied to all cashflows. This escalation rate is considered appropriate for a PBC submission but may be refined during the DBC phase.

15.7 Financial Net Present Value

Based on the assumptions described above, this section presents the unadjusted Financial Net Present Value (**FNPV**) of each option by projecting costs and revenues, discounted using an appropriate WACC, but not adjusted for risk.

The FNPVs presented have been derived from a comprehensive financial model that includes forecasted volumes and prices (to generate revenue projections), projected operating costs, and the expected capital costs of each component of each option. This generates cash flows for each year of the 30-year forecast period; these cash flows are then discounted using an appropriate WACC to identify the unadjusted FNPV for each option.

15.7.1 Summary of options

Consistent with Chapter 7: Options Shortlist of this PBC, the base case and shortlisted options considered for the purposes of financial and commercial analysis are as follows:

[50] As provided by email from Regional Investment Corporation on 23 January 2019

- Base case: No Urannah Dam constructed; duplication of Burdekin to Moranbah pipeline to create incremental supply for Moranbah.
- Shortlist Option 1: New Urannah Dam yielding 150,000 ML/yr with instream distribution to Collinsville and designated agricultural precinct, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah.
- Shortlist Option 2: New Urannah Dam yielding 70,000 ML/yr with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, duplicating the existing pipeline to provide incremental supply to Moranbah.
- Shortlist Option 3: New Urannah Dam yielding 50,000 ML/yr with instream distribution to Collinsville, new pipelines from Urannah to Peter Faust Dam and to Eungella Dam, augmentation of the existing pipeline to Moranbah to improve reliability at Moranbah and duplication of the Burdekin to Moranbah pipeline.

15.8 Capital Costs

15.8.1 Base case

The capital costs associated with the base case (duplication of the Burdekin Moranbah Pipeline) have been estimated based on high-level desktop research. Construction costs have been benchmarked using SunWater estimates for transport from Burdekin Haughton Water Supply System (BHWSS) to Moranbah-Burton Gorge Dam Cluster[51] (namely 300km of pipeline costing $960m in 2013 dollars); this provides a benchmark construction cost for a 25,000ML/a pipeline of $3.62 million per km in 2018 dollars (assuming 2.5% price inflation between 2013 and 2018).

Applying this benchmark to the estimated length of the Burdekin Moranbah Pipeline duplication project (209km)[52] yields a construction cost estimate of $757 million for a 25,000ML/a pipeline.

15.8.2 Shortlist Option 1

Shortlist Option 1 assumes construction of the following infrastructure:

- 290 FSL dam at Urannah (with the additional dam height necessary to support the yield requirements of irrigated agriculture)
- distribution pipeline from Urannah to Peter Faust Dam and Abbot Point
- distribution pipeline from Urannah to Eungella Dam
- distribution pipeline from Eungella Dam to Moranbah (with sufficient volume to supplement water supply in Moranbah)
- distribution infrastructure from Bowen Weir to irrigation customers on the left and right banks of the Bowen River

Because of direct water supply from Urannah to Moranbah, this option negates the need to duplicate the Burdekin to Moranbah pipeline.

[51] SunWater, Bowen and Galilee Basins Water Supply Strategy Report, December 2013, p. 82
[52] SunWater, Bowen and Galilee Basins Water Supply Strategy Report, December 2013, p. 65

Capital costs for the Urannah Dam were estimated by SMEC during preliminary engineering design work described in chapter 9 of this PBC. The results are presented in Table 15-8 below and shows the cost of each type of dam at each proposed dam height.

Table 15-8 Construction costs Urannah Dam ($2018)

Full Supply Level (m)	Concrete Faced Rockfill Dam ($ millions)	Earth and Rockfill Dam ($ millions)	Roller Compacted Concrete Dam ($ millions)
280	492	558	629
285	569	648	734
290	673	773	873
295	822	923	1041

SMEC also estimated the capital costs for distribution infrastructure to Peter Faust Dam and Abbot Point, which are presented in Table 15-9 below

Table 15-9 Construction costs Distribution to Peter Faust Dam and Abbot Point ($2018)

Annual Demand (ML)	Indicative cost ($M)	Capex +40% contingency ($M)
5,000	110.0	154.0
10,000	130.0	182.0
15,000	150.0	210.0
20,000	190.0	266.0
25,000	230.0	322.0

SMEC estimated the construction cost of a pipeline from Urannah Dam to Eungella Dam, and then on to Moranbah, and the results are summarised in Table 15-10 below.

Table 15-10 Construction costs Distribution to Moranbah via Eungella Dam ($2018)

Annual Demand (ML)	Indicative cost ($M)	Capex +40% contingency ($M)
5,000	135.0	189.0
10,000	180.0	252.0
15,000	224.0	313.6
20,000	242.0	338.8
25,000	273.0	382.2

For the purposes of this chapter, Shortlist Option 1 capital costs are based on a 25,000 ML per annum capacity pipeline from Urannah to Moranbah.

Construction costs of distribution infrastructure from the Bowen Weir to irrigation customers under the scenarios were estimated at $200 million. As a consequence, estimated total construction costs under Shortlist Option 1 are as shown in Table 15-11 below.

Table 15-11 Shortlist Option 1 construction costs ($2018)

Construction cost element	Estimate ($M)
290 FSL CFRD Dam	$673
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML)	$210

Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML)	$382
Irrigation distribution infrastructure	$200
Total construction cost	$1,465

15.8.3 Shortlist Option 2

Shortlist Option 2 assumes construction of the following infrastructure:

- 280 FSL dam at Urannah
- distribution pipeline from Urannah to Peter Faust Dam and Abbot Point
- distribution pipeline from Urannah to Eungella Dam
- distribution pipeline from Eungella Dam to Moranbah (with sufficient volume to supplement water supply in Moranbah)

Because of direct water supply from Urannah to Moranbah, this option negates the need to duplicate the Burdekin to Moranbah pipeline.

The total construction cost of Shortlist Option 2 is shown from Urannah Dam to Eungella Dam and then on to Moranbah, with other construction costs equivalent to Shortlist Option 1. Accordingly, the total construction cost estimate is $1,221m, as shown in Table 15-12 below.

Table 15-12 Shortlist Option 2 construction costs ($2018)

Construction cost element	Estimate ($M)
280 FSL RCC Dam	$629
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML)	$210
Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML)	$382
Total construction cost	$1,221

15.8.4 Shortlist Option 3

Shortlist Option 3 assumes construction of a 255 FSL dam at Urannah, combined with distribution pipelines from Urannah to Peter Faust Dam and Abbot Point and a second distribution pipeline from Urannah to Eungella Dam (to supplement reliability of existing allocations from Eungella). As Shortlist Option 3 also includes duplication of the Burdekin to Moranbah Pipeline, estimated construction costs for the BMP duplication have also been included.

SMEC estimated the cost of a pipeline from Urannah Dam to Eungella Dam, as shown in Table 15-13.

Table 15-13 Shortlist Option 2 construction costs distribution to Eungella Dam ($2018)

Annual Demand (ML)	Indicative cost ($M)	Capex +40% contingency ($M)
5,000	16.0	22.4
10,000	21.0	29.4
15,000	26.0	36.4
20,000	31.0	43.4
25,000	35.0	49.0

Total construction costs for Shortlist Option 3 are summarised in Table 15-14 below.

Table 15-14 Shortlist Option 3 construction costs ($2018)

Construction cost element	Estimate ($M)
255 FSL RCC Dam	$258
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML)	$210
Pipeline Urannah Dam to Eungella Dam (5,000 ML)	$22
Burdekin Moranbah Pipeline Duplication (25,000 ML)	$757
Total construction cost	$1,247

15.9 Initial One-off Operating Costs

For the purposes of this PBC, no initial one-off operating costs have been identified that would be material to the financial and commercial analysis of any of the shortlisted options. As a result, initial one-off operating costs have been disregarded.

The exclusion of initial one-off operating costs for the purposes of financial modelling will be revisited and tested during the DBC stage.

15.10 Ongoing Costs

Each of the shortlisted options included in this PBC involves ongoing operating costs. The most significant ongoing operating cost for each option is the cost of pumping water through distribution networks, and for the purposes of the this PBC these pumping costs were the only material operating costs considered. Table 15-15 below summarises annual pumping costs for each option.

Table 15-15 Operating Expenses ($2018)

A$ millions	Base case	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Annual opex				
BMP duplication	27.1	-	-	27.1
Urannah – Peter Faust Dam	-	3.1	3.1	3.1
Urannah – Eungella	-	-	-	2.0
Urannah – Moranbah	-	9.7	9.7	-
Irrigation distribution	-	2.5	-	-
Total annual opex	27.1	15.3	12.8	32.2
NPV of annual opex	-209	443	419	134

With the exception of the BMP duplication, annual operating costs have been derived from SMEC engineering reports. BMP duplication annual operating costs have been estimated based on desktop research and are subject to further validation during the DBC stage.

15.11 Revenues

The assumptions that underpin revenue assumptions in the base case and in each of the shortlisted options are contained in section 15.12 and Table 15-16 below summarise the key demand assumptions in the base case and short-listed options.

Table 15-16 Demand assumption base case and shortlisted options

A$ millions	Base case	Option 1	Option 2	Option 3
Industrial demand (annual)				
Abbot Point industrial demand	-	3,000ML	3,000ML	3,000ML
Collinsville industrial demand	-	5,000ML	5,000ML	5,000ML
Moranbah demand – reliability augmentation	-	5,000ML	5,000ML	5,000ML
Moranbah demand – additional supply from BMP duplication	25,000ML	-	-	25,000ML
Moranbah demand – additional supply from Urannah and Eungella Dams	-	20,000ML	20,000ML	-
Urban demand (annual)				
Proserpine urban demand	-	5,000ML	5,000ML	5,000ML
Bowen urban demand	-	2,000ML	2,000ML	2,000ML
Agricultural demand (annual)				
High reliability	-	25,000ML	-	-
Medium reliability	-	85,000ML	-	-

Table 15-17 below summarises the key pricing assumptions that apply across each scenario.

Table 15-17 Pricing Assumptions

Prices	Upfront allocation price ($/ML)	Ongoing price ($/ML/a)
Industrial – High security	-	$2.000
Urban – High security	-	$2,000
Agricultural – High security	$3,000	$55
Agricultural – Medium security	$2,000	$55

15.12 Value Capture

Value capture opportunities have been considered for each short-listed option. Value capture involves seeking and obtaining funding contributions from beneficiaries (other than users) of new infrastructure. It commonly focuses on landholders who benefit from value uplift as a consequence of new infrastructure.

Consideration of value capture involves the following steps:

15.12.1 Identify benefits and beneficiaries

The main benefits of the proposed infrastructure include:

- Increased value of agricultural land directly served by irrigation infrastructure;
- Increased profitability of mining assets benefiting from incremental water supply;
- Economic development, population growth and reduced unemployment in the region as a consequence of more intensive agriculture and increased mining production; and
- Increase in land values in the region as a consequence of economic development.

The benefits of the shortlisted options include increases in direct and indirect employment (and associated reduction in unemployment), and increased direct and indirect returns on capital, including improved profitability of enterprises in the region.

Since direct benefits largely accrue to customers of the scheme, value capture primarily pertains to indirect job creation and returns to capital among individuals and enterprises that are not customers of the scheme, such as increased employment in the general community, improved profitability of businesses located in the region, and increases in amenity for the general community.

The most important of these benefits – improved conditions in the regional economy and increases in land values in the region – will partially be captured through increased tax revenue.

15.12.2 Estimate value uplift

Value capture methods seek to identify beneficiaries of infrastructure development (other than direct users of infrastructure) and to generate private sector contributions based on the value uplift delivered by the new infrastructure.

In this case, the most easily identifiable beneficiaries of the infrastructure are users including irrigators and mining operations in the region. In both cases, because the infrastructure directly benefits users, the benefit accruing to them is expected to be reflected in their willingness to pay for water, and less directly through their contributions to taxation revenue (and in the case of mining companies) royalty streams. As a consequence, value capture mechanisms are unnecessary for these beneficiaries.

A second set of beneficiaries includes urban water users in the Whitsunday region. While the ability to supply water to this region is expected to remove a significant constraint to economic growth and development, this benefit is expected to be reflected in water charges and tax revenue from the area.

Broader, indirect benefits (such as increased indirect employment, and increased profitability of regional enterprises) are expected to be significant, but difficult to attribute in a meaningful way to individual taxpayers.

15.12.3 Identify relevant value-capture mechanisms

As identified in the previous section, the most easily identifiable benefits of the project are those that accrue directly to users of the infrastructure. While significant, broader indirect benefits are more difficult to attribute to individual taxpayers. As a consequence, value capture is unlikely to be an appropriate mechanism for funding this scheme.

15.12.4 Evaluate mechanisms

Any proposed value capture mechanism could be evaluated against a number of criteria, including:

- Efficiency (in terms of economic efficiency and taxation efficiency)
- Equity and fairness
- Materiality and sustainability

A broad-based value capture mechanism, which sought to defray the costs of the Urannah Water Scheme by applying one-off or ongoing levies against the theoretical indirect beneficiaries of the project, would require extensive stakeholder consultation and support. Any such mechanism would be unlikely to generate widespread community support (given a prevailing view that investment in regional economic development is an existing government responsibility that should not require additional taxes or levies).

15.12.5 Value capture: conclusion

Value capture is unlikely to form a meaningful contributor to the funding of the Urannah Water Scheme. The economic benefits that accrue to individuals and enterprises beyond the scheme's direct customers are indirect, dispersed, difficult to quantify, and difficult to attribute to individual taxpayers. While this will be reflected in increased income tax, company tax and stamp duty revenue, broader value capture mechanisms are not considered viable. Accordingly, value capture has not been incorporated in the financial analysis for any of the shortlisted options.

15.13 Residual Values

For the purposes of this PBC, it is assumed that the useful life of dam and spillway infrastructure is 100 years, and that the useful life of distribution infrastructure is 50 years. Residual values in year 30 were determined by depreciating the capital value of dam/spillway and irrigation assets on a straight line basis over their useful lives. The NPV of residual values was calculated by discounting the year 30 residual value at the WACC, and the results are presented in Table 15-18 below.

Table 15-18 Residual values

Option	NPV of residual values ($M)
Base case	126
Shortlist Option 1	304
Shortlist Option 2	289
Shortlist Option 3	243

15.14 Risk Unadjusted Financial NPVs: Summary

Table 15-19 shows the results of the financial NPV analysis without risk adjustments.

Table 15-19 Risk unadjusted financial NPVs

Financial NPV	Base case	Option 1	Option 2	Option 3
NPV of revenue	1,026	1,973	1,660	1,866
NPV of capex	(778)	(1,506)	(1,255)	(1,282)
NPV of annual opex	(583)	(329)	(275)	(693)
NPV of one-off opex	-	-	-	-
NPV of value capture	-	-	-	-
NPV of residual value	126	304	289	243
Total NPV	**(209)**	**443**	**419**	**134**

As can be seen, each of the options described above has positive financial NPV and the FNPV for each of the shortlisted options is well above that of the base case.

15.15 Risk Analysis Method

15.15.1 Risk assessment

This section identifies key risks relating to the short-listed options and quantifies the impact of these risks. It considers risk analysis through sensitivity analysis, which is considered the most appropriate risk assessment framework for the purposes of this PBC to align with the depth of analysis of risk analysis in the SMEC technical reports.

More detailed quantification of risk inputs, and Monte-Carlo analysis, will be included in the DBC stage.

15.15.2 Risk categories for each option

The following are considered to be relevant risks for each of the shortlisted options.

Table 15-20 Risk categories

Risk categories	Risk categories
Social/stakeholder risk	Water sales contractual risk
Environmental risk	Default risk for annual charges
Demand assessment risk	Site risk
Design risk (e.g. peak flows)	Construction risk
Capital cost risk	Operating cost risk
Funding risk (e.g. water allocation pricing risk)	Health and safety risk
Annual charges/ongoing revenue risk	Native Title and Cultural Heritage Risk

For the purposes of this PBC, the following risks have been modelled using sensitivity analysis:

- Construction cost (+/- 40%)
- Demand risk (+/- 20%)
- Price risk (+/- 20%)
- Discount rate (3% min, 4% max)

15.16 Risk Analysis Construction Costs

Sensitivities for construction costs were conducted on each of the shortlisted options, with the results presented in Table 15-21 below.

Table 15-21 Construction cost sensitivities

Construction costs	Scenario 1	Scenario 2	Scenario 3
Financial NPV			
Business case +40%	(38)	33	(282)
Business case	443	419	134
Business case -40%	923	806	549

15.17 Risk Analysis Demand Risk

Sensitivities for demand scenarios were conducted on each of the shortlisted options, with the results presented in Table 15-22 below.

Table 15-22 Demand sensitivities

Water demand	Scenario 1	Scenario 2	Scenario 3
Financial NPV			
Business case +20%	837	751	507
Business case	443	419	134
Business case -20%	48	87	(239)

15.18 Risk Analysis Pricing

Sensitivities for water pricing were conducted on each of the shortlisted options, with the results presented in Table 15-23 below.

Table 15-23 Pricing sensitivities

Water pricing	Scenario 1	Scenario 2	Scenario 3
Financial NPV			
Business case +20%	837	751	507
Business case	443	419	134
Business case -20%	48	87	(239)

15.19 Risk Analysis Discount rate

Sensitivities for discount rate (weighted average cost of capital) were conducted on each of the shortlisted options, with the results presented in Table 15-24 below.

Table 15-24 Discount rate sensitivities

Discount rate	Scenario 1	Scenario 2	Scenario 3
Financial NPV			
3.50%	616	578	267
Business case (4.03%)	443	419	134
4.50%	307	296	30

15.20 Conclusions

Initial findings of Financial and Commercial Analysis suggest that the Urannah project has the capacity to generate positive Financial NPVs across the short-listed options, and that these Financial NPVs exceed those available under the base case.

The conclusions of the Financial and Commercial Analysis are dependent on a number of key assumptions, including

- Construction and operating costs of the dam and distribution infrastructure
- The likely demand for water and the price at which that water would be sold
- Other financial assumptions, including the WACC, escalation rates and residual values

These assumptions and particularly those relating to demand and pricing, should be tested and refined during the DBC phase of the project.

16 DELIVERY MODEL

16.1 Chapter Summary

This chapter concentrates on Shortlist Option 1, with the full-size dam and agricultural precinct, being the Urannah Water Scheme, split into two packages of work. The first being the Dam and associated infrastructure and the second is the development of the agricultural precinct.

Under traditional delivery models, funding is provided by the public sector, demand risk is retained by the public sector and the asset is transferred to the State at the end of the construction period. A key differentiator between traditional delivery models is the allocation of risk at key stages in the project lifecycle

Key stakeholders and advisors attended a Delivery Model Workshop to conduct the preliminary assessment of both traditional and non-traditional delivery models.

Workshop participants were asked to consider what aspects of Shortlist Option 1 were most important in the achievement of project objectives relating to schedule, cost, Value for Money, quality, customer, approvals and operational considerations

Workshop participants wanted to see the irrigation precinct packaged in any early contractor engagement model's so interest from finance partners could be gauged.

16.2 Purpose

The purpose of this chapter is to conduct a preliminary assessment on a range of delivery models, identify a preferred traditional delivery model and then compare it to non-traditional delivery models to understand how the most value for money (**VfM**) can be achieved, through cost and quality of outcomes, while meeting the identified need.

This chapter concentrates on Shortlist Option 1, with the full-size dam and agricultural precinct, being the Urannah Water Scheme, split into two packages of work. The first being the Dam and associated infrastructure and the second is the development of the agricultural precinct.

16.3 Delivery Model Categories

There are a number of traditional and non-traditional delivery models which have advantages and disadvantages, and different risk profiles and implementation considerations.

16.3.1 Traditional Delivery Models

Under traditional delivery models, funding is provided by the public sector, demand risk is retained by the public sector and the asset is transferred to the State at the end of the construction period. A key differentiator between traditional delivery models is the allocation of risk at key stages in the project lifecycle.

16.3.2 Public Private Partnerships Delivery Model

The National Public Private Partnerships (**PPP**) Guidelines require a PPP delivery model be considered as a delivery option where the capital value of a project exceeds $50 million.

A PPP is typically a long-term service contract between the public and private sectors where the State pays the private sector (typically a consortium) a service fee to deliver infrastructure and related services over an agreed project term. The private sector consortium typically designs, builds and finances the facility, and maintains and/or operates it to specified standards. PPPs typically make the private sector parties who build public infrastructure financially responsible for its condition and performance throughout the asset's lifetime.

PPPs can deliver VfM when there is good opportunity for risk transfer, opportunities for whole of life costing and innovation, potentially higher asset utilisation and good opportunity for integration of design, construction and operations.

PPPs also have the potential to provide a greater degree of time/whole of asset cost certainty than 'traditional' delivery approaches.

16.4 Assessment Process

There are two key VfM determinants, being cost and quality of outcomes. The evaluation of the traditional and non-traditional models focused on these two determinants and was conducted using the following process:

- Delivery model workshop
- Market sounding
- Refinement of delivery model strategy

16.5 Delivery Model Assessment

Key stakeholders and advisors attended a Delivery Model Workshop to conduct the preliminary assessment of both traditional and non-traditional delivery models. The sections below record the outcomes of that process.

16.5.1 Project characteristics, objectives, constraints and risks

Workshop participants reviewed the background to the PBC, the PBC objectives, the shortlisted options and the risk register. This identified a number of constraints and opportunities as outlined in the Table 16-1 below.

Table 16-1 Constraints and opportunities

Constraint	Opportunities
A private led consortium rather than SunWater provides market difficulties and certainty on the lead proponent	Large investment into the resources sector has seen demand for new water sources and construction works increase in the area leading to favourable market conditions
Adherence to ANCOLD requirements (Australian National Committee on Large Dams)	Partnerships with SunWater as operator can be expanded to detailed design.
PPP delivery in water is rare given the limited opportunities to provide finance certainty.	A form of traditional ownership in the dam ownership and construction is highly supported with existing programs and training.
Contract interfaces with the Dam delivery, resource companies and customers creates complexity.	Finance on connecting pipelines on standalone operating arrangements will assist financing.

16.5.2 Precedent Delivery Models

The delivery model analysis considered recent dam projects in Queensland and Tasmania. The most recent project in Queensland was the Connors River Dam, which while not completed, undertook competitive Early Tender Involvement (**ETI**). In Tasmania there have been a number of projects completed in the past ten years all using the Design and Construct (**D&C**) lump sum delivery model.

16.5.3 Cost and Quality Criteria

Workshop participants were asked to consider what aspects of Option 1 were most important in the achievement of project objectives through a paired assessment of the developed criteria.

Responses are summarised below:

- Schedule
- Cost
- Value for Money
- Quality
- Customer
- Approvals
- Operation

The workshop then prioritised the list above, categorised them against cost and quality of outcomes, and applied then weightings for all criteria as follows:

Criteria		Schedule	Cost	VFM	Quality	Customer	Approvals	Operation		
	x	1	2	3	4	5	6	7	Total	Rank
Schedule	1	x	1.00	1.00	1.00	3.00	1.00	3.00	10.0	4
Cost	2		x	1.00	1.00	3.00	3.00	3.00	12.0	3
VFM	3			x	3.00	3.00	3.00	9.00	20.0	1
Quality	4				x	3.00	3.00	9.00	18.0	2
Customer	5					x	1.00	1.00	4.0	6
Approvals	6						x	1.00	6.0	5
Operation	7							x	2.67	7

Value for money objectives relating to quality were considered to be of higher importance than cost due to the importance of producing a safe dam.

16.5.4 Packaging

Packaging involves the disaggregation of project components into distinct contracting or works packages. It was assumed that two packages, being the completion of dam design and construction of the dam were relevant at this PBC stage.

16.6 Assessment of Traditional Delivery Models

Workshop participants considered a range of traditional delivery models which included:

- Competitive Alliance (**CA**)
- Early Contractor Involvement (**ECI**)
- Managing Contractor (**MC**)
- Construction Only (**CO**)
- Design and Construct (**D&C**)
- Design, Construct and Maintain (**DCM**)

The Design, Construct, Maintain and Operate (**DCMO**) and Design, Construct, Finance, Maintain and Operate (**DCFMO**) were not considered as it is assumed that SunWater will operate the dam.

Table 16-2 summarises the assumed allocation of responsibilities for various project functions to government or the private sector under each of the proposed models.

Table 16-2 Allocations of responsibilities

Function	CA	ECI	MC	CO	D&C	DCM
Ownership	Gov	Gov	Gov	Gov	Gov	Gov
Design	Priv	Priv & Gov	Priv	Gov	Priv	Priv
Funding	Gov	Gov	Gov	Gov	Gov	Gov
Supply & Install	Priv	Priv	Priv	Priv	Priv	Priv
Interface Mgmt	Gov & Priv	Gov	Gov & Priv	Gov	Gov	Gov
Maintenance	Gov	Gov	Gov	Gov	Gov	Priv
Operations	Gov	Gov	Gov	Gov	Gov	Gov

16.7 Preliminary Market Sounding

The Building Queensland BCDF requires a PBC to undertake preliminary market sounding. The market sounding process aims to seek market feedback on the project to enable a procurement strategy to be developed that will generate market interest, deliver value for money and appropriately allocate and manage risk. A discussed in Chapter 10, marketing sounding was conducted with a number of relevant stakeholders to determine the demand for additional water and a project of this size. In addition, feedback was obtained from contractors on:

- package structure
- delivery model
- early works scope and staging
- interface with existing operations
- procurement timetable
- market trends and characteristics

16.7.1 Objectives of Market Sounding

The primary objectives of market sounding with contractors is to:

- attract a wide range of market participants to the project and create greater competition
- optimise packaging and procurement options in a way that is most likely to address any market issues
- build market feedback into the proposed procurement strategy, including appetite for the procurement options available
- provide a formal mechanism of documenting the market's views on commercial issues

Secondary objectives of the market sounding process include:

- informing the market of the status of the project, including key features and potential timeframes
- investigating the feasibility of the project and interest from potential financial advisers/arrangers which can be fed into the value for money assessment

16.7.2 Market Sounding Methodology

The methodology for market sounding involved the following:

- questionnaire development
- participant selection
- interviews
- documentation and analysis

16.7.3 Questionnaire Development

Key stakeholders and advisors considered a range of topics that need to be investigated during market sounding which resulted in the following list of questions to be asked of participants:

Name of Company:
Please provide brief background information on your company including relevant experience of a similar nature.
What is your company's capability to provide a solution with regards to one or more of the design, construction, and funding aspects?
What is your company's capacity to provide a solution in the short to medium term in terms of competing demands for your company's resources that may impact on the ability to provide a solution?
What would enhance the commercial attractiveness of the project to your company?
With regards to the risk allocation of project risks, please comment for each risk listed below on who is best placed to carry the risk (the Government or a private provider) and the impact on the attractiveness of the project if your company were required to carry the risk: a. Water demand risk during the operational stage b. Water supply risk during the operational stage c. Construction cost escalation risk d. Maintenance risk e. Infrastructure delivery timing risk f. Planning risk g. Any others?
The project may include design, construction, maintenance and funding elements, which can be procured separately or in combination. For example, delivery models may include a combination of Design and Construct, Construct only, or Public Private Partnership (availability payment model or user generated revenue model), alliance contracting or long term lease. In your view, which delivery model(s) for the project would be most attractive to your company and why?
If known, what would your proposed solution to meet the project objectives be? Please comments on the following aspect of your proposed solution: a. The type and location of associated infrastructure

b. The likely funding structure (eg capital funded by Government or recurrent charges). c. The proposed pricing arrangements d. Innovative components of the solution (eg utilising other water source points, non-infrastructure solutions, etc)
What are you current plans for long term climate impacts with regards to water reliance?
To what extent does your proposed solution address each specific element of the project objectives as set out in the market sounding information: a. Water security b. Water supply service level requirements c. Flexibility d. Water supply quality e. Affordability
How would you most effectively deliver a bulk water supply solution to meet seasonal peak water demand service level requirements without over-investing in infrastructure?
What is the anticipated timeframe to deliver your proposed solution from the time of contract execution to commencement of operations, and what approach would you take to ensure that delivery timeframes would be met given the importance for water security?
Would there be any other benefits that your solution could deliver (eg irrigation precinct impact)?
Please indicate how you would alter your commercial offering for the bulk water solution should you also have interest, capability, and/or capacity to deliver the Urannah Water Scheme?
If UWS decides to procure a solution from the market, what information would be required by your company in subsequent phases to enhance the efficiency and effectiveness of the procurement process?
Please provide any other comments, suggestions, feedback or concerns about any aspect of the project that you would like to provide.

16.7.4 Participant selection

Key stakeholders and advisors identified a list of organisations that might be interested in participating in the market sounding process. A list of the participants is provided in Appendix 13.

16.7.5 Market Feedback

- A total of nine Participants responded and were interviewed. While there was a high response rate from the infrastructure construction market, potential customers in the industrial areas were lower than expected.
- Market sounding interviews were conducted via a combination of face to face interviews and teleconference. In order to meet the PBC probity requirements, market sounding interviews were attended by a combination of representatives from HIC, BCE and VSB.
- There is strong interest in the project from qualified large-scale Dam builders.

- Participants agreed that an Early Contractor Engagement (**ECI**) model with two stage design and construct was preferable allowing for risk sharing on identified risks.
- The project is considered very large but simple for the dam phase; the project size that includes connection pipelines and hydropower is very complex and includes multiple revenue streams.
- The financing of the various elements will require an innovative financing solution with potential long term supply agreements supporting securing project finance.
- The price, security and allocations of water will strongly influence the delivery of this project.

16.8 Outcomes of the Preliminary Delivery Model Assessment

Table 16-3 Urannah Water Scheme Delivery Model

	Cost	Quality	Schedule	VFM	Approvals	Customer	Operation	Ranking
Traditional CO - Lump Sum	Y	Y	N	N	N	N	N	2
D&C - Lump Sum	Y	Y	N	N	N	N	N	2
D&C with ECI (short listed Tenderers) - Lump Sum	Y	Y	Y	N	N	N	N	3
ECI -Lump Sum (risk adjusted price)	Y	Y	N	Y	N	N	N	3
ETI	N	Y	N	Y	Y	N	N	3
Lump Sum (risk adjusted price)	N	Y	Y	N	N	N	N	2
Relationship style Target Price – Alliance	N	Y	Y	N	Y	N	Y	4
PPP	N	Y	Y	N	Y	Y	Y	5
Schedule of Rates / Cost Reimbursable	N	Y	N	N	N	N	N	1

16.9 Recommendation

The market sounding has resulted in sufficient interest to commence detailed processes with market participants on partnership models. Further work in detailed business case phases would examine the use of funding models and provide the market with certainty on Government commitments.

17 PREFERRED OPTIONS FOR FURTHER DEVELOPMENT

17.1 Chapter Summary

Shortlist Option 1 – New Urannah Dam yielding 150,000 ML/yr, supplying Peter Faust and Eungella, supply to Moranbah and Collinsville irrigation precinct and Shortlist Option 2 – New Urannah Dam yielding 70,000 ML/yr supplying Peter Faust and Eungella, duplicating supply to Moranbah are the preferred options for further evaluation.

Shortlist Option 3 – New Urannah Dam yielding 50,000 ML/yr supplying Peter Faust and Eungella, and a duplication of the BMP is not recommended to proceed to a Detailed Business Case at this time.

Key success factors for Shortlist Options 1 and 2 are:

- increasing operational performance of the scheme to service significant areas of the urban demand nodes in Bowen, Collinsville, Proserpine, Whitsundays and Moranbah
- servicing the urban and industrial demand in and around Collinsville
- increasing the reliability of Peter Faust and Eungella dams
- creates new water supply allocations to ensure reliability of water supply to enable the development of additional industrial demand nodes

An additional key success factor for Shortlist Option 1 is:

- Allows for the creation of an agricultural precinct around Collinsville

There are limited negative impacts that would result from the implementation of either of the scheme options.

17.2 Purpose

This chapter outlines the assessment of the shortlisted options to identify the preferred option(s) to proceed to further evaluation.

17.3 Approach

The analysis of the three shortlisted options undertaken in the preceding chapters of this PBC was considered alongside the Building Queensland Prioritisation Framework categories, which are used for the purpose of prioritising projects across government. The Building Queensland Prioritisation Framework criteria of strategic, economic and financial, social and environmental and deliverability were weighted equally in the assessment.

Table 17-1 Analysis of shortlisted options

Criteria	Base Case	Option 1 (FSL RL290)	Option 2 (FSL RL280)	Option 3 (FSL RL255)
Strategic				
Alignment to government objectives	Low	High	Medium	Medium
Effectiveness in addressing the service need	Low	High	Medium	Medium
Economic and Financial				
Estimated new water available (ML)	25,000 ML/yr	150,000 ML/yr	70,000 ML/yr	50,000 ML/yr
Estimated capital costs (2018$M)	$757	$1,465	$1,221	$1,247
Estimated operational costs per annum (2018$M)	$27.1	$15.3	$12.8	$32.2
Financial Net Present Value ($M)	$70	$558	$598	$457
Benefit Cost Ratio	-	1.7	0.9	0.4
Social and Environmental				
Social Impacts	N/A	Positive (High)	Positive (Medium)	Positive (Medium)
Environmental Impacts	N/A	Negative (Low)	Negative (Low)	Negative (Low)
Deliverability				
Risk	Low	High	Medium	Medium
Potential VfM from a Public Private Partnership	No	Yes	Yes	Yes

17.3.1 Conclusion

Shortlist Option 1 and Shortlist Option 2 are the preferred options to progress to further evaluation.

17.4 Impacts of Preferred Options

17.4.1 Strategic Impact

Shortlist Option 1 and Shortlist Option 2 will contribute to the strategic objectives of the following government plans and policies:

- Australian Infrastructure Plan – Shortlist Option 1 aligns in that it will enhance our regional productive capacity to take advantage of growing demand for our produce in South-East Asia and China.

- Northern Australia Audit – Shortlist Options 1 and 2 align with the NAA by addressing critical economic infrastructure gaps required to meet projected Northern Australia population growth and mitigate water availability issues that affect the development of Northern Australia
- National Water Initiative – The options are supported by this blueprint for water reform and the commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities.
- State Infrastructure Plan – Shortlist Options 1 and 2 support the key outcomes, such as:
  - water supply infrastructure where there is a sound business case and water resources are available
  - supporting the water needs of local governments
  - mitigating the effects of flooding
  - ensuring the dam is safe during extreme climate events
  - capturing a valuable finite resource (water) and increasing its availability to Queenslanders
- Queensland Agricultural Land Audit – Shortlist Option 1 is important to current and future agricultural production, removes some constraints to development and give security to potential investors in the agricultural sector.
- Advancing North Queensland – Shortlist Options 1 and 2 align with the priority area of water security.
- National Water Infrastructure Development Fund – the options align with the objective of the feasibility component of the fund to undertake the detailed planning necessary to inform water infrastructure investment decisions and stimulate regional economic benefits

17.4.2 Economic Impacts

Table 17-2 below outlines the key indicators of Shortlist Options 1 and 2.

Table 17-2 Key Indicators

Item	Option 1 (FSL RL290)	Option 2 (FSL RL255)
Estimated new water available (ML)	150,000 ML/yr	70,000 ML/yr
Estimated capital costs (2018$M)	$1,465	$1,221
Estimated operational costs per annum (2018$M)	$15.3	$12.8
Financial Net Present Value ($M)	$558	$598
Benefit Cost Ratio	1.7	0.9

17.4.3 Social and Environmental Impacts

Table 17-3 below summaries the positive social impacts that were consistent across each of the options to varying degrees.

Table 17-3 Positive social impacts

Social Impact	Description
Increase in agricultural production, leading to higher value land use	Access to a bulk water supply storage provides additional water supply sources, increases regional water availability and security for water users. Increased water accessibility will increase the extent to which producers can improve land activities to increase productivity.
Increase in mining expansion and project certainty	Access to a bulk water supply provides additional water supply sources, increasing regional water availability and security for water users. An increase in reliable high priority water allocations could lead to additional regional mining activities, including the expansion of existing mines.
Increase in regional employment from enhanced agricultural productivity	These additional water resources will increase agricultural productivity, creating a number of additional agricultural employment opportunities. Additional regional opportunities will aid population growth and vitality
Increase in regional employment from enhanced mining activity	These additional water resources will increase agricultural productivity, creating a number of additional mining employment opportunities. Additional regional opportunities will aid population growth and vitality
Opportunities for Indigenous business development and employment	Investing in Urannah Dam could produce additional short- and long-term Indigenous employment opportunities during the construction and operational phases of Urannah Dam
Increased certainty of long-term water supply to at risk urban areas	Access to a reliable bulk water supply storage system will shift water demand away from the Peter Faust Dam at Proserpine (96 per cent allocated). The connection supply to Peter Faust Dam catchment will provide additional allocations and security for residents and tourists, located in the 'at risk' urban area.
Enhanced confidence to invest in long term business operations and succession opportunities	The increase in water security will increase the level of confidence within the agricultural and mining sectors to generate long term investment.
Increase in value and flexibility of existing water allocations	Access to a bulk water supply provides additional water supply sources which could lead to additional water trading and an increase in the value of water traded.
Increase in tourism to the region	An additional water body in the region could lead to increased tourism such as seen in Lake Tinaroo in North Queensland.
Decrease in crime	A decrease in unemployment resulting from the Project could result in a decrease in crime.
Additional demand on existing services during construction and operational phases	Skilled trade and other professionals will be in high demand in the region throughout the construction and operational phases

The key environmental issues associated with Shortlist Option 1 are

- The development of a new dam and the consequential agricultural expansion within a Great Barrier Reef catchment may require approval under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- An estimated 2,763 ha of ‘of concern’ regional ecosystems and 3,336 ha of ‘least concern’ regional ecosystems, would be inundated by the dam.
- The project needs to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures.
- The changes that will occur in the local water system due to a large-scale dam in the region.

The key environmental issues associated with Shortlist Option 2 are:

- As per Shortlist Option 1, areas of ‘of concern’ and ‘least concern’ regional ecosystems would be inundated. No areas of endangered regional ecosystems or any TECs would be affected by the proposed dam or its inundation area.
- The project needs to demonstrate consideration of options to minimise potential impacts on the regional wetlands through proposed management and mitigation measures.
- The changes to the water system due to the introduction of another dam in the region.

18 CONCLUSIONS

Water is a critical resource for the communities of the Mackay, Isaac and Whitsunday Region and their productive mining and agricultural sectors. These sectors contribute greatly to Queensland's economy, regional jobs and the social fabric of many rural and regional towns. Yet investigations show existing unmet and latent demand for water across the region (excluding Mackay) that is restricting economic growth and undermining business confidence to invest.

Western mines, coastal farmers and Whitsunday industrial operators are currently limiting their activities to avoid using their full water allocations as they are concerned water supply might fail at critical moments. Water supply from Eungella and Peter Faust dams used by these mines, farms and operators is unreliable. When dams get low, water supply to users with low priority water allocations ceases in order to preserve supply for high priority users, particularly urban communities.

The Burdekin to Moranbah pipeline, which brings water into western parts of the region from Burdekin Falls Dam, is also fully contracted to its capacity. Mines in Collinsville and Moranbah are trading in water at prices of up to $6,000 per megalitre and optimising water use through re-use and recycling. Current prices place water beyond the reach of agricultural users in many western areas, which is inhibiting the growth of this sector.

Demand modelling suggests additional annual demand for water of up to 125,650 ML consisting of 40,650 ML from industry and mining, 5,000 ML from coastal communities & industry and up to 80,000 ML from agriculture.

Market sounding reveals mining operators and proponents of new resource projects want SunWater to duplicate the pipeline from Gorge Weir to Moranbah with a 209-kilometre pipeline that would supply around 25,000 ML per annum (Base Case). Operators indicated that numerous resource projects would have proceeded when favourable commodity markets returned in recent years had secure access to water been available.

However, this PBC demonstrates that constructing a dam at Urannah, on an elevated site that receives more rainfall than the existing Eungella Dam, could deliver more water to more locations than duplicating the pipeline and much greater social benefits to the region.

As well as delivering water to western mining, Urannah Dam could be used to top up water in Eungella and Peter Faust dams, taking advantage of existing infrastructure to create a comprehensive water grid and provide greater water security for western and coastal communities. Urannah Dam would almost triple the dam capacity of the Mackay, Isaac and Whitsunday Region, delivering almost 80 per cent of the capacity of Burdekin Falls Dam on less than 20 per cent of the land area.

Constructed to its full potential, Urannah Water Scheme could also supply water for a new irrigated agricultural precinct near Collinsville for high-value crops with significant export appeal. Drawing on the experiences of Emerald, a mining town that branched into irrigated agriculture, this could be expected to reinvigorate Collinsville by creating new jobs and broadening the local economic base, with flow-on benefits to the regional economy.

Urannah Water Scheme would become part of the BBWSS and connect via pipeline to the Proserpine WSS. It would also supplement water from the BHWSS, to which it would be connected via the river system.

Around 10,500 hectares of land would be inundated by the dam in a sub-catchment with high conservation value. While property impacts would be minimal, some remnant regional ecosystem vegetation would be submerged, which could affect state and federally protected fauna. Environmental impacts will require greater investigation and careful management, particularly for sensitive areas downstream. It is likely that an EIS and EPBC approval will be required, along with environmental offsets.

While the dam site and irrigation area are either under native title or subject to a native title claim, the Urannah Water Scheme concept is supported by the Traditional Owners. However, potential impacts to Aboriginal cultural heritage needs further assessment.

Preliminary economic analysis shows the full Urannah Water Scheme, which combines the construction of a full-sized dam yielding 150,000 ML/a and supplying an irrigated agricultural precinct of up to 11,000 hectares, is economically viable with an attractive BCR of 1.7 and a capital cost of $1,465 million. This is the preferred option identified by this PBC. Construction of a smaller scale dam at Urannah yielding 70,000 ML/a (at a capital cost of $1,221 million) is the second most viable option examined by this PBC and has a BCR of 0.9. Both options should be examined further through a DBC to inform an investment decision.

Additionally, as instructed by DNRME, economic analysis was completed using an alternative 'Do Nothing' base case as a means of comparison with the project options. Whilst this did not change the shortlisted options the results of the CBA were as follows:

- The construction of a full-sized dam yielding 150,000 ML/a and supplying an irrigated agricultural precinct of up to 11,000 hectares, concluded a BCR of 0.9 and a capital cost of $1,465 million.

Given the project is at the PBC stage, it is expected that there will be opportunities for value engineering which could generate a BCR of greater than 1 for Shortlist Option 1. Shortlist Option 1 remains the preferred option identified by this PBC.

Analysis shows that reform measures, strategies to influence demand and capital works to supplement existing water supply systems alone would be insufficient to meet the identified service need.

This PBC represents the completion of the NWIDF-funded feasibility study into the Urannah Dam.

19 RECOMMENDATIONS

The Urannah Water Scheme Preliminary Business Case recommends the following:

1. Endorsement that Shortlist Option 1 progress for further evaluation:
   - the construction of a large-scale dam to a height of 290 FSL with a yield of 150,000 ML per annum
   - augmentation of supply to the Peter Faust and Eungella Dams to address the urban demand in the Bowen, Proserpine, Collinsville and Whitsundays regions
   - instream distribution through the Bowen/Broken river system to supply industrial use for existing mining operation in the Collinsville area
   - augmentation of supply, through duplication of the existing pipeline, to Moranbah industrial customers
   - provision of an irrigated, agricultural precinct of up to 11,000ha around Collinsville
2. Endorsement that Shortlist Option 2 progress for further evaluation:
   - construction of a medium-scale Dam to a height of 280 FSL with a yield of 70,000 ML per annum
   - augmentation of supply to the Peter Faust and Eungella Dams to increase reliability of urban water supply to the Bowen, Proserpine, Collinsville and Whitsundays regions
   - instream distribution through the Bowen/Broken river system to supply industrial use for existing mining operation in the Collinsville area
   - augmentation of supply, through the existing pipeline, to Moranbah industrial customers
3. Endorsement that Shortlist Option 3 not progress to further evaluation via a Detailed Business Case at this time.
4. Note that the Urannah Water Scheme aligns with, and contributes to, the strategic objectives, programs and policies of both State and Federal government, namely:
   - deliver greater water security for Northern Australia
   - support the growth of agriculture in the Mackay, Isaac and Whitsunday Region
   - promote regional economic investment and development
   - will promote market engagement under public private partnership arrangements.

20 ADDENDUM A

20.1 Chapter Summary

The economic analysis was undertaken using a CBA framework that applies discounted cash flow techniques.

The development of the Dam and associated infrastructure will generate a number of benefits to the Queensland community. The benefits included in the economic appraisal are those which were identified as monetisable.

Based on the outcomes of the CBA, and when compared against a 'Do Nothing' base case, it was determined that Shortlist Option 1, a 150,000 ML per annum dam with instream distribution to Collinsville, pipeline to Peter Faust Dam, a pipeline to Eungella Dam and to Moranbah and the provision of an agricultural irrigation network, is the most viable option with a BCR of 0.9.

Given the project is at the PBC stage, it is expected that there may be opportunities for value engineering which could generate a BCR of greater than 1 for Shortlist Option 1. Additionally, the BCR is just one of a range decision making criteria and should be considered alongside the other non-monetisable benefits.

20.2 Purpose

The Base Case analysis outlined in Chapter 14: Economics and in Appendix 11: Economics Technical Appendix presents a situation where the proposed Burdekin to Moranbah Pipeline (BMP) duplication is assumed as the 'Do Minimum' base case. Given this, there is deemed to be sufficient certainty to conclude that, in the absence of other infrastructure projects, the BMP will be developed.

However, it is noted that DNRME do not consider that sufficient intent exists to include the BMP duplication as the Base Case for this PBC as it is not yet included in SunWater's capital works program nor has it received confirmed funding for the State. Therefore, the purpose of this Addendum A to the Urannah PBC has been developed to highlight the impacts to the economic viability of the Project if the Base Case is considered a 'Do Nothing' approach.

20.3 Assumptions

The assumptions for the alternative "Do Nothing' base case analysis are identical to the 'Do Minimum' analysis with the following exceptions:

- The capital cost of the BMP duplication is removed as an avoided cost from Option 1 and 2
- The operational cost savings of the BMP duplication is removed as an avoided cost from Option 1 and 2
- The capital and operating cost of the BMP duplication is included in Option 3
- Benefits of increased production at Moranbah are included in Option 1, 2 and 3 to reflect the impacts of the incremental water supply relative to the Base Case without the BMP duplication.

20.3.1 Key assumption and parameters

Key assumptions for this analysis are consistent with those set out in the Building Queensland BCDF and Infrastructure Australia's (**IA**) Assessment Framework. The key assumptions for the Project are reiterated in Table 20-1 Economic analysis key assumptions below.

Table 20-1 Economic analysis key assumptions

Assumption	Note	Justification
Discount rate	7% (real) with sensitivities conducted at 4% and 10%	Infrastructure Australia
Appraisal period	30 years	Building Queensland and Infrastructure Australia
Base year	2019	PwC
Construction start	01/01/2020	Urannah Water
Construction end	31/12/2023	Urannah Water
Operations start	01/01/2024	Urannah Water
Residual value	$788 million	Estimated using straight line depreciation based on an asset life of 100 years for dam infrastructure and 50 years for pipelines.
Base Case		The Base Case for the Project includes the current water infrastructure in the region, with the development of a new 25,000 ML/yr pipeline by SunWater from Burdekin to Moranbah.

20.3.2 Project Case

During the options assessment process, (described in Chapter 6: Options Filter), three options were identified for further analysis through the economic assessment. A brief description of each of the options is provided in Table 20-2 Project Case option infrastructure assets developed below.

Table 20-2 Project Case option infrastructure assets developed

Asset	Base case 'Do Nothing'	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Construction Method	-	CFRD	RCC	RCC
Urannah Dam Yield	X	150,000 ML	70,000 ML	50,000 ML
Instream distribution to Collinsville	X	√	√	√
Pipeline to Peter Faust Dam	X	√	√	√
Pipeline to Eungella Dam	X	√	√	√
Moranbah supply	X	Urannah to Moranbah pipeline	Urannah to Moranbah pipeline	Burdekin to Moranbah duplication
Agricultural irrigation network	X	√	X	X

20.4 Costs

This section sets out the costs applied in the economic appraisal, including capital and operating costs associated with the construction, ongoing operation and maintenance of each project option. On farm costs associated with increases in production resulting from the development of the Project have been captured as part of the estimation of the increase in Industry Value Add (**IVA**) from agricultural production.

20.4.1 Delivery phase costs

The total real costs estimated by SMEC (represented in $2019) are presented in Table 20-3 - Capital cost ($ million, real, $2018) below. All costs are incremental to the Base Case consistent with standard CBA appraisal methodology. Shortlist Option 3 includes the cost of the Burdekin to Moranbah pipeline as the cost is incremental to the 'Do Nothing' Base Case.

Table 20-3 - Capital cost ($ million, real, $2018)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Dam & Spillway	673.0	629.0	258.0
Pipeline Urannah Dam to Peter Faust & Abbot Point (15,000 ML)	210.0	210.0	210.0
Pipeline Urannah Dam to Eungella Dam and Moranbah (25,000 ML)	-	-	22.4
Pipeline Urannah Dam to Eungella Dam	382.2	382.2	-
Irrigation network	200.0	-	-
BMP Duplication	-	-	756.7
Avoided Cost (Burdekin Moranbah Pipeline Duplication)	-	-	-
Total	**1,465.2**	**1,221.2**	**1,247.1**

20.4.2 Operating phase costs

Operating cost estimates have been developed by SMEC and include all relevant costs for the operation of each option over the 30-year appraisal period. The operating phase costs of each option under the 'Do Nothing' base case definition are outlined in Table 20-4 - Operating phase costs ($ million, discounted 7% real) below.

Table 20-4 - Operating phase costs ($ million, discounted 7% real)

Cost stream	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
Dam and spillway	-	-	-
Urannah – Peter Faust Pipeline	27.3	27.3	27.3
Urannah – Eungella	-	-	17.7
Urannah – Moranbah	85.8	85.8	
BMP Duplication	-	-	240.0
Irrigation distribution	22.1	-	
Avoided cost (BMP duplication)	-	-	
Total	**135.3**	**113.2**	**285.0**

20.5 Benefits

Under the ‘Do Minimum’ base case, the benefits generated by industrial demand from Moranbah were included and therefore were not measured in the benefits of each of the options. Under the ‘Do Nothing’ base case scenario the BMP duplication is not constructed, and therefore this demand is not serviced, these benefits are included.

The demand assumptions and estimation are outlined in more detail in Sections 4 and 6 of Appendix 11: Technical Economics Appendix. Outlined in Table 20-5 - Industrial and mining demand below is a summary of the demand and price assumptions included in the economic analysis.

Table 20-5 - Industrial and mining demand

User	Ongoing price ($/ML/yr)	NPV of Benefit ($million, discounted at 7% real)
Abbot Point demand	2,000	$53.1
Moranbah demand	2,000	$353.9
Collinsville demand	2,000	$88.5

Source: Urannah Water

20.6 Results

The following tables present the outcomes of the CBA for each project option, presented in NPV and BCR terms for the ‘Do Nothing’ Base Case. Table 20-6 - Summary of CBA results ($million, discounted at 7% real) below presents a summary of the NPVs and BCRs for each of the options.

Table 20-6 - Summary of CBA results ($million, discounted at 7% real)

CBA -Results	Option 1 (FSL 290)	Option 2 (FSL 280)	Option 3 (FSL 255)
NPV	-173.4	-519.4	-632.7
BCR	0.9	0.5	0.5

Table 20-7 - CBA results ($million, discounted at 7% real) below presents the outcomes of the CBA for Options 1, 2 and 3.

Table 20-7 - CBA results ($million, discounted at 7% real)

CBA Results	Option 1 (FSL 290)		Option 2 (FSL 280)		Option 3 (FSL 255)	
	NPV	BCR build up	NPV	BCR build up	NPV	BCR build up
Costs						
Capital costs	1,159.6		966.5		986.9	
Operations costs	135.3		113.2		285.0	
Total costs	**1,294.8**		**1,079.6**		**1,272.0**	
Benefits						
Urban user	1.3	0.0	1.3	0.0	1.3	0.0
Industrial user	407.0	0.3	407.0	0.1	495.5	0.4
Mining user	88.5	0.4	88.5	0.3	88.5	0.5
Agricultural user	550.9	0.8	0.0	0.3	-	0.5

Residual value[53]	73.8	0.9	63.4	0.9	54.0	0.5
Total benefits	**1,121.5**		**560.2**		**639.2**	
Results						
Total Benefit - Cost	**-173.4**	**0.9**	**-519.4**	**0.5**	**-632.7**	**0.5**

20.7 Summary

Based on the revised 'Do Nothing' base case, Shortlist Option 1 has an estimated BCR of 0.9. Given the project is at the PBC stage, it is expected that there may be opportunities for value engineering which could allow the project to have a BCR of greater than 1. Additionally, the BCR is one of a range decision making criteria and needs to be considered alongside the non-monetisable benefits outlined in Chapter 12: Social Impact.

[53] The difference between the residual value in the economics and financial analysis is due to the different application of escalation and discount rate between the two sets of analysis.

21 APPENDICES

Appendix 1 – Geology
Appendix 2 – Environment
Appendix 3 – Yield Hydrology
Appendix 4 – Flood Hydrology
Appendix 5 – Dam & Spillway
Appendix 6 – Hydro Power & Storage
Appendix 7 – Irrigation & Distribution
Appendix 8 – Tenure
Appendix 9 – Schematics
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Appendix 12 – Social Impact
Appendix 13 – Market Sounding
Appendix 14 – Risk Register
Appendix 15 – Demand Assessment Report (GHD)