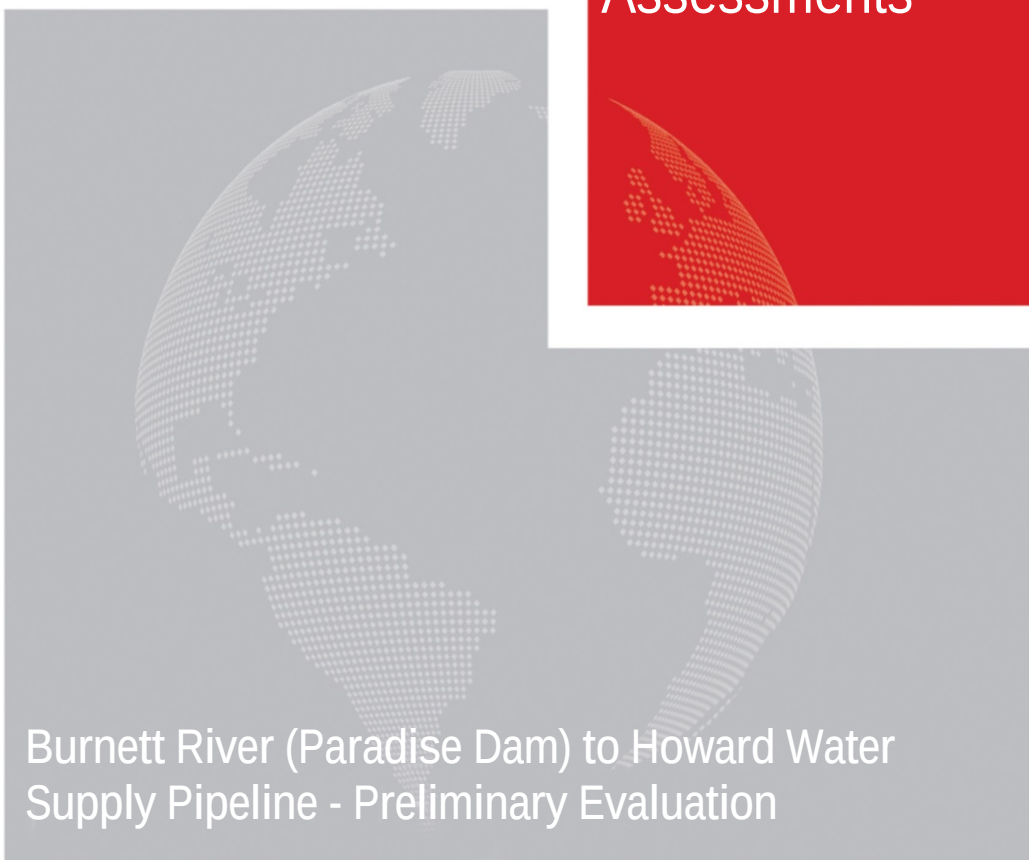
KBR

MIPP Early Stage Assessments

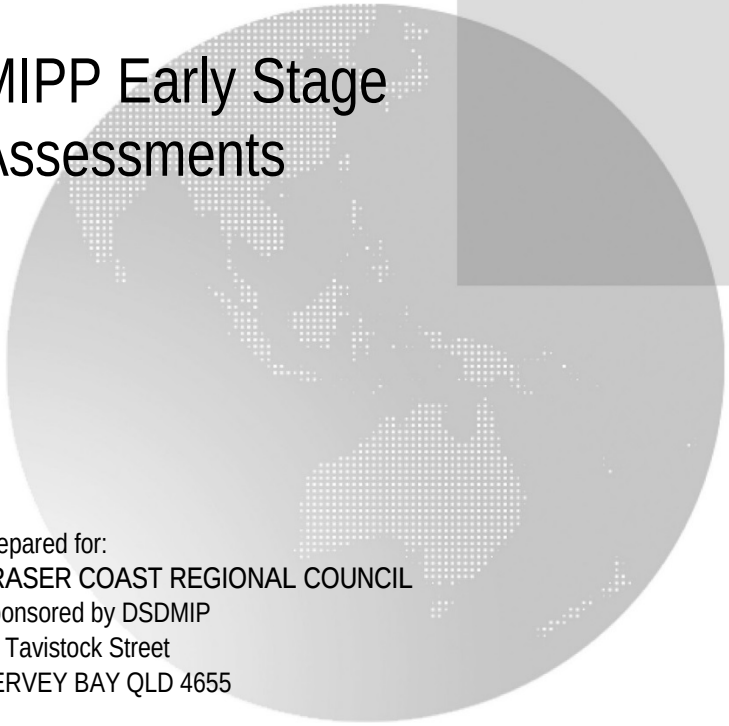


Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Preliminary Evaluation

We Deliver

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Preliminary Evaluation

MIPP Early Stage Assessments



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Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to present future Hervey Bay water source options outlined in the 2015 Fraser Coast Water Supply Strategy, in the form of a Preliminary Evaluation (PE), in accordance with the scope of services set out in the contract between KBR and Fraser Coast Regional Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from the findings from the 2015 Fraser Coast Water Supply Strategy. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

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Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	14/09/2018	Draft Issue	M. Herring	R. Populin	R. Populin	K. Fung
0	10/10/2018	Final	M. Herring	T. Belgrove	R. Populin	K. Fung

Contents

List of abbreviations

ADD	Average Day Demand
AHD	Australian Height Datum
ARI	Average Recurrence Interval
BCR	Benefit Cost Ratio
BRC	Bundaberg Regional Council
CAPEX	Capital Expenditure
DEWS	Department of Energy and Water Supply
DILGP	Department of Infrastructure, Local Government, and Planning
DNRME	Department of Natural Resources Mines and Energy
DSDMIP	Department of State Development Manufacturing Infrastructure and Planning
ED	Equivalent Dwellings
FCRC	Fraser Coast Regional Council
HP	High Priority
IPR	Indirect Potable Reuse
KBR	Kellogg Brown & Root Pty Ltd
LOS	Levels of Service
MDMM	Mean Day Maximum Month
MIPP	Maturing the Infrastructure Pipeline Program
MP	Medium Priority
MSCL	Mild Steel Cement Lined
NPV	Net Present Value
O&M	Operating and Maintenance
OPEX	Operational Expenditure
PAF	Project Assessment Framework
PE	Preliminary Evaluation
PRW	Purified Recycled Water
PV	Present Value
QGSO	Queensland Government Statistician's Office
RWSSA	Regional Water Supply Security Assessment

SASR	Strategic Assessment of Service Requirements
WBBROC	Wide Bay Burnett Regional Organisation of Councils
WBWC	Wide Bay Water Corporation (now Wide Bay Water)
WTP	Water Treatment Plant

Summary

Fraser Coast Regional Council (FCRC) has undertaken a number of planning studies for water supply and future water sources and these have identified a need to progress options to secure the long term reliable supply of water for the Fraser Coast community.

To progress these studies one of the potential future supply options identified - Burnett River (Paradise Dam) to Howard Water Supply Pipeline is being presented as a Preliminary Evaluation (PE), under the Maturing the Infrastructure Pipeline Program (MIPP) – Early Stage Assessment.

The MIPP follows the state governments Project Assessment Framework (PAF) which defines steps in the process and requirements to meet the state government objectives in respect to projects that may be eligible for future funding and to promote due diligence of a project through the defined lifecycle of a project.

THE PROJECT

The project involves obtaining high priority water from the Paradise Dam source on the Burnett River and transferring the water to the Burrum Weir pump station which is connected to two FCRC water treatment plants. The current system capacity and the proposed project would meet the projected FCRC water demands to 2066 without further duplication or utilisation of addition source water opportunities. When completed, the project would supply significant additional long term source water security for FCRC.

The primary objective of the project is to address the long term water security for the Fraser Coast region with the potential benefit if appropriate to provide medium priority water to new irrigation and industry users along the pipeline route. The lack of reliable water supply is a risk factor in the future economic development within the region.

Figure 1 below shows a preliminary alignment of the Burnett River to Burrum Pipeline, put forward by FCRC as part of the 'Maturing the Infrastructure Pipeline Program' submission. The submission suggested a staged approach for this pipeline, with Stage 1 utilising a potential surplus in the Isis main channel system to push out any augmentation of the Hervey Bay system by 5 years. Stage 2 extends this pipeline to a potential source extraction point at Causeway Rd, Booyal.

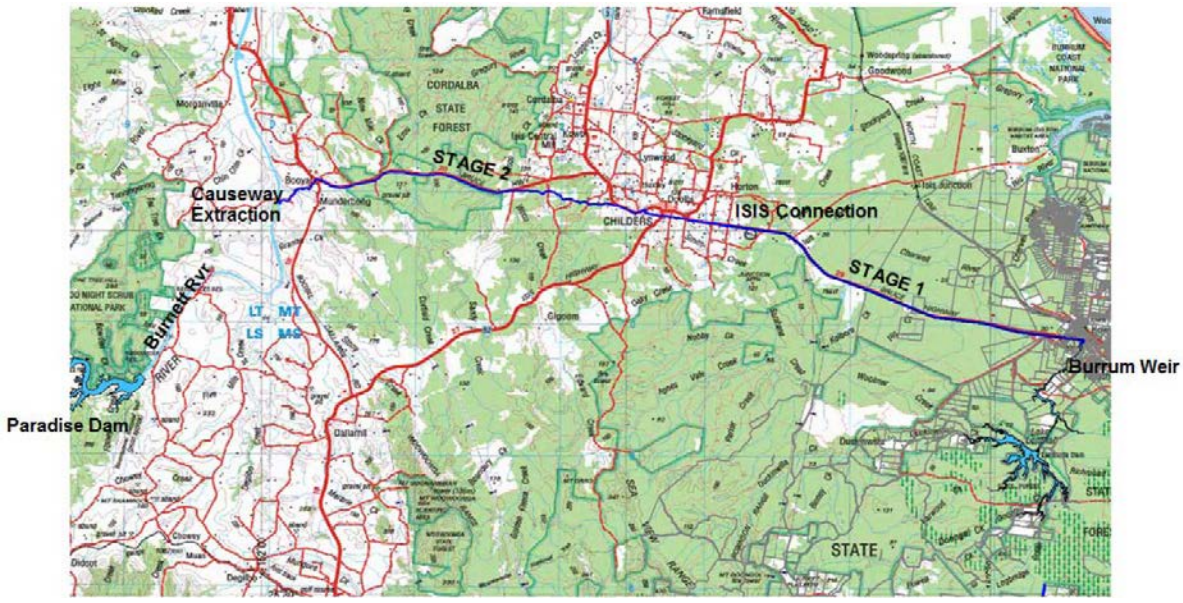

Figure 1 Burnett River to Burrum Pipeline from MIPP Submission Proposal

STAKEHOLDER ENGAGEMENT

A consultation process was undertaken in a series of one-on-one meetings with the stakeholders nominated by FCRC. This process identified a number of agricultural demand regions that are potentially serviceable by Burnett River / Paradise Dam water. These regions are shown below in Figure 2.

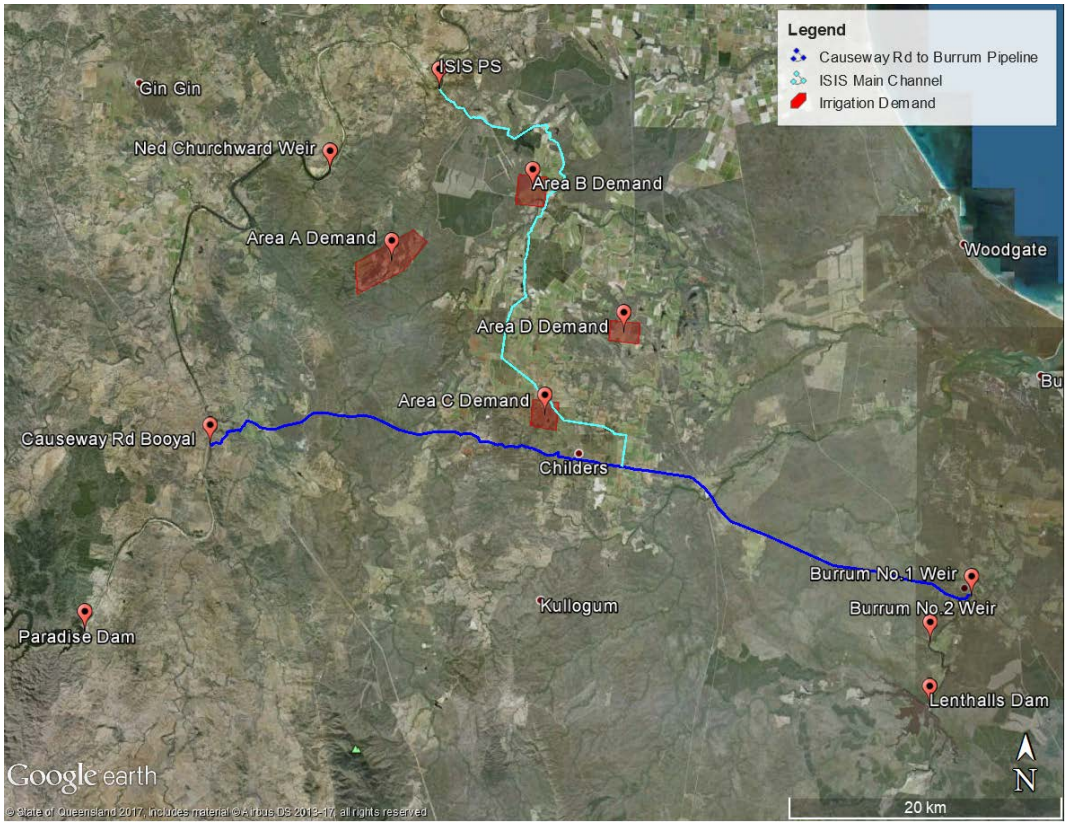

Figure 2 Irrigation demands identified in the Burnett Wide Bay Region

Route Alignments

Following the Stakeholder Engagement process, and the subsequent potential demands identified in the Burnett Region, three potential routes for this pipeline have been developed:

- Option 1: Ned Churchward Weir to Burrum No 1 Weir
- Option 2: Causeway Rd to Burrum No 1 Weir (MIPP submission alignment)
- Option 3: Paradise Dam to Burrum No 1 Weir

For the purpose of assessing the potential benefits associated with supplying additional water for agricultural use, each of the three identified pipeline alignments was assessed utilising the following:

- A: Inclusion of offtakes to agricultural demands in the vicinity of the main pipeline. Takes into consideration the identified irrigation demands
- B: No offtakes, assuming a peak demand in-line with Hervey Bay Urban Demand.

An overview of the routes is shown in Figure 3.

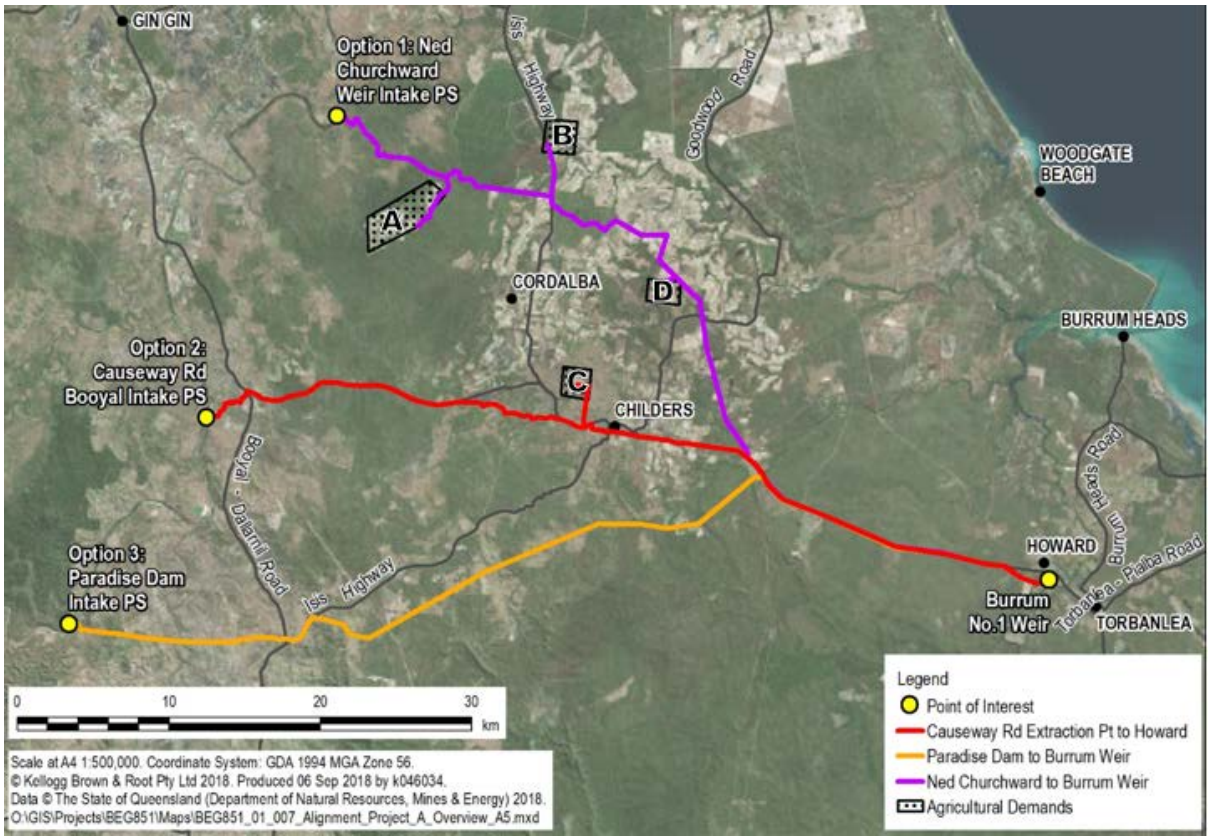

Figure 3 Pipeline Route Options

REQUIRED PIPELINE CAPACITIES

The FCRC propose the new Burnett River water source to have a capacity of 8,000 ML/a to allow for future demand growth in the Hervey Bay and Maryborough areas.

Taking into consideration both urban and agricultural demands, the pipeline design capacities for each of the options is presented in Table 1.

Table 1 Required pipeline capacity for each option

Option	Description	Irrigation Areas - Peak Demand (ML/a)				Hervey Bay Urban Demand (ML/a)	Total Peak Demand (ML/a)	Peak Daily Flow Rate (ML/d)
		A	B	C	D			
1a	Ned Churchward Weir to Burrum (inc. offtakes)	1000	800[1]		1800[1]	8000	9000	24.7
1b	Ned Churchward Weir to Burrum (no offtakes)					8000	8000	21.9
2a	Causeway Road to Burrum (inc. offtakes)			500		8000	8500	23.3
2b	Causeway Road to Burrum (no offtakes)					8000	8000	21.9
3	Paradise Dam to Burrum					8000	8000	21.9

1. Opportunistic irrigation demands to be taken over a 6 month period

COST ESTIMATES

Capital and operating and maintenance costs have been determined for the three proposed alignments.

Capital costs have been prepared to a pre-feasibility study (+50%/-50%) estimate accuracy, and are summarised in Table 2.

Table 2 Project Capital Cost

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Total Capital Cost	$129,100,000	$121,600,000	$118,200,000	$112,700,000	$129,700,000

Operating costs for each of the options are summarised below in Table 3.

Table 3 Project Annual Operation and Maintenance Costs

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
O & M for Pipeline ($/a)	$395,976	$374,341	$367,477	$362,502	$400,543
O & M for Pump Stations ($/a)	$324,821	$310,740	$270,558	$196,410	$253,831
O & M for Balance Tanks ($/a)	$2,020	$2,020	$2,020	$2,020	$2,020
Total O&M Costs ($/a)	$722,817	$687,101	$640,055	$560,931	$656,394

The cost structure for water from the Burnett River has an initial allocation purchase cost along with ongoing annual costs. Water pricing for each option is summarised below in Table 4 based on the SunWater Fees & Charges Schedule 2017-2018 - Burnett Water Prices.

Table 4 Burnett Water Prices (Options Comparison)

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Purchase Price					
Purchase Price [Bulk Charge - Part A]	$25,845,840 (upfront cost)	$22,974,080 (upfront cost)	$24,409,960 (upfront cost)	$22,974,080 (upfront cost)	$22,974,080 (upfront cost)
Variable Pricing					
Allocation Charge [Part A + Part C Charges]	$1,133,190 / yr	$1,007,280 / yr	$971,890 / yr	$914,720 / yr	$914,720 / yr
Allocation Water [Bulk Charge - Part B]	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used

Power costs have been developed for each option in Table 5, taking into consideration the total pumped head of the associated pump stations.

Table 5 Power Costs (Options Comparison)

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Intake Pump Station Power Costs	$90/ML	$87/ML	$114/ML	$110/ML	$127/ML
Transfer Pump Station Power Costs	$37/ML	$37/ML	-	-	-

PRELIMINARY FINANCIAL AND ECONOMIC ANALYSIS

Synergies Economic Consulting (Synergies) has completed the economic analysis of the Burnett River (Paradise Dam) to Howard Water Supply Pipeline project in accordance with the requirements for a Preliminary Evaluation (PE) as set out in the Queensland Government's Project Assessment Framework (PAF).

In accordance with the PE (and Cost-Benefit Analysis) guideline under the PAF, the following approach was applied in undertaking the economic assessment:

- define the base case, with particular regard to
  - the urban water supply-demand balance for the region over the study period
  - the water supply augmentation(s) likely to be pursued under the base case (based on discussions with personnel from the FCRC and other relevant stakeholders), including the feasibility and cost of the various augmentation options
  - the frequency and severity of water restrictions over the study period
  - the likelihood that emergency water supply measures will be required over the study period
- quantify cash flows that ensue from the base case over the study period
- define the reference project options for which economic benefits and costs are to be assessed relative to the base case
- identify all economic benefits and costs to be assessed under the reference project options, based on an assessment of available data and information and consultation with project stakeholders
- where possible, quantify economic benefits and costs under the reference project options
- where impacts are not able to be quantified, undertake a detailed qualitative evaluation of the nature of the impact

- conduct discounted cashflow modelling of the economic benefits and costs of the reference project options and calculate the Net Present Value (NPV) and Benefit Cost Ratio (BCR) for each option
- conduct sensitivity and scenario analysis to assess the impact of changes to key parameters and assumptions on the results.

The base case takes into consideration the costs incurred by urban water users as a result of the implementation of level 3 and level 4 water restrictions. No costs associated with supply augmentation have been included in the base case as long-term water supply-demand projections indicate that augmentation will not be required within the next 30 years.

The PV estimates for the economic costs and benefits of the reference project options relative to the base case are summarised in Table 6 below.

Table 6 **Summary of results from the economic analysis ($millions, PV terms)**

Metric	Present Value Estimates ($million)				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Economic benefits					
Avoidance of severe water restriction	$18.98	$18.98	$18.98	$18.98	$18.98
Increased agricultural production	$16.78	n/a	$1.75	n/a	n/a
Total benefits	$35.76	$18.98	$20.73	$18.98	$18.98
Economic costs					
Capital costs	$104.89	$98.80	$96.04	$91.57	$105.38
Operating and maintenance costs	$12.43	$9.30	$9.15	$7.81	$9.11
Water allocation costs	$34.52	$30.65	$31.54	$29.68	$29.68
Total costs	$151.84	$138.74	$136.72	$129.06	$144.17
Benefit Cost Ratio	0.24	0.14	0.15	0.15	0.13
Net Present Value	($116.08)	($119.77)	($115.99)	($110.08)	($125.19)

The economic analysis shows that all reference project options for the construction of a pipeline from the Burnett River to the Burrum Weir Pump Station result in significantly negative NPVs (ranging from ($110.08 million) to ($125.19 million)) with BCRs of well below 1 (ranging from 0.13 to 0.24). These results are driven by the following:

- The absence of a water supply augmentation under the base case over the study period. This is due to urban water demand in the Hervey Bay region not exceeding the Burrum River extraction licence limit over the 30 year economic study period.
- The significant up-front cost associated with the reference project options, including the capital cost of construction of the pipeline and the purchase of the water allocations. The reference project options also

involve significant ongoing costs in relation to operating and maintenance expenditure and the costs associated with water allocation charges.

- The relatively low level of agricultural water use under the reference project options.

In conclusion, the urban water supply-demand balance in the Hervey Bay region over the next 30 years means that a major water supply augmentation in the short-to-medium term is unlikely to be feasible, particularly one with the significant up-front and ongoing costs as the development of a pipeline from the Burnett River to the Burrum Weir Pump Station.

CONCLUSIONS AND RECOMMENDATIONS

As a result of these investigations completed as part of the Preliminary Evaluation, the following conclusions and recommendations have been made:

1. Urban water demand in the Hervey Bay region is not expected to exceed the Burrum River extraction licence limit over the 30 year economic study period. The frequency of Level 3 and 4 water restrictions over this period will, however become more frequent than what is commonly accepted by communities adopting a Levels of Service objective approach.

2. There are inherent risks associated with the proposed project, including the Risks associated with the potential benefit of supplying agricultural demands in the Burnett – Burrum region. In particular, there is an uncertainty on both the availability and pricing of High Priority water in the region, and the willingness of the agricultural community to pay for it.

3. There is relatively low economic benefit of supplying agricultural water in the Burnett – Burrum region. Due to the preliminary level of investigations carried out on this PE assessment (and lack of available information), alternative demands such as potential pumped hydro schemes in the region have been discounted.

4. The urban water supply-demand balance in the Hervey Bay region over the next 30 years means that a major water supply augmentation in the short-to-medium term is unlikely to be feasible, particularly one with the significant up-front and ongoing costs as the development of a pipeline from the Burnett River to the Burrum Weir Pump Station.

1 Introduction

1.1 PROJECT BACKGROUND

FCRC has undertaken planning studies for water supply and future water sources and these have identified a need to progress options to secure the long term reliable supply of water for the Fraser Coast community. The planning studies undertaken are:

- 2015 Fraser Coast Water Supply Strategy
- 2014 Fraser Coast Water Supply Grid and Future Source (Draft only).

To progress these studies one of the potential future supply options identified - Burnett River (Paradise Dam) to Howard Water Supply Pipeline was put forward by FCRC as a suitable project for funding support from the Queensland State Government under the MIPP – Early Stage Assessment. The Department of Infrastructure, Local Government, and Planning (DILGP) offered to progress these proposals, in partnership with FCRC, by engaging Kellogg Brown & Root Pty Ltd (KBR) to undertake early stage assessments. The assessments undertaken are in accordance with the Queensland Treasury Project Assessment Framework (PAF) and the Queensland Treasury Corporation Project Decision Framework in written correspondence dated 6 July 2017.

The project

The project involves obtaining high priority water from the Paradise Dam source on the Burnett River and transferring the water to the Burrum Weir pump station which is connected to two FCRC water treatment plants. There is 20,000ML of high priority water within the Paradise Dam scheme much of which remains unallocated. Upon consultation with SunWater, it has been identified that major works are required to address safety issues with Paradise Dam, and there is consideration in lowering the spillway (hence reducing the storage volume and yields) to reduce the capital expenditure required to make it compliant. At this stage there is uncertainty as to what affect this will have on the available high priority allocation from Paradise Dam.

Previous planning proposes that the project be undertaken in 2 stages with completion in 2046, and would supplement the existing water supply. The current system capacity and the proposed project would meet the projected FCRC water demands to 2066 without further duplication or utilisation of addition source water opportunities. When completed the project would supply significant additional long term source water security for FCRC.

The primary objective of the project is to address the long term water security for the Fraser Coast region with the potential benefit if appropriate to provide medium priority water to new irrigation and industry users along the pipeline route. The lack of reliable water supply is a risk factor in the future economic development within the region.

MIPP Process

The MIPP supports the development of a robust project pipeline and enables projects to be matured from the conceptually good ideas into solid proposals. The MIPP follows the state governments PAF process which defines steps in the process and requirements to meet the state government objectives

in respect to projects that may be eligible for future funding and to promote due diligence of a project through the defined lifecycle of a project.

The PAF defines the lifecycle of a project to include:

- Strategic assessment of service requirements (SASR)
- Preliminary evaluation (PE)
- Business case development
- Supply Strategy development
- Source supplier/s
- Establish service capability
- Deliver service
- Benefits realisation.

The MIPP funding support was to progress the development of the PE for the project. The PE requirements can be summarised as follows:

- Confirm the outcomes identified in the SASR.
- Define the options to achieve these outcomes.
- Determine the preferred option and develop concept including potential alignment.
- Undertake preliminary evaluation of the costs, risks, and economic benefits associated with the identified project.

The following is carried out for projects deemed viable, and considered for further assessment:

- determine the most suitable procurement strategy
- detail proposed project governance and organisational arrangements
- develop a plan and budget for the Business Case as the next stage in the project.

Burnett River to Howard Water Pipeline Project Evaluation (PE)

In undertaking the development of the PE the following key points should be noted:

- Local Government projects do not need to comply with all requirements under the PAF but it was decided that the PE developed would be closely aligned to State Government PAF requirements.
- Early in the PE development it was identified that a SASR had not been formally developed, so a high level SASR has been incorporated as part of the PE.
- The PE process details the level of stakeholder engagement required and at what stages through the PE development the engagement should occur. As this project was run in parallel with the SASR for the “Interconnection of Hervey Bay and Maryborough Water Supply Schemes” a combined engagement process for both projects was undertaken.
- FCRC has no guarantee of access to Paradise Dam’s high priority water.

Project oversight for the development of the PE for Burnett River (Paradise Dam) to Howard Water Supply Pipeline has jointly been managed by FCRC as the proponent and Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) the project funding sponsor.

1.2 PROJECT GOALS

The project goals are the provision of sufficient water supplies to provide long-term water security for urban water supply in the region. FCRC has also identified an opportunity associated with the development of additional water supply infrastructure in the region, with the potential for additional water to be used to facilitate the growth of agricultural production in the region.

1.3 STRATEGIC ASSESSMENT OF SERVICE REQUIREMENTS (SASR)

A formal SASR has not been prepared for this project in accordance with the PAF guidelines, however similar works have been undertaken as part previous planning works by FCRC. FCRC have identified the need and identified options for the Hervey Bay future water supply needs as part of the 2015 Fraser Coast Water Supply Strategy. These options are detailed in Section 3.1. This information has been documented into an SASR format in the report Burnett River (Paradise Dam) to Howard Water Supply Pipeline Strategic Assessment of Service Requirement report. A copy of the report in included in Appendix A.

2 Needs identification

2.1 HERVEY BAY RAW WATER SOURCE

The primary driver for the project is to ensure that there is sufficient water supply to service the Hervey Bay area with potable water supply.

The Hervey Bay area water supply is sourced from a raw water source on the Burrum River. The 2015 Fraser Coast Water Supply Strategy identified that augmentation of its water resources would be required in 2046 when the existing source capacity is exceeded. At that time Hervey Bay's water demand was projected to exceed the Burrum River extraction licence limit of 14,020 ML/annum.

FCRC has subsequently updated demand projections to account for the Queensland Government Statistician's Office (QGSO) revised population projections based on the 2016 census. The updated population projections are presented in Table 2.1 represented as Equivalent Dwellings (ED) and converted to Average Annual Demand. Based on these latest projections, Hervey Bay's demand is projected to exceed the Burrum River extraction limit by 2066, refer Figure 2.1.

Table 2.1 Hervey Bay Water Supply Demands

Year	Total ED[1, 2]	Average Annual Demand (ML/a)[3]
2016	36630	8423
2021	39557	8823
2026	43378	9447
2031	47292	10149
2036	51057	10772
2041	55122	11327
2046	59511	11881
2051	64249	12435
2056	69365	12990
2061	74888	13544
2066	80851	14099

1. Equivalent Dwelling. A measure to quantify loading of individual properties. Typically a 3 bedroom house is considered as 1 ED (2015 Fraser Coast Water Supply Strategy).
2. Figures have been updated by FCRC from the 2015 Fraser Coast Water Supply Strategy, to account for the QGSO (2016 census) and subsequent projections.
3. Average Day Demand = 630 L/ED/D x No. of ED's for Hervey Bay (2015 Fraser Coast Water Supply Strategy).

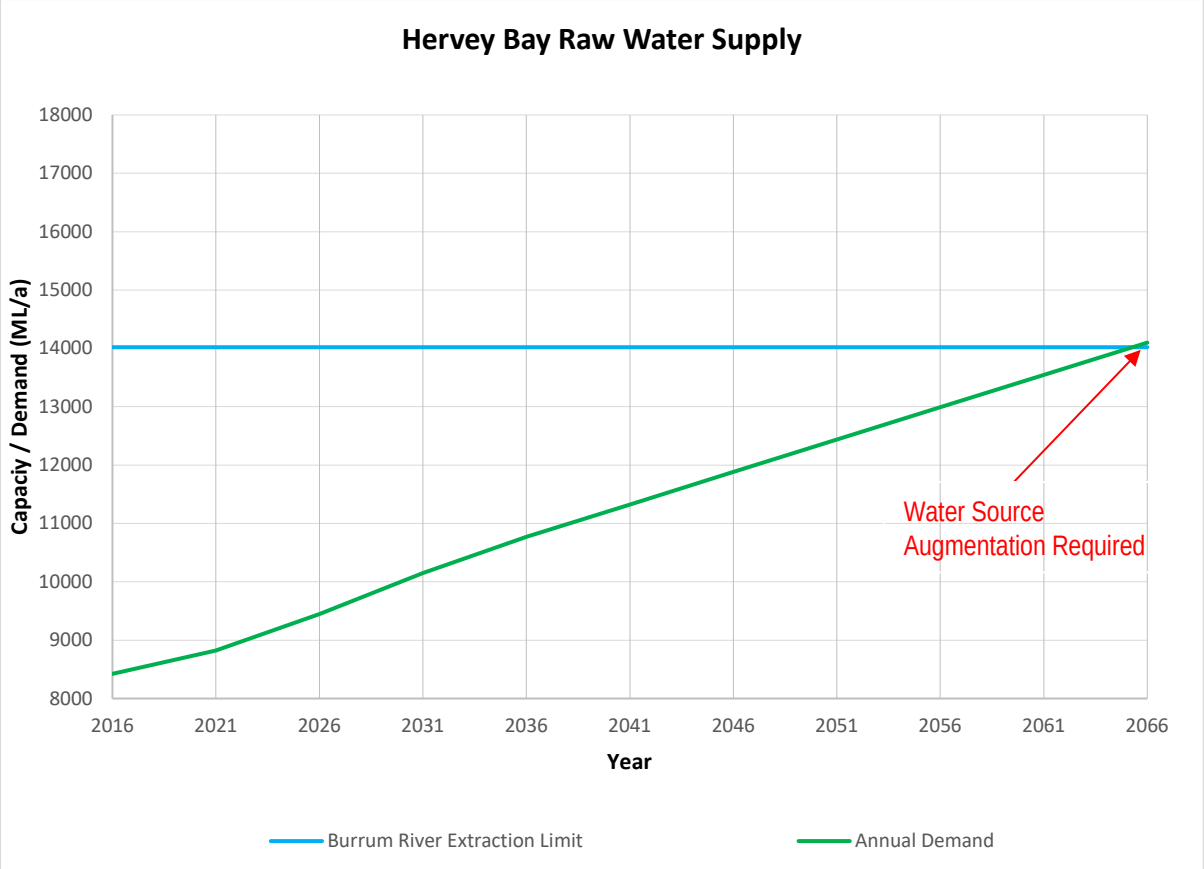

Figure 2.1 Hervey Bay Water Supply – Raw Water Current Capacity and Projected Demand

Current water sources appear to be sufficient to meet the water supply needs for the Hervey Bay region over the next 45 years based on the Burrum River extraction licence limit of 14,020 ML/a. Beyond this timeframe, increasing demand will place further pressure on water supplies leading to increased water shortages and frequency of water restrictions. Separate analysis has indicated that as extraction from the Burrum River system increases and approaches the current licence limit, Hervey Bay will be subjected to increasing regularity of severe water restrictions that will impact economic performance.

2.1.1 Frequency of Water Restrictions

Water restrictions are imposed when the water stored within the Lenthall Dam system fall below preset values with the intent to reduce water demand to extend the water supply. The restriction trigger levels and targeted reduction in demand are shown in Table 2.2.

Table 2.2 Hervey Bay Restriction Demand Reduction Targets

Water Restriction Level	Lenthall Dam Level (% full)	Target reduction in demand
Level 1 (Permanent)	>60%	Nil
Level 2	60%	5%
Level 3	40%	20%
Level 4	30%	40%

Source: Hervey Bay Drought Management Plan (29 November 2017)

A Regional Water Supply Security Assessment undertaken by Department of Energy and Water Supply (DEWS) (2015) investigated the likelihood of water restriction levels being reached using stochastic modelling techniques with over 100 years of historical data.

The Lenthall Dam / Burrum River system catchment was used to assess the water supply for Hervey Bay. The assessment determines the expected frequency of restrictions and failure of supply. The modelling results are shown below in Figure 2.2.

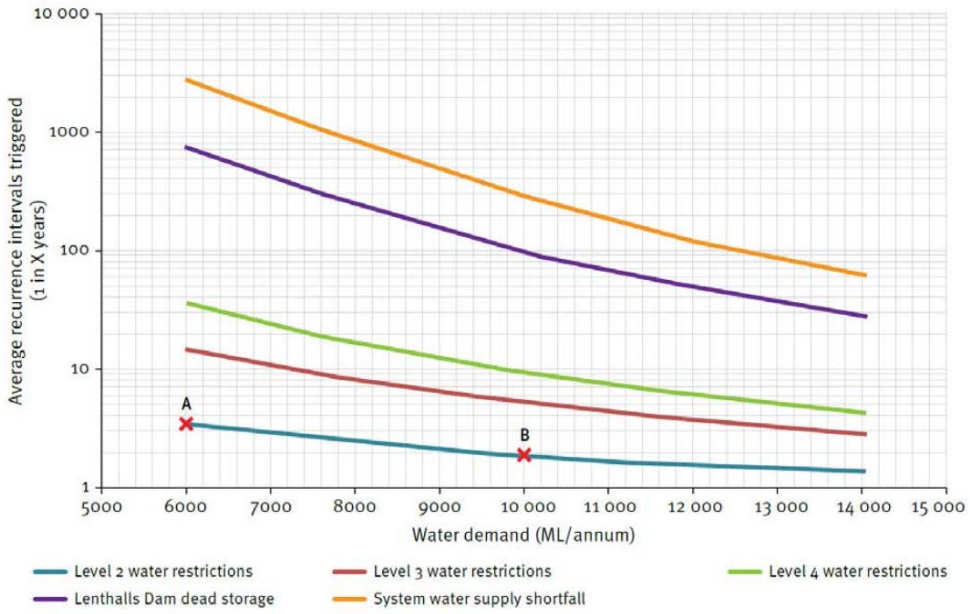

Figure 2.2 Hervey Bay – Frequency of Water Restrictions Against Total Annual Demand

Source: DEWS, 2015

The result indicate that if the full Burrum River extraction limit of 14,020 ML/a is reached then full source failure will occur, at an Average Recurrence Interval (ARI) of 60 years, and Level 3 and 4 restrictions implementation will occur on a regular basis (approximately 3 and 4 years ARI respectively). Level 3 and 4 restrictions have been found to have notable impacts upon the community and the economy. Complete loss of supply would have a substantial impact and would present a significant risk to a large community such as Hervey Bay.

Based on the DEWS analysis, the full extraction allowance from the Burrum River overstates the reliable extraction volume from the system with a reasonable probability of supply failure for the Hervey Bay community.

Levels of Service Objectives Approach

The Queensland State Government has recently released Water Security Level of Service Objectives – Guidelines for Development (April 2018). This approach allows for the community to set the target occurrences of restrictions in developing water source supply capacity requirements. An example provided in the document include the Cairns region which has adopted Levels of Service (LOS) objectives for Level 3 restrictions of 10 year ARI. This approach has been used in South East Queensland for the yield assessment of water sources with the objectives for medium restrictions of 25 year ARI.

2.1.2 Existing Infrastructure

Hervey Bay's existing raw water supply is based on the Burrum River, where three storages have been constructed (Burrum No.1 and Burrum No.2 Weirs and Lake Lenthall). These are able to supply water to the main water treatment plants at Howard and at Burgowan with water extracted from the Burrum No.1 weir.

The storage capacity is as follows:

- Lenthall Dam: 28,400 ML
- Burrum Weir No.1: 1,715 ML
- Burrum Weir No.2: 2,242 ML

In addition the system includes two relatively small dams on the headwaters of Beelbi Creek, near the Burgowan Water Treatment Plant (WTP) known as Cassava 1 (2,187 ML) and Cassava 2 (426 ML). The Cassava Dams have a small catchment and are also used as a balancing storage for raw water from the Burrum River.

Water from the Burrum River system supplies the Burgowan WTP while the Cassava Dams supplement supply to Burgowan WTP when required. Two raw water mains (DN600 and DN375) and a pump station, transfer water from the Burrum River to the Burgowan WTP and/or the Cassava Dams.

The Howard WTP is also supplied from the Burrum River via a DN450 raw water main. The Howard WTP is currently a standby treatment plant and is only used when demand exceeds the capacity of the Burgowan WTP or if operational reasons require it. The "Hervey Bay Disinfection By-Product" report by WBWC (2011) recommended that all future water for Hervey Bay be supplied from the two existing treatment trains at the Burgowan WTP with no upgrades to the Howard WTP.

Treated Water Network

Most of the treated water from the Burgowan WTP and the Howard WTP is transferred to the Takura reservoirs, which includes Takura Reservoir No.1 (1 ML) and Takura Reservoir No.2 (9 ML). Uneven turnover of water in these reservoirs occurs because the reservoirs are constructed at different levels. As a result Takura No.1 is currently out of service because it has the highest detention time due to the uneven turnover and consequently has experienced water quality issues.

From Takura, water gravitates to the 32 ML Urraween Reservoir and from there it is pumped up to the Ghost Hill Reservoirs. Hervey Bay City and River Heads are supplied from the Ghost Hill No.1 (4.5 ML) Reservoir. Ghost Hill No.2 Reservoir (6.7 ML) supplies the higher ridge area of Kawungan and the Nikenbah Ridge (Summit Ridge and Bayridge housing developments). Treated water from the Burgowan WTP and the Howard WTP also supply the townships of Howard, Torbanlea, Toogoom, Burrum Heads and Dundowran.

Burgowan WTP can produce a maximum of 41 ML/day, following the installation of an Actiflo high rate clarifier in 2014.

An overview of the treated water system is shown in Figure 2.3.

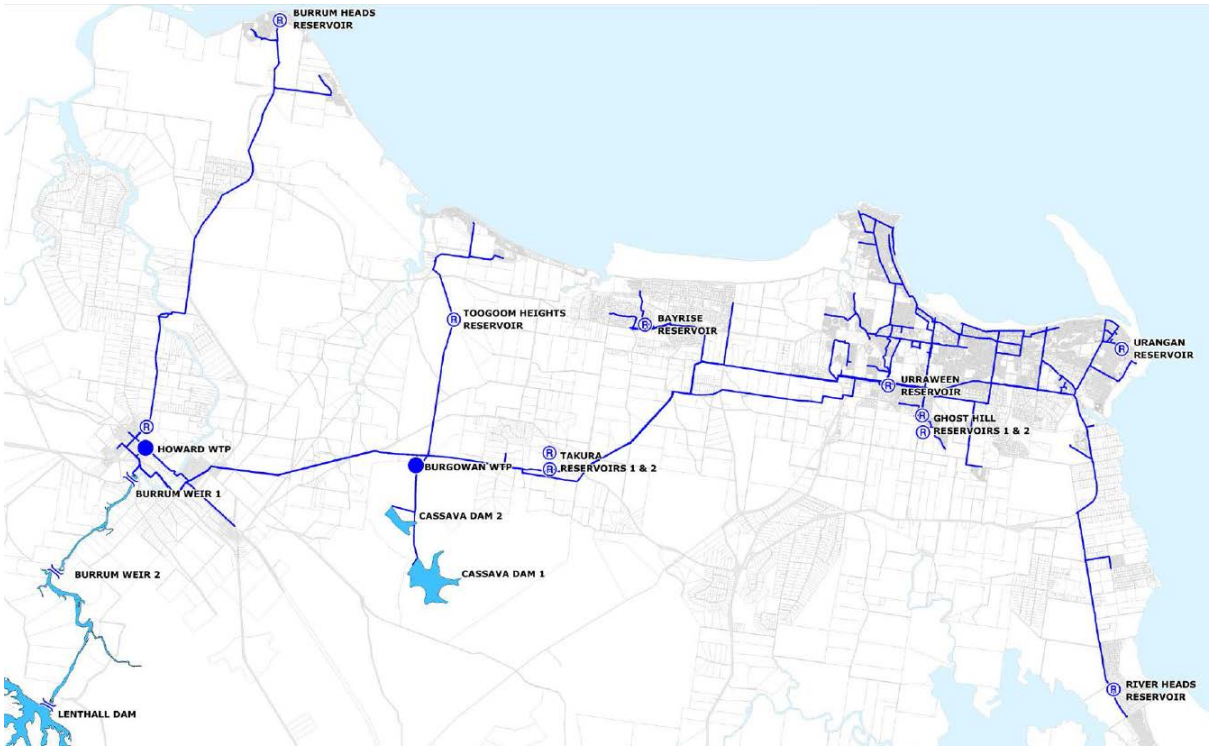

Figure 2.3 Hervey Bay Water Supply Infrastructure

2.2 PROJECT NEED

Following the above investigations into security of water supply in the Hervey Bay region, the project needs have been defined as follows:

- The provision of sufficient water supplies to provide long-term water security for urban water supply in the region.
- FCRC has also identified an opportunity associated with the development of additional water supply infrastructure in the region, with the potential for additional water to be used to facilitate the growth of agricultural production in the region.

2.3 DRIVERS

The project drivers are defined as follows:

- growth (meeting the increased water demand, and facilitating the growth of agricultural production in the region)
- service improvement, including improving the reliability of supply and reducing the frequency of water restrictions.

3 Preliminary options considered

3.1 OPTIONS IDENTIFIED IN THE SASR

An SASR has been prepared on options to address the future water supply needs for the Hervey Bay region (see Appendix A) based on the options identified in the 2015 Fraser Coast Water Supply Strategy.

Seven options were identified and assessed in the SASR, including:

- Option 1: Base Case (maintain the Status Quo)
- Option 2: Interconnection between Hervey Bay and Maryborough
- Option 3: Indirect Potable Reuse
- Option 4: Mary River
- Option 5: Fraser Island
- Option 6: Desalination
- Option 7: Burnett River (Paradise Dam).

The above options were assessed against the following key criteria:

- ability to meet identified project needs
- technical feasibility
- costs
- environmental and social impacts
- community acceptance.

Based on the assessment of the above options, Option 7 (Burnett River – Paradise Dam) was identified as providing a suitable water source to address future demands and provide regional economic benefit in the Hervey Bay region. It was the only option identified that has the potential to offset operational costs by making additional water available for agricultural production in the region.

As such, Option 7 has been progressed to the next stage of the PAF process, Preliminary Evaluation.

3.2 BURNETT RIVER TO BURRUM PIPELINE

3.2.1 Background

This option comprises the construction of a new pipeline and associated infrastructure to transport raw water from the Burnett River to the Burrum Weir Pump Station. The FCRC 'Maturing the Infrastructure Pipeline Program' submission (August 2017) request suggested the water pipeline would be constructed in a staged approach as follows:

- Stage 1: Connection to the Isis channel system near Childers, extending out to the Burrum Weir Pump Station (approximately 27.5 km). The expected output of the channel system at the proposed

connection was identified as 30 L/s, however this figure was not confirmed. This flow rate would push out any augmentation of the Hervey Bay raw water supply by 5 years.

- Stage 2: Extension of the pipeline to the Burnett River (an additional 35 km) to a source extraction point at Causeway Rd, Booyal.

Figure 3.1 below shows the staging of the Burnett River to Burrum Pipeline from the previous planning works.

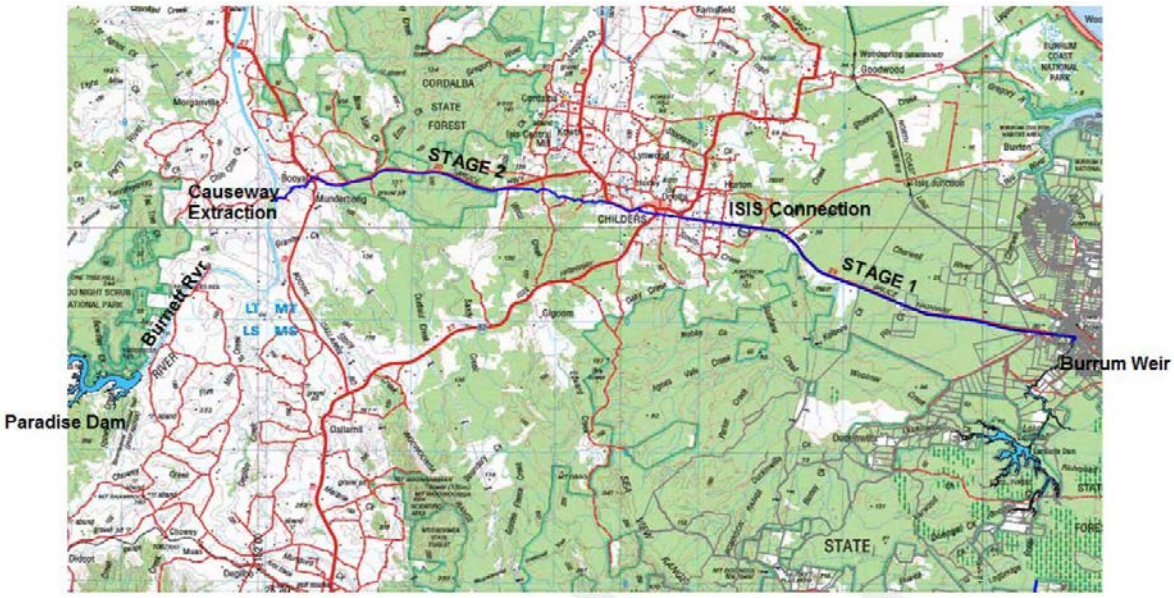

Figure 3.1: Burnett River to Burrum Pipeline from MIPP Submission Proposal

In order to enhance the benefits and viability of the pipeline, the MIPP submission proposed the pipeline consider the supply to other urban communities and to other potential water users as a combined scheme.

3.2.2 Stakeholder Engagement

In order to assess the viability of this alignment for delivering water from the Burnett River to Burrum, as well as to meet the secondary project need of supplying water for agricultural production, a consultation process was undertaken to assess the appetite for water demands in the region.

The Department of Natural Resources Mines and Energy (DNRME) and DSDMIP were contacted regarding potential demands in the region. The DSDMIP has completed a study, Water for Economic Development in the Wide Bay Burnett Region considering demands, however this was not able to be released. Discussions with DSDMIP indicated that they have not identified many potential users in the route section between Childers and Howard.

A consultation process was undertaken in a series of one-on-one meetings with the stakeholders nominated by FCRC. The following parties were consulted by KBR:

- Bundaberg Regional Council
- Isis Central Sugar Mill Company
- MSF Sugar
- Wide Bay Burnett Regional Organisation of Councils (WBBROC)
- SunWater.

The meetings were used to brief the stakeholders on the two projects. The meetings were used to determine interest in water demands that may be able to be supplied by the Burnett River to Howard pipeline.

Bundaberg Regional Council (BRC)

The principle BRC urban centres located along the pipeline routes are Childers and Woodgate. They are currently supplied from a weir of the Gregory River and from groundwater. These will be upgraded in the future to be supplied from a combined scheme. The scheme will source water from the irrigation channel system. BRC have an existing pump station into the channels (previously constructed as a drought contingency). This will be used as the source point. There was no interest in water from a Burnett River pipeline given the majority of the raw water infrastructure already exists.

The Bundaberg City area expects to obtain future water sources from the Burnett River source. This area is remote from any pipeline routes to Hervey Bay and not does not present any opportunity for a combined scheme.

Isis Sugar

Isis Central Sugar Mill indicated there was limited need for additional water in the current areas served by the channel system; although there are other land areas that have a need for additional water if the channel systems were extended. They did indicate a desire for water to the Coalstoun Lakes area, which is an area of good agricultural land that is currently mostly dry farmed. The area is to the south east of the Paradise Dam wall.

The scheme would involve in the order 15,000 ML/a of irrigation water to supply 6,000 Ha of land.

A potential option mentioned was for a pipeline heading south from Paradise Dam wall to Coalstoun Lakes then east to the headwaters of the Burrum River catchment. Water for Fraser Coast could be released into the Burrum River and would drain to Lenthall Dam. A route is shown in Figure 3.2.

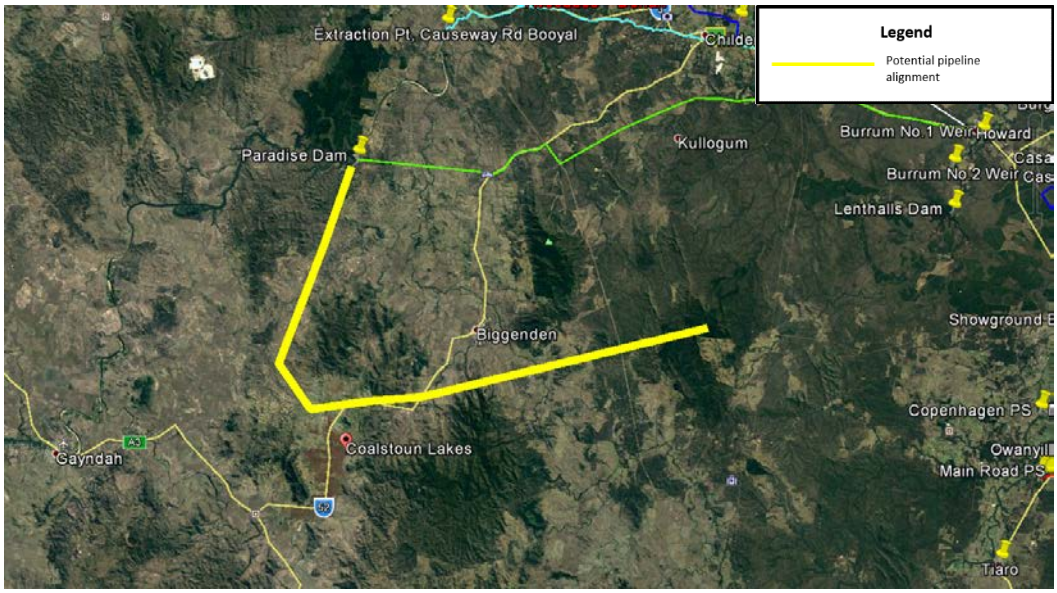

Figure 3.2 Supply to Hervey Bay via Coalstoun Lakes

The route shown is approximately 70 km long to the headwaters of the Burrum System. The proposal has a number of significant drawbacks as a combined scheme with FCRC.

- The piped route is longer than all the alternative routes being considered.

- Coalstoun Lakes area is elevated at about RL 250 mAHD, with the pipeline route required to traverse above RL 300 mAHD. This would require substantially more energy input for pumped water to Hervey Bay compared to other options.
- The option involves discharging to headwaters of the Burrum River, resulting in substantial river flow losses up to Lenthall Dam. There would be further evaporation losses from water stored in the Lenthall Dam. This would multiply both the cost for allocation purchase and water usage costs for FCRC. Delivering into a live storage also reduces the air space available for capturing of water from significant rainfall events, which is effectively the loss of otherwise storable runoff water.

As the option would substantially increase the purchase and operating costs of water for FCRC this was not considered viable for further consideration.

Isis Central Sugar Company indicated that the Irrigation Channel system was at full capacity south of the Gregory River. They did, however indicate that there was potentially some spare capacity between the Balancing Storage and the Gregory River, although this comment has not been confirmed with SunWater at this stage.

This segment of channels is approximately 20–25 km north of the Routes 2 and 3 and would not present a suitable connection point for these routes. The channel is located approximately 5 km north of Route 1 (from Ned Churchward Weir). It would not be ideal for a temporary connection point given that it only potentially delays construction of about 15 km of pipeline to the Ned Churchward Weir for a stage implementation case.

MSF Sugar

MSF Sugar were consulted to canvas their desire for additional water. They have interest in up to 20,000 ML/a of demand delivered to the Mary River system to irrigate currently cropped lands. The Mary River is approximately 24 km south of any proposed routes for a pipeline to Hervey Bay, with no obvious compromise route available that would not significantly impact upon pipeline length to service Hervey Bay. Alternative pipeline routes to the south necessitate crossing more elevated areas, adding to the pumping energy required.

Supply is not considered practical without significantly increasing cost to FCRC, so a combined option with MSF Sugar has not been considered further.

WBBROC

WBBROC is in the process of undertaking a regional assessment of water needs. This is considering the urban, industrial and irrigation needs within the region. There is an urban water deficiency at Biggenden. Biggenden is approximately 20 km south of the most southern route proposed and therefore does not appear to be a practical beneficiary of a combined scheme to Hervey Bay. A MIPP study by North Burnett Regional Council is also underway for supply to Biggenden.

Potential pumped hydro sites have been identified on the route from Paradise Dam to Hervey Bay (non-WBBROC project). A feasible pumped hydro scheme would require a number of features – significant elevation difference (say 300m) between two potential sites for high and low storages, proximity to the HV power grid and a supply of water to fill the storages and provide top-up water lost to evaporation. In that respect there would be synergies with a pipeline to Hervey Bay, with an initial large volume needed to fill the storages and then minor volumes to provide make-up water.

The quantity of continual demand has not been quantified at this stage. The lack of credible information on this opportunity, in addition to the potential location for the scheme being a significant distance from a potential pipeline alignment, is the reason this opportunity has not been considered further in this study.

SunWater

SunWater are responsible for the distribution of water to irrigators and urban demands in the Bundaberg and Childers regions. The area to be traversed by a potential pipeline route is currently serviced by the Isis channel system. Channel water is sourced via the Isis pump station, located 29 km upstream of the Ben Anderson Barrage, and downstream of the Ned Churchward Weir on the Burnett River.

SunWater indicated that the Isis channel system is at capacity under peak flow, and suggested a pipeline to specific demands would be more feasible. As such, the staged approach of the pipeline identified in Section 3.2.1 is not recommended, wherein Stage 1 of the pipeline from the Isis channel system to Burrum Weir site was proposed to augment the required water supply for an initial 5 years period.

The issue of operation of the pipeline would need to be resolved if water was delivered to the channel system and there was not specific customers that had an independent demand from other allocated irrigation demands.

SunWater are undertaking a study for supplies from the Burnett River dam, as a study for the National Water Infrastructure Fund, to look at opportunities to distribute the water from Paradise Dam. A draft of the report has been submitted to the Government (to Department of Natural Resources Mines and Energy (DNRME) for submission to the Federal Government), however the report is not available for release until approved by the government.

Other Irrigation Demands

SunWater has undertaken an assessment of potential demands in the Isis irrigation area for additional water from the Burnett River. These were reviewed to determine the practicality for supply from a pipeline to Hervey Bay.

Irrigation demands have been categorised as:

- opportunistic irrigation where the crops / cropping practices can tolerate Medium Priority water allocation
- necessary irrigation where the crops / cropping practices would require High Priority water allocation.

The following agricultural irrigation demands have been identified in the Burnett Wide Bay Region, potentially serviceable by Burnett River / Paradise Dam water.

- Area A – Citrus / Avocado. Necessary demands near Promiseland (1,000 ML/a)
- Area B – Sugar Cane. Opportunistic demand near North Gregory (800 ML/a)
- Area C – Avocado. Necessary demand near North Isis (500 ML/a)
- Area D – Sugar Cane. Opportunistic demand north west of Redridge (1800 ML/a).

These demands are shown below in Figure 3.3.

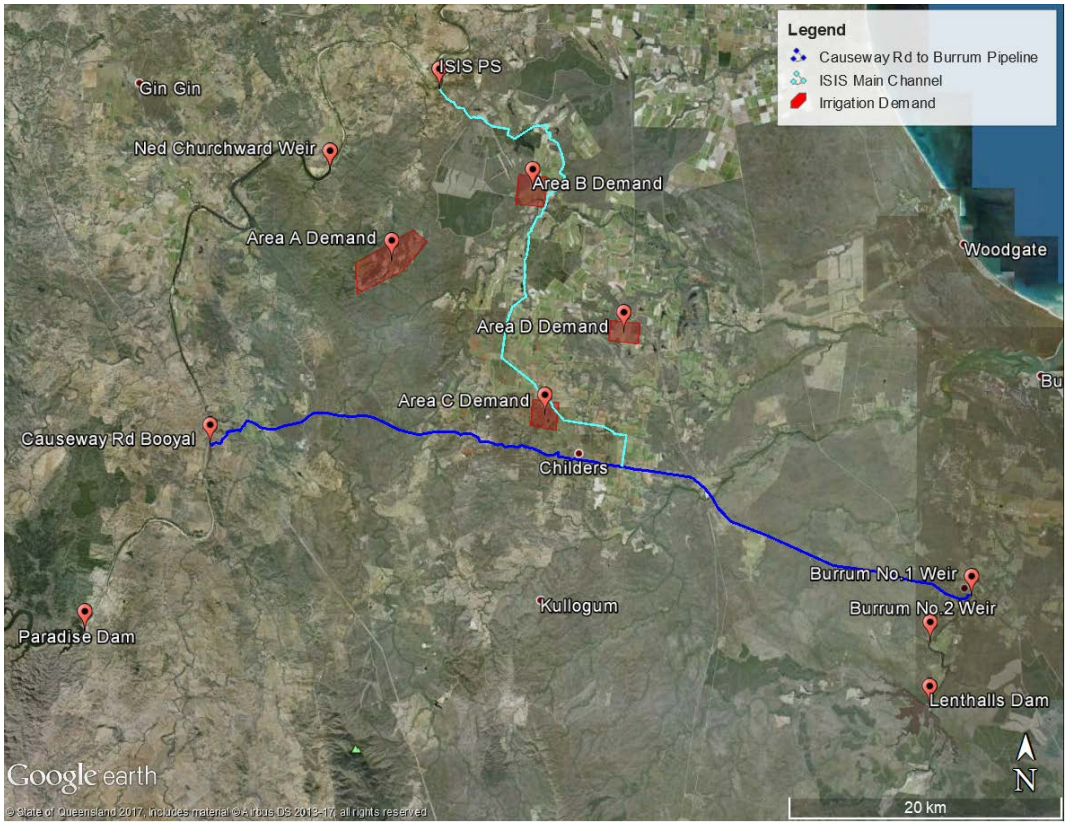

Figure 3.3 Irrigation demands identified in the Burnett Wide Bay Region

4 Options development

4.1 PIPELINE DEMANDS

4.1.1 FCRC Demands

The FCRC propose the new Burnett River water source to have a capacity of 8,000 ML/a to allow for future demand growth in the Hervey Bay and Maryborough areas.

4.1.2 Other Demands

A proposed pipeline would be able to service areas of demand in close proximity to the pipeline route. The potential demands located in areas traversed by possible pipeline routes as detailed in Section 3.2.2 are summarised in Table 4.1 below.

Where the demands are for opportunistic irrigation (sugar cane) these would be serviced from the pipeline by spare capacity when not required for the supply to Hervey Bay, without influencing the size of the pipeline infrastructure. Higher value crops (Citrus and Avocado) that require necessary irrigation to sustain, will require additional allocation along with pipeline capacity to allow for the long term supply for the crops.

The opportunistic irrigation demand have been assumed to occur constantly over a 6 month irrigation period. Demands for necessary irrigation have been assumed to occur for the full year with the irrigator responsible for onsite storage to attenuate any peaks.

Table 4.1 Irrigation Demand Summary

Area	Crop	Allocation Priority	Average Annual Demand (ML/a)	Peak Demand Factor[2]	Peak Instantaneous Demand (ML/d)
A	Citrus/Avocado	High	1000	1	2.74
B	Sugar Cane	Medium	800[3]	2	4.38
C	Avocado	High	500	1	1.37
D	Sugar Cane	Medium	1800[3]	2	9.86

1. Area B and Area D sugar cane demands are medium priority, and will only be used when urban demand is not required by Hervey Bay.
2. Sugar cane irrigation demands are assumed to occur over a 6 month period. A 2 times factor is used for determining peak pipeline demand.
3. Sugar cane demands could have future demand requirements >5,000 ML/a MP if the current channel systems were extended.

4.1.3 Burrum River Supply

Once the Burnett River to Hervey Bay supply is available, consideration would need to be given to the water extraction from the Burrum River system, as the system has a low reliability when operated at full licenced extraction limit. As noted in Section 2.1.1 if the full Burrum River extraction limit of 14,020 ML/a

is reached then full source failure will occur with an Average Recurrence Interval (ARI) of 60 years and Level 3 and 4 restrictions implementation will occur on a regular basis (approximately 3 and 4 years ARI respectively).

If a LOS Objectives approach is adopted with objectives of frequency of restrictions defined, then the desirable maximum draw from the Burrum River system can be quantified. The frequency of severe water restrictions based on the DEWS 2015 assessment is presented in Figure 4.1. Adopting a LOS objective of limiting Level 3 restrictions to a 10 year ARI would equate to an extraction limit of 7,400 ML/a from the Burrum River system. Should a 25 year ARI of Level 3 restriction be the desired objective then the available extraction from the Burrum River system would be approximately 5,000 ML/a.

For the purposes of this assessment a 10 year ARI of Level 3 restrictions has been adopted with a Burrum River extraction of 7,400 ML/a.

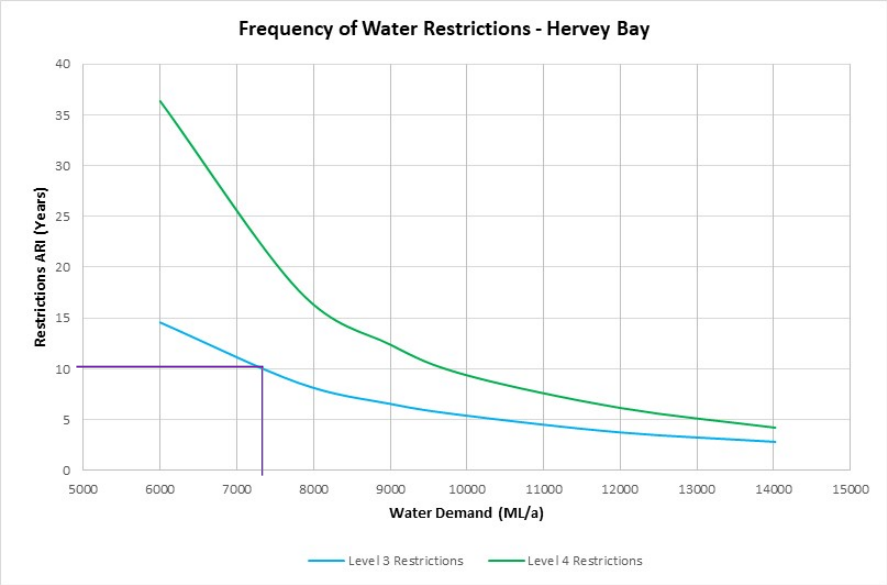

Figure 4.1 Burrum River Extraction vs Frequency of Water Restrictions

4.2 BURNETT RIVER DISCHARGE LOCATION

The pipeline is proposed to terminate at Howard adjacent to the Burrum No 1 weir to allow it to utilise the existing raw water transfer system (DN375 plus DN600) that extends from the existing intake pump station to Burgowan WTP and Cassava dams. This would also allow for connection into the raw water pipeline that extends to the Howard WTP.

The pipeline would connect downstream of the existing raw water pumps to allow for combined use of the transfer mains. A flow control facility consisting of a control valve would be provided to regulate flow to facilitate system operation and if the hydraulic grade is inadequate to transfer, an inline pump station would be provided to boost the head.

Refer to Figure 4.2 for an indicative location of this connection.

Figure 4.2 Proposed Discharge Connection

The pipeline will require sufficient head at the Burrum discharge point to allow for flow to be transferred to Burgowan WTP and Cassava dams. A preliminary assessment has indicated that the pipeline discharge hydraulic grade level of 60 mAHD will be necessary to allow for the full transfer of the Burnett River capacity to Burgowan (8,000 ML/a) via the DN600 main.

4.3 DESIGN CRITERIA

4.3.1 Demands

Fraser Coast Demand

The FCRC demand would be supplied from the Burnett River pipeline at a constant rate over the year, with fluctuation in demands throughout the year managed by drawing from the Burrum River storages and the Cassava dams. The total annual capacity of the pipeline delivering the Burrum system will be 8,000 ML/a, with water drawn at a constant rate over the year (i.e. 22 ML/d).

Other Demands

Irrigation Demands

The irrigation demands are detailed in Section 4.1.2.

4.3.2 Infrastructure Design Criteria

The design criteria used for the sizing of the transfer pipeline infrastructure is summarised in Table 4.2.

Table 4.2 Infrastructure Design Criteria

Parameter	Design Criteria
Hydraulic Assessment	
Pump Flow	20 hrs per day
Pipeline Friction	Colebrook-White k = 0.6 mm
Intake Pump Stations	
Type	River intake
Pump Configuration	Duty / Standby
Motor Voltage	400 V
Transfer Pump Stations	If required
Type	Pumps housed within building
Pump Configuration	Duty / Standby
Motor Voltage	400 V
Balancing Reservoirs	
Type	Above ground circular storage tank
Capacity	2 hrs storage
Burrum Connection	
Type	Flow control valve structure connected to existing raw mains
Main Transfer Pipeline	
Material	MSCL pipe Cathodically protected

4.4 ROUTE ALIGNMENTS

Following the Stakeholder Engagement outlined in Section 3.2.2, and the subsequent potential demands identified in the Burnett Region, the potential routes for the Burnett River to Burrum Pipeline alignment have been developed.

4.4.1 Criteria for potential alignments

Pipeline alignments have been developed based on the following criteria:

- Vicinity to other demands identified in Section 3.2.2.
- Avoiding critical high points, with the intention of reducing unnecessary pumping operational costs.
- Minimising the pipeline length, reducing both the capital expenditure of the pipeline, and operational costs associated with pumping.
- Suitability of extraction point: Ensuring a suitable river flow control structure is in place.
- Where possible, following existing easements, road reserves and corridors.

Based on the above criteria, the following alignments were developed for further assessment:

- Option 1: Ned Churchward Weir to Burrum No 1 Weir
- Option 2: Causeway Rd to Burrum No 1 Weir (MIPP submission alignment)

- Option 3: Paradise Dam to Burrum No 1 Weir

An overview of the routes is shown in Figure 4.3.

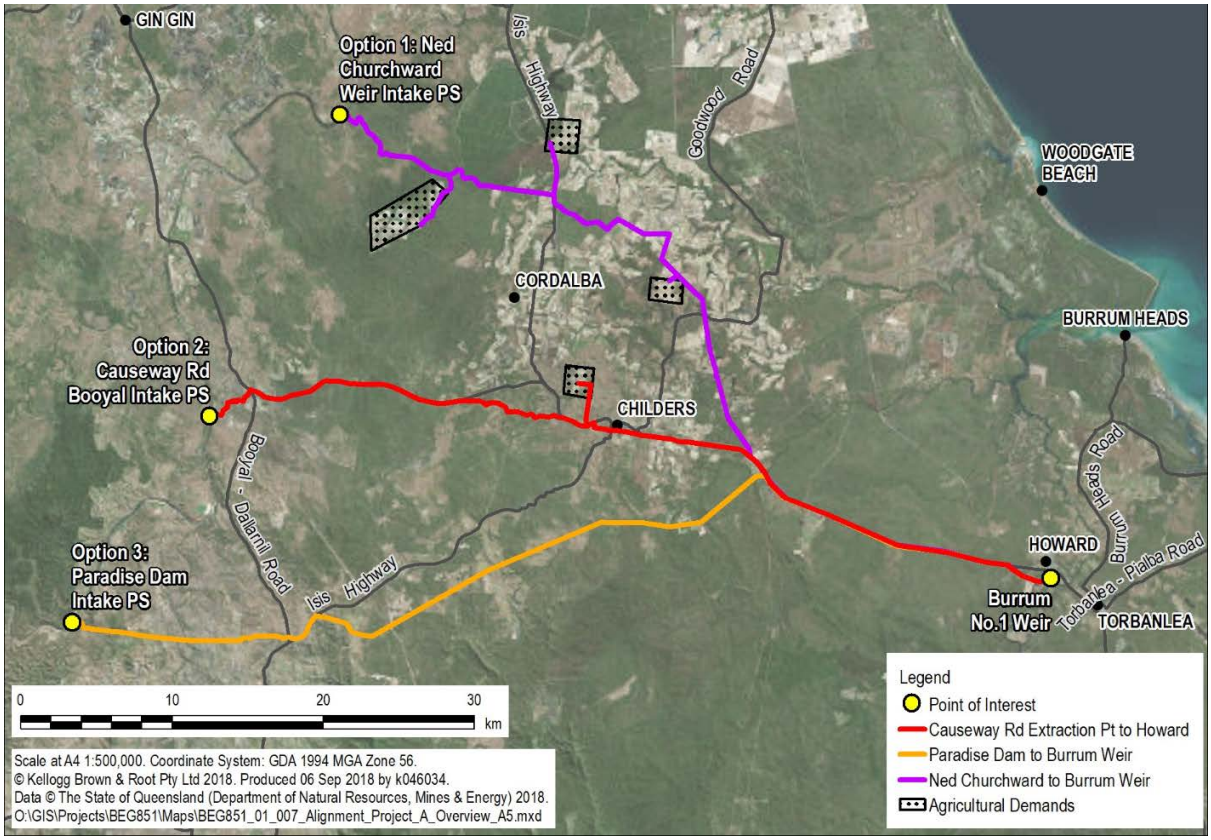

Figure 4.3 Pipeline Route Options

4.4.2 Option 1: Ned Churchward Weir to Burrum

This alignment was developed with an emphasis on targeting the identified agricultural demand regions in Section 3.2.2. The three largest (out of four identified) agricultural regions totalling 5,200 ML/a are within close vicinity to this alignment and can be serviced by this pipeline.

Extraction Point

Ned Churchward Weir, previously known as Walla Weir, was completed in September 1998, and is located 74 km from the mouth of the Burnett River. It is a concrete gravity structure with a storage capacity of 29,000 ML.

The proposed extraction point would be immediately upstream of the weir via a new intake pump station.

Figure 4.4 Ned Churchward Weir

Alignment

The alignment is approximately 66 km long, and passes through Promisedland, Farnsfield and Redridge, before following the Bruce Highway through Cherwell to the Burrum Weir Pump Station.

The 66 km long pipeline consists of:

- 3.5 km through open cattle land
- 15 km through an existing power line easement
- 29 km through minor road verge
- 18.5 km through the Bruce Highway verge.

Refer Appendix C for the layout plan of the Ned Churchward Weir to Burrum Pipeline Alignment.

Refer Appendix D for the profile of the Ned Churchward Weir to Burrum Pipeline Alignment.

4.4.3 Option 2: Causeway Road to Burrum

The Burnett River (Paradise Dam) to Howard Water Supply Pipeline MIPP submission identified a potential extraction point at Causeway Road, Booyal, and an indicative alignment to the Burrum No.1 weir.

An agricultural demand region of 500 ML/a is within close vicinity to this alignment and can be serviced by this pipeline.

Extraction Point

This extraction point is located approximately 21 km downstream of Paradise Dam located upstream of the Causeway Road crossing of the river. Causeway Road crosses the Burnett River at this point with a water pool immediately upstream of the causeway. This site is currently used by an irrigator as a river extraction pumping pool.

The technical viability of this site as a suitable pumping pool for the urban water supply is still to be confirmed with SunWater.

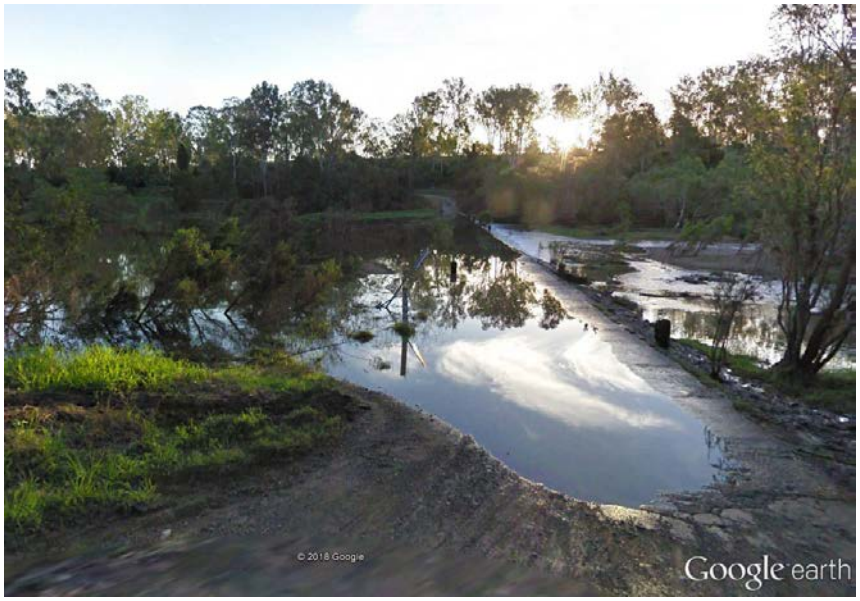

Figure 4.5 Causeway Road Extraction Point

Alignment

The Causeway Road to Burrum alignment is approximately 62 km long, and predominantly follows the Bruce Highway to the Burrum Weir Pump Station.

The 62 km long pipeline consists of:

- 1.5 km through open cattle land
- 18 km through minor road verge
- 42.5 km through the Bruce Highway verge.

Refer Appendix C for the layout plan of the Causeway Road to Burrum Alignment.

Refer Appendix D for the profile of the Causeway Road to Burrum Alignment.

4.4.4 Option 3: Paradise Dam to Burrum

Extraction Point

Paradise Dam is located north west of Childers on the Burnett River. Construction of the dam was completed in 2005, with a maximum storage capacity of 300,000 ML. The proposed extraction point is at the dam site.

The dam facility at the site includes a downstream water release system. Connection to the water release system pipework would simplify the water extraction facility for the Hervey Bay pipeline. The downstream release system includes a 2.79 MW mini-hydro which offers a suitable HV power network to the site for the extraction pump station.

Figure 4.6 Paradise Dam

Alignment

The Paradise Dam to Burrum alignment is approximately 72 km in length, and passes through north of Dallarnil, Golden Fleece and Kullogum, before following the Bruce Highway through Cherwell to the Burrum Weir Pump Station.

The 72 km long pipeline consists of:

- 11.5 km through open cattle land
- 2 km through forested land, requiring clearing
- 30 km through an existing power line easement
- 8.5 km through minor road verge
- 20 km through the Bruce Highway verge.

Refer Appendix C for the layout plan of the Paradise Dam to Burrum Pipeline Alignment.

Refer Appendix D for the profile of the Paradise Dam to Burrum Pipeline Alignment.

4.4.5 Land Use & Environmental Impact Assessment

All routes have significant areas where there are potential environmental and other constraints. The common section north of Howard along the Bruce Highway has the greatest array of potential constraints with most of this area subject to at least one constraint value. The balance of the route options are affected in part by a mixture of potential constraints.

Neither of the three options stands out as having the least potential constraints. Each route will require detailed route assessments and environmental surveys to determine actual constraints.

An alignment that minimises vegetation clearing and that considers underboring of creeks and drainage lines is likely to have the least obstacles to construction.

Where construction is proposed along the Bruce Highway corridor, an alignment located at the outer edge of the corridor is likely to be more acceptable to DTMR, but is likely to be more exposed to environmental constraints.

The powerlines along the Bruce Highway and along the easement from Buxton to Dallarnil are 66kV lines. There are no easements in roads. The easements are generally 10m wide, and a separate set of pipeline easements would be required within the Ergon Energy easement.

Consultation and formal requests will be required with these agencies as part of further investigations.

A number of Queensland Globe searches were conducted on the three pipeline routes. The results are attached in Appendix E.

4.5 INFRASTRUCTURE SIZING

4.5.1 Hydraulic Capacity

For the purpose of assessing the potential benefits associated with supplying additional water for agricultural use, each of the three identified pipeline alignments was assessed utilising the following:

- A: Including offtakes to agricultural demands in the vicinity of the main pipeline. Takes into consideration the irrigation demands identified in Table 4.1.
- B: No offtakes, assuming a peak demand in-line with Hervey Bay Urban Demand.

Required Pipeline Capacities

The pipeline design capacities for each of the options is presented in Table 4.3

Table 4.3 Required pipeline capacity for each option

Option	Description	Irrigation Areas - Peak Demand (ML/a)				Hervey Bay Urban Demand (ML/a)	Total Peak Demand (ML/a)	Peak Daily Flow Rate (ML/d)
		A	B	C	D			
1a	Ned Churchward Weir to Burrum (inc. offtakes)	1000	800[1]		1800[1]	8000	9000	24.7
1b	Ned Churchward Weir to Burrum (no offtakes)					8000	8000	21.9
2a	Causeway Road to Burrum (inc. offtakes)			500		8000	8500	23.3
2b	Causeway Road to Burrum (no offtakes)					8000	8000	21.9
3	Paradise Dam to Burrum					8000	8000	21.9

1. Opportunistic irrigation demands to be taken over a 6 month period

4.5.2 Pipeline Infrastructure Details

Hydraulic Profile

Hydraulic profiles have been developed for each alignment, and are included in Appendix D.

All routes include a balance tank on the highest point of the alignment. The intake pump station would deliver to the balance tank, with the water gravitating from that location to the Burrum connection. Route 1 options would require an inline pump station east of the balance tank to allow for the flow to clear a second high point on the route and achieve the pipeline design flows. Routes 2 and 3 do not require a booster pump and are able to gravitate from the balance tank to the Burrum connection with sufficient head at the connection point to deliver onto Burgowan.

Pipe details

Based on the above peak daily flow rates in Table 4.3, the following pipe details have been calculated.

Table 4.4 Pipe Details

Option	Description	Pipe Size	Pipe Length
1	Ned Churchward Weir to Burrum Main line	DN600	66.00 km
	Offtake to Demand A	DN200	4.49 km
	Offtake to Demand B	DN250	3.49 km
	Offtake to Demand D	DN400	1.24 km
1b	Ned Churchward Weir to Burrum (no offtakes)	DN600	66.00 km
2a	Causeway Road to Burrum (inc offtakes)	DN600	61.80 km
	Offtake to Demand C	DN150	3.60 km
2b	Causeway Road to Burrum (no offtakes)	DN600	61.8 km
3	Paradise Dam to Burrum	DN600	71.4 km

Reservoir Sizing

Reservoirs have been sized based on 2 hours retention time at peak design flows (as determined in Table 4.3). The location of reservoirs have been optimised based on the hydraulic profiles for each alignment.

Table 4.5 Reservoir Sizing

Option	Option Description	Peak Flow Rate (ML/d)	Reservoir Size
1a	Ned Churchward Weir to Burrum (inc offtakes)	24.7	2.5 ML
1b	Ned Churchward Weir to Burrum (no offtakes)	21.9	2.5 ML
2a	Causeway Road to Burrum (inc offtakes)	23.3	2.5 ML
2b	Causeway Road to Burrum (no offtakes)	21.9	2.5 ML
3	Paradise Dam to Burrum	21.9	2.5 ML

Pump Station Sizing

Based on the above demands, pipe sizes, route alignments and elevations, the following preliminary pump station sizing was developed for each option.

Table 4.6 Pump Station Sizing

Option	Option Description	Intake Pump Station (kW)	Transfer Pump Station (kW)
1a	Ned Churchward Weir to Burrum (inc offtakes)	475	180
1b	Ned Churchward Weir to Burrum (no offtakes)	405	180
2a	Causeway Road to Burrum (inc offtakes)	590	N/A
2b	Causeway Road to Burrum (no offtakes)	530	N/A
3	Paradise Dam to Burrum	530	N/A

4.5.3 Powerline Infrastructure

A substantial power supply connection will be required to the intake pump station and transfer pump station sites. The powerline infrastructure will be provided by Ergon, however the project would likely be required to contribute to any network extensions and power network upgrades.

Based on a high level review of the existing powerline networks, an allowance has been made for network upgrades for the power supply to intake pump stations for Options 1 and 2. As Option 3 intake pump station is located adjacent to mini-hydro the existing network to the area is likely to be adequate. As the Option 1 transfer pump station is adjacent to the 11 kV powerline network and is a lesser load it has been assumed that no network upgrades will be required for this site. The powerline upgrade allowances are summarised in Table 4.7.

Table 4.7 Assumed Intake Pump Station 11 kV Powerline Network Upgrades

Option	Option Description	Powerline Infrastructure
1a	Ned Churchward Weir to Burrum (inc offtakes)	6 km
1b	Ned Churchward Weir to Burrum (no offtakes)	6 km
2a	Causeway Road to Burrum (inc offtakes)	14 km
2b	Causeway Road to Burrum (no offtakes)	14 km
3	Paradise Dam to Burrum	Nil

4.6 COST ESTIMATES

The below sections give a high level qualification on the capital and operating and maintenance costs associated with the three proposed pipeline alignments. A detailed basis of estimate report is attached in Appendix F.

4.6.1 Cost Estimate Qualifications

Capital Cost Estimate Criteria

The capital cost estimate has been:

- Prepared to a pre-feasibility study (+50%/-50%) estimate accuracy.
- Expressed in Australian dollars.
- Expressed in cost terms based on August 2018 pricing. The estimate assumes no escalation beyond this base date.
- Developed with the best available information at this time. Additional investigations such as survey and service detection and detailing of staging would be required to improve the estimate accuracy.
- Developed excluding Goods and Services Tax.

Easement Costs

The following easement and land purchase costs were assumed, based on previous project experience.

Table 4.8 Easement and Land Purchase Costs

Land Type	Cost
Grass Paddock	$150/m
Farm Land (Cane etc.)	$300/m
Urban	$600/m

Operating and Maintenance Cost Criteria

Infrastructure O&M

The parameters used for the assessment of the ongoing operating and maintenance costs of the pipeline and pump station are given in Table 4.9.

Table 4.9 Operating and Maintenance Costs

Parameter	Value
Power Costs	
Average power cost	22 c / kwhr
Annual Operating and Maintenance Costs	
Pipelines	0.65% of the pipeline capital value. This includes allowances for general maintenance required on the pipeline
Balance tanks	0.25% of the balance tank capital value
Pump station	3% of the pump station capital value + (35 x the total installed kW)

Water Costs

The cost structure for water from the Burnett River has an initial allocation purchase cost along with ongoing annual costs. The Burnett Water Prices have been based on the SunWater Fees & Charges Schedule 2017-2018, and are summarised in Table 4.10.

Table 4.10 Burnett Water Prices (High Priority Water)

Description	Units	Option 1 Ned Churchward Weir to Burrum	Option 2 Causeway Rd to Burrum	Option 3 Paradise Dam to Burrum
Purchase Price				
Purchase Price [Bulk Charge - Part A]	$/ML allocation	$2,871.76	$2,871.76	$2,871.76
Variable Pricing				
Allocation Charge (River) [Bulk Charge - Part A]	$/ML allocation/a	$114.34	$114.34	$114.34
Peak Capital Charge [Part C peak - Gin Gin / Bingera]	$/ML allocation/a	$11.57	-	-
Allocation Water [Bulk Charge - Part B]	$/ML used	$1.25	$1.25	$1.25

Power Costs

The criteria for determining power costs for each option has been summarised below in Table 4.11.

Table 4.11 Power Costs

Parameter	Value	Units
Unit Power Cost	$0.22	$/kWhr
Overall System Efficiency	74%	%
Unit Pumping Costs	$0.81	$/ML/m pumped head

4.6.2 Cost Estimate Quantification

Capital Costs Estimates

Capital costs have been prepared for each of the pipeline options and are presented in Appendix G.

The project capital costs are summarised in Table 4.12.

Table 4.12 Project Capital Cost

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Total Capital Cost	$129,100,000	$121,600,000	$118,200,000	$112,700,000	$129,700,000

Operating and Maintenance Costs

Infrastructure O&M

The ongoing operating and maintenance costs of the pipeline and pump station are summarised in Table 4.13.

Table 4.13 Project Annual Operation and Maintenance Costs

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
O & M for Pipeline ($/a)	$395,976	$374,341	$367,477	$362,502	$400,543
O & M for Pump Stations ($/a)	$324,821	$310,740	$270,558	$196,410	$253,831
O & M for Balance Tanks ($/a)	$2,020	$2,020	$2,020	$2,020	$2,020
Total O&M Costs ($/a)	$722,817	$687,101	$640,055	$560,931	$656,394

Water Costs

The pricing structure in Table 4.10, has been summarised for each option in Table 4.14.

Table 4.14 Burnett Water Prices (Options Comparison)

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Purchase Price					
Purchase Price [Bulk Charge - Part A]	$25,845,840 (upfront cost)	$22,974,080 (upfront cost)	$24,409,960 (upfront cost)	$22,974,080 (upfront cost)	$22,974,080 (upfront cost)
Variable Pricing					
Allocation Charge [Part A + Part C Charges]	$1,133,190 / yr	$1,007,280 / yr	$971,890 / yr	$914,720 / yr	$914,720 / yr
Allocation Water [Bulk Charge - Part B]	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used	$1.25/ML Used

Power Costs

The power cost criteria in Table 4.11 has been summarised for each option in Table 4.15 taking into consideration the total pumped head of the pump stations, as determined in Section 4.5.2.

Table 4.15 Power Costs (Options Comparison)

	Option 1 Ned Churchward Weir to Burrum		Option 2 Causeway Rd to Burrum		Option 3 Paradise Dam to Burrum
Description	1A (inc. Offtakes)	1B (No Offtakes)	2A (inc. Offtakes)	2B (No Offtakes)	No offtakes
Intake Pump Station Power Costs	$90/ML	$87/ML	$114/ML	$110/ML	$127/ML
Transfer Pump Station Power Costs	$37/ML	$37/ML	-	-	-

4.6.3 Pipeline Construction and Implementation

The pipeline implementation has been assumed to have a start date for the planning of January 2020 to be operation by January 2023. The project capital cost expenditure profile is summarised in Table 4.16.

Table 4.16 Capital Cost Expenditure Profile

Year	Expenditure	Works
2020	5 % total capex	Investigations and approvals
2021	5 % total capex	Project design and easements
2022	45% of total capex	Project construction
2023	45% of total capex	Projection construction and commissioning

5 Preliminary financial and economic analysis

5.1 INTRODUCTION

Synergies Economic Consulting (Synergies) has undertaken the economic analysis of the Burnett River (Paradise Dam) to Howard Water Supply Pipeline project (the Burnett River pipeline project) in accordance with the requirements for a Preliminary Evaluation (PE) as set out in the Queensland Government's PAF. A copy of the Economic Analysis Report is included in Appendix H.

This section of the report contains the economic assessment of the Burnett River pipeline project. The economic benefits and costs of the project options have been assessed against the base case using the well-accepted cost-benefit analysis technique, in accordance with the requirements in the PAF.

The report has been structured as follows:

- Section 5.2 outlines the methodology, assumptions and data sources used
- Section 5.3 defines the base case against which the reference project options are to be assessed
- Section 5.4 describes the reference project options
- Section 5.5 assesses and quantifies the economic benefits under the reference project options
- Section 5.6 assesses and quantifies the economic costs to be incurred under the reference project options
- Section 5.7 sets out the results of the economic analysis of the reference project options, including the results of the sensitivity and scenario analysis
- Section 5.8 details the key findings and conclusions.

5.2 APPROACH

This section sets out the approach to undertaking the economic analysis and the key assumptions to be applied.

5.2.1 Methodology

In accordance with the PE (and Cost-Benefit Analysis) guideline under the PAF, the following approach was applied in undertaking the cost-benefit analysis:

- define the base case, with particular regard to
  - the urban water supply-demand balance for the region over the study period
  - the water supply augmentation(s) likely to be pursued under the base case (based on discussions with personnel from the FCRC and other relevant stakeholders), including the feasibility and cost of the various augmentation options
  - the frequency and severity of water restrictions over the study period

  - the likelihood that emergency water supply measures will be required over the study period
- quantify cash flows that ensue from the base case over the study period
- define the reference project options for which economic benefits and costs are to be assessed relative to the base case
- identify all economic benefits and costs to be assessed under the reference project options, based on an assessment of available data and information and consultation with project stakeholders
- where possible, quantify economic benefits and costs under the reference project options
- where impacts are not able to be quantified, undertake a detailed qualitative evaluation of the nature of the impact
- conduct discounted cashflow modelling of the economic benefits and costs of the reference project options and calculate the NPV and BCR for each option
- conduct sensitivity and scenario analysis to assess the impact of changes to key parameters and assumptions on the results.

5.2.2 Key assumptions

The key assumptions for this economic analysis are:

- a real discount rate of 7 per cent, with sensitivity analysis to be conducted at 4 and 10 per cent
- a study period of 30 years is considered appropriate for projects involving the development of long-lived infrastructure such as water supply pipelines
- 2018 as Year 0 for the analysis.

5.2.3 Key data and information sources

The key sources of data and information used to inform the analysis were:

- the 2015 Fraser Coast Water Supply Strategy, published by Wide Bay Water Corporation
- the Regional Water Supply Security Assessment (RWSSA) completed for the Hervey Bay region by the Department of Energy and Water Supply (in conjunction with the FCRC) in 2015
- an early stage assessment submission for the Burnett River pipeline, prepared by FCRC in 2017
- the SASR completed for the Burnett River pipeline project
- SunWater documentation, including 2017/18 fees and charges schedules for the Lower Mary River and Bundaberg (Burnett) Water Supply Schemes
- various studies and reports regarding water users' willingness to pay to avoid water restrictions. These include: Australian National University (2012). Willingness to Pay Research Project – Final Report; Cooper, B., Crase, L. & Burton, M. (2011). Urban Water Restrictions: Attitudes and Avoidance; Allen Consulting Group (2007). Willingness to Pay for Increased Reliability of Water Supply in South East Queensland: A contingent valuation study.

5.3 BASE CASE

This section sets out the base case against which the reference project options are to be assessed. The relevant considerations in defining the base case are:

- future urban water demand for the Hervey Bay region
- the future water supply-demand balance in the region

- planned water supply augmentations and the timing and cost of these augmentations
- the frequency and severity of water restrictions over the study period.

5.3.1 Future urban water supply-demand balance

Urban water demand

Estimates of future urban water demand for the Hervey Bay region were supplied by FCRC. The demand estimates were based on the projections from the 2015 Wide Bay Water Fraser Coast Water Supply Strategy, updated using latest population projections from the QGSO. These results have been presented in Section 2.1.

Urban water supply

Hervey Bay urban water supply sources are presented in Section 2.1.

Supply-demand balance

The analysis presented in Section 2.1 show that urban water demand for the Hervey Bay region is not expected to exceed the Burrum River extraction licence limit until 2066.

5.3.2 Water supply augmentations

The SASR for the Burnett River pipeline project identified a shortlist of options with the potential to address future water demands in the Hervey Bay region. Five options (in addition to the Burnett River Pipeline) were assessed:

- Interconnector pipeline between Hervey Bay and Maryborough
- Indirect Potable Reuse (IPR)
- Mary River
- Fraser Island
- Desalination.

A summary of each augmentation option, including a number of key elements of the option being considered, is detailed in Table 5.1.

Table 5.1 **Overview of water supply augmentation options**

Augmentation option	Project details	Parameter inputs	Impact on supply-demand balance	Consideration under the base case
Hervey Bay-Maryborough Interconnector	This option requires the development of a new pipeline from Burgowan WTP (Hervey Bay) to the Boys Avenue Reservoir (Maryborough) and associated pumping stations.	CAPEX estimated at $31 million[a] Estimated energy (operating) cost is approximately $20/ML[d]	Does not make additional water supplies available for the Fraser Coast region. Rather, it would enable the more efficient management of available water supplies.	Project is currently under consideration by FCRC as part of a separate assessment process. Not considered further as a viable water supply augmentation as it does not make additional volumes of supply available.
Indirect Potable Reuse	This option involves augmenting the Nikenbah WWTP to enable it to perform advanced treatment (reverse osmosis and advanced oxidation) to produce Purified Recycled Water (PRW). Water would then be piped to Cassava Dam and, subsequently, used as a raw water source for the Burgowan WTP.	CAPEX estimated at $47 million[a]	Capacity increase of 4.8 ML of water per day[a] Increased supply capacity, however, is unable to meet the total volume required in the region.	Not considered further, because it: does not provide sufficient water source into the supply system; and public/political resistance, in addition to potentially high OPEX.
Mary River	This option involves the installation of a pipeline from the Mary River Barrage to the Burgowan WTP site and the construction of a pump station. The option also involves the purchase of 8,000 ML of high-priority water allocations.	CAPEX estimated at $59.5 million[a] Up-front water allocation cost estimated at $10.1 million [c] Note that the charges are for the Lower Mary channel and not the Mary Barrage. This would indicate that additional water is not available from the Mary River and therefore this would be subject to further modelling and investigation with DNRME. OPEX includes: a fixed annual cost of $115,000 and an additional variable charge of $1.89/ML;[c] and energy costs estimated at $44/ML.[d]	Capacity increase of 22 ML of water per day.[a] Provides sufficient capacity to address the identified water supply need, though, concerns exist such as: the availability of high priority water; and ongoing reliability of the source.	Identified as potentially feasible supply augmentation under the base case as: it meets the long-term water security needs in the Hervey Bay region; is technically feasible; and FCRC identified it as a relatively inexpensive future water source option.

Fraser Island	This option involves sourcing water from the Bogimbah Creek area (either via a borefield or directly from the creek flow itself) and then transferring it to mainland Hervey Bay by means of a submarine pipeline.	CAPEX estimated at $56 million[b] Estimated energy (operating) cost is approximately $45/ML[d]	Capacity increase of 56 ML of water per day[a] Provides sufficient capacity to meet the project need, though, the following risks have been identified: close proximity to an environmentally sensitive (heritage-listed) area; and potentially high-water colouring issues, in turn, requiring further treatment and expenditure.	Identified as potentially feasible supply augmentation under the base case as: it meets the long-term water security needs in the Hervey Bay region; is technically feasible; and has relatively low CAPEX and OPEX. However, it is important to note the issues in relation to environmental impacts.
Desalination	This option involves the construction of two small desalination plants in suitable sites, e.g. River Heads, Booral, Dundowran and Burrum Heads.	Capex estimated at $81.2 million[a]	Capacity increase of 20 ML of water per day[a] Provides sufficient capacity to meet the project need of providing long-term water security.	While the option is not suitable to address long-term water demands, due to its high CAPEX and OPEX outlays (including possible environmental issues relating to disposal of waste brine), it could be considered as an emergency measure to safeguard against unforeseen drought events.

a WBWC (2015) - Fraser Coast Water Supply Security Strategy. b KBR (2018) - SASR. c SunWater (2017) - Fees and Charges Schedule. d FCRC (2018) – inputs emailed on 5 July 2018.

Note: CAPEX, OPEX, WTP and WWTP denote capital expenditure, operating expenditure, water treatment plant and wastewater treatment plant, respectively.

The key findings from the assessment of the identified water supply augmentation options presented in the above table are:

- The Mary River and Fraser Island augmentation options are most likely to be pursued to provide long-term water supply security to the Hervey Bay region, noting the environmental issues associated with the Fraser Island option.
- The Interconnector project would not increase the volume of water supply available to the Fraser Coast region and has therefore not been included in the base case, however it is important to note that this project is currently under consideration as part of a separate assessment process. Scenario modelling has been conducted to account for the scenario in which the Interconnector project is developed (see Section 5.7.2).
- The IPR and desalination options do not represent viable augmentations under the base case, noting the latter could form part of an emergency supply response.

Based on consultation with FCRC, the assumption has been adopted that, in the event that the water supply-demand balance in the Hervey Bay region results in a supply augmentation being required, either the Fraser Coast Island or Mary River supply options are likely to be pursued. For the purpose of this cost-benefit analysis, it has been assumed that the Fraser Island option would be pursued.

Given that a 30-year evaluation period has been adopted for this analysis (i.e. from 2019 to 2048), and augmentation is not required within this timeframe (based on current demand projections and the current estimate of the Burrum River extraction licence limit), capital and operating expenditure for the Fraser Island source augmentation option were excluded from this analysis.

5.3.3 Water restrictions

Water restrictions are another measure that can be applied to manage the urban water supply-demand balance. As the supply-demand balance tightens, it is expected that the frequency and severity of water restrictions imposed on Hervey Bay water users will increase. This imposes a cost on the community under the base case. To quantify this cost, it is necessary to derive estimates for:

- the frequency of water restrictions
- the economic cost incurred when restrictions are implemented.

Frequency of water restrictions

The frequency of different levels of water restrictions in the Hervey Bay region over the study period was assessed based on the modelling undertaken by DEWS (in conjunction with FCRC). The results of this modelling are presented in Section 2.1.1.

Economic cost of water restrictions

Based on a number of studies that have estimated the cost of water restrictions in Australia (see below), households were found to place a material value on the ability to avoid the implementation of severe water restrictions. While households were willing to pay to reduce the likelihood of the implementation of severe water restrictions, for less severe restrictions, they were found to be willing to pay only a small amount (or none). This is the rationale for not attributing an economic cost to the occurrence of Level 1 or Level 2 restrictions.

Table 5.2 provides a summary of several studies from the relevant literature that have investigated the economic cost of water restrictions in Australia.

Table 5.2 **Summary of studies on water triggers and restriction levels**

Study	Location (user group)	Method	Result(s)
Allen Consulting Group (2007)[a]	Southeast Queensland (residential users)	Contingent valuation	WTP to reduce the frequency of Level 4 restrictions (from 50% to 20%) estimated at $132 p.a.
Australian National University (2012)b	Canberra, ACT (residential users)	Choice modelling	WTP to reduce the frequency of Stage 4 restrictions (by 5%) estimated at $200 p.a., whilst the corresponding estimate for Stage 3 restrictions was $70 p.a.
DBM Consultants (2007)c	South East Queensland (residential users)	Choice modelling	For the highest set of water security outcomes (level 4 restrictions 1 in 100 years), the average WTP was $174 p.a.

Hensher, D., Shore, N. and Train, K. (2006)[d]	Canberra, ACT (residential and business users)	Choice modelling	WTP to avoid level 3 water restrictions was estimated at $239 p.a.
Marsden Jacob Associates (2006)[e]	South East Queensland (commercial, industrial and residential users)	An average WTP using methods such as contingent valuation/choice modelling	Households were willing to pay $233 and $291 to avoid level 3 and 4 restrictions, respectively.

a Allen Consulting Group (2007). Willingness to Pay for Increased Reliability of Water Supply in South East Queensland - A Contingent Valuation Study.

b Australian National University (2012). Willingness to Pay Research Project – Final Report.

c DBM Consultants (2007). Economic Valuation of Water Reliability in South-East Queensland Using Choice Modelling.

d Hensher, D., Shore, N. and Train, K. (2006). Water Supply Security and Willingness to Pay to Avoid Drought Restrictions. Economic Record, 82, pp 56-66.

e Marsden Jacob Associates (2006). Economic Cost of Water Restrictions in South East Queensland.

Adjusting (or escalating) the cost estimates in Table 5.2 for inflation results in an average willingness to pay to avoid water restrictions of approximately $236 per ED per annum (in $2018). Inflation rates were based on 6401.0 Consumer Price Index, Australia, Mar 2018.

This estimate, which has been applied for the economic cost of level 3 restrictions, was derived by averaging the escalated/inflated estimates from relevant studies/reports relating to the cost of implementing moderate to severe restrictions. The $236 per ED per annum cost estimate was derived by escalating and then averaging estimates from the 2012 Australian National University report ($78.90 per ED in $2018), the 2006 Hensher et al. study ($318.48 per ED in $2018) and the 2006 Marsden Jacob Associates report ($310.48 per ED in $2018).

For level 4 (severe) restrictions, it has been assumed that the economic cost incurred by households will be two and a half times this estimate (i.e. $354 per ED per annum). That is, the cost of level 4 restrictions is $354 per household, plus the $236 per household incurred as a result of level 3 restrictions being imposed. This is based on the assessment that level 4 restrictions require the same level of reduction in terms of the volume of water use (i.e. 20 per cent reduction), however the cost incurred by households in reducing consumption increases as water consumption falls.

Due to the inherent uncertainty associated with non-market parameter estimates, nonetheless, these estimates have been subject to sensitivity analysis (see Section 5.7.2).

Estimated cost of water restrictions under the base case

The economic cost of water restrictions under the base case is estimated by applying the estimate for the cost of water restrictions per household (or dwelling) to the number of EDs in the Hervey Bay region. This produces an estimate for the economic cost imposed on the community in a year in which level 3 or level 4 water restrictions are implemented. The expected incidences of water restrictions are then applied to these estimates to derive an estimate for the economic cost of water restrictions in each year of the study period.

For example, in 2020 it is estimated that 38,023 EDs will be supplied via the Hervey Bay water supply system. At a cost of $236 per ED for level 3 and $354 per ED for level 4, the economic cost associated with the imposition of severe water restrictions is estimated at approximately $22.4 million (in $2018). Based on an expected incidence of moderate to severe water restrictions, i.e. 14.6 per cent for level 3 and 6.9 per cent for level 4, this equates to an economic cost of water restrictions of $2.23 million ((0.146 * 8.97) + (0.069 * 13.46)) in 2018.

Table 5.3 sets out the calculation of the economic cost of water restrictions under the base case over the evaluation period.

Table 5.3 **Estimating the cost of water restrictions under the base case ($ million as of 2018)**

Metric	2020	2024	2028	2032	2036	2040	2044	2048
Level 3	14.6%	15.8%	17.5%	19.4%	21.0%	22.8%	24.8%	27.0%
Community cost[a]	$8.97	$9.44	$9.98	$10.54	$11.05	$11.51	$11.98	$12.47
Level 4	6.9%	8.5%	9.8%	11.2%	12.3%	13.5%	14.9%	16.5%
Community cost[a]	$13.46	$14.16	$14.97	$15.81	$16.58	$17.26	$17.97	$18.71
Cost of restrictions[b]	**$2.23**	**$2.69**	**$3.22**	**$3.81**	**$4.37**	**$4.95**	**$5.66**	**$6.46**

a This is computed by multiplying total ED to the estimated cost of water restriction in each year of the evaluation period.

b This represents the total cost of level 3 and 4 water restrictions.

Source: Synergies modelling.

Based on the inputs set out above, the total economic cost of water restrictions to be imposed on water users supplied by the Hervey Bay reticulation network under the base case is estimated to be $45.16 million (in PV terms) over the study period.

5.3.4 Emergency supply measures

Emergency supply measures are implemented when it is not possible for conventional water supply augmentations to be pursued to alleviate a water supply-demand imbalance. This may be due to timing issues or augmentation options not being viable due to climate or other factors. Where there is a likelihood that emergency supply measures will be required under the base case, it is appropriate to assess the potential cost and likelihood of these measures to quantify this cost under the base case.

Using stochastic modelling techniques with over 100 years of historical data, DEWS (2015) revealed the likelihood of the Lenthall Dam falling below the minimum operating level (dead storage) at around 1 in every 200 years at the 2019 demand. At total demand of 12,097 ML per annum (year 2048 demand), this probability increases to around 1 in every 50 years.

Based on consultation with FCRC, it is anticipated that desalination represents the most likely supply option to be pursued in an emergency supply scenario, primarily due to the fact that this option is not climate-dependent, and the relatively short lead-time associated with the implementation of this option. However, given that, based on current urban water demand projections for the Hervey Bay region, it is not anticipated that a supply augmentation will be required over the next 30 years, no costs associated with the need to implement emergency supply measures have been included in the base case.

5.3.5 Summary of the base case

In summary, the key features of the base case against which the reference project options are to be assessed are:

- in the event that a supply augmentation is required, the Fraser Coast Island supply option has been identified as the option most likely to be adopted. However, no cost associated with this augmentation has been included in the base case due to the long-term water supply-demand projections indicating that augmentation will not be required within the next 30 years;
- a total cost of $45.16 million (PV terms) to be incurred by urban water users as a result of the implementation of level 3 as well as level 4 water restrictions; and
- no cost has been included in relation to emergency supply measures, based on the long-term urban water supply-demand projections for the Hervey Bay region.

5.4 REFERENCE PROJECT OPTIONS

The reference project involves the construction of a new pipeline and associated pump station over a four-year period to 2023 to transport approximately 22 ML of water per day (or around 8,000 ML per annum) from three identified route options to the Burrum Weir Pump Station (see Figure 5.1).

The following alternative route options have been identified:

- Option 1A – supply from Ned Churchward Weir to Burrum, in addition to offtakes for agricultural production
  - Option 1B – as above, but excluding offtakes
- Option 2A – supply from Causeway Road to Burrum, in addition to offtakes for agricultural production
  - Option 2B – as above, but excluding offtakes
- Option 3 – supply from Paradise Dam to Burrum.

The project would provide long-term water supply security to the Hervey Bay region, in addition to potentially making water available for agricultural production in the region (Option 1 and 2 include private agricultural demands by priority).

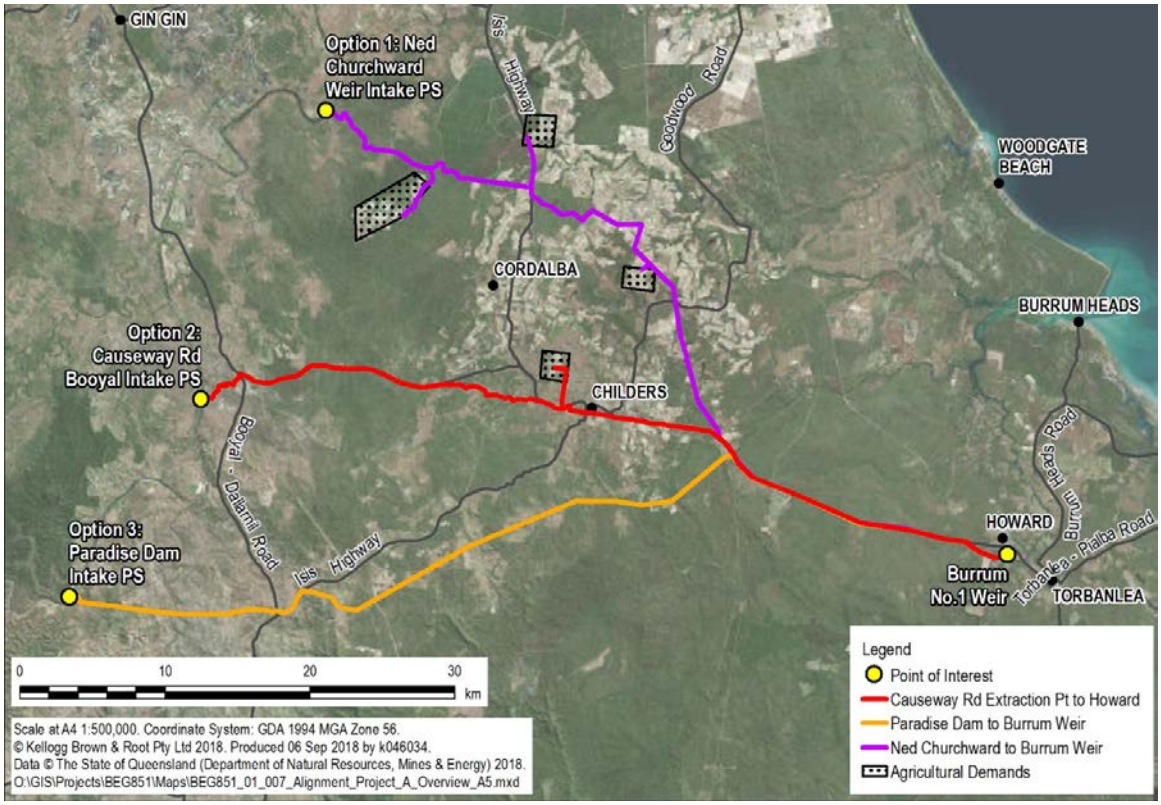

Figure 5.1 **Burnett River to Hervey Bay – route options**

The economic benefits and costs associated with these reference project options relative to the base case are set out in the following sections.

5.5 ECONOMIC BENEFITS

This section sets out the economic benefits attributable to the reference project options relative to the base case. The following benefits have been identified:

- avoided cost of water restrictions

- economic value derived from water use for agricultural production.

Note that given no costs associated with water supply augmentations or emergency water supply measures have been included in the base case, there are no benefits associated with the avoidance of these costs under the reference project options.

5.5.1 Avoided cost of water restrictions

The construction of the Burnett River pipeline will result in a significant increase in the volume of water available to meet urban water demand in the Hervey Bay region over the study period. This will result in a reduction in the frequency of implementation of level 3 and level 4 restrictions and hence the economic cost associated with the implementation of these restrictions.

Section 5.3.3 sets out the estimated cost of level 3 and level 4 water restrictions under the base case. The magnitude of this benefit under the reference project options will depend on the extent to which the frequency of level 3 and level 4 restrictions will be reduced as a result of the reference project options. The economic cost of water restrictions under the reference project options is estimated at $26.18 million in PV terms. As such, of the costs incurred under the base case, $18.98 million (in PV terms) is avoided under the reference project options.

Table 5.4 sets out annual estimates of the economic cost of water restrictions under the base case and reference project options for selected years of the study period.

Table 5.4 **Estimating the cost of water restrictions under the project options ($ million as of 2018)**

Scenario	2020	2024	2028	2032	2036	2040	2044	2048
Base case costs	$2.23	$2.69	$3.22	$3.81	$4.37	$4.95	$5.66	$6.46
Reference project options	$2.23	$1.60	$1.69	$1.78	$1.87	$1.95	$2.03	$2.11
Avoided cost[a]	**$0.00**	**$1.10**	**$1.53**	**$2.03**	**$2.50**	**$3.01**	**$3.63**	**$4.35**

a The resulting difference is the cost saving (or benefit) obtained from reduced risk of water restrictions.

Source: Synergies modelling.

5.5.2 Economic value of agricultural production

As noted in Section 5.4, several of the reference project options will also make water available for agricultural production.

The following key activities and irrigator demands have been identified in the Burnett Wide Bay Region, with the potential to be served by the reference project:

- Ned Churchward Weir to Burrum (Option 1A):
  - 500 ML of high priority water per annum for the production of citrus crops
  - 500 ML of high priority water per annum for the production of avocados
  - 2,600 ML of medium priority water per annum for the production of sugarcane.
- Causeway Road to Burrum (Option 2A):
  - 500 ML of high priority water per annum for avocado production.

Determining the economic value derived from the use of water for agricultural production requires the following to be established:

- for each crop, the volume of water to be used and the irrigation application rate (i.e. ML per hectare)
- the revenue to be derived from the production of each crop on a per hectare or per unit basis, having regard to crop yields and crop prices received by producers
- the total cost of production, including pre-harvest, irrigation, harvest and post-harvest costs, annual administration costs, annualised cost of capital equipment, annualised crop establishment costs and an allowance for the opportunity cost of land.

This results in an estimate for the net economic return per hectare from crop production. Dividing this estimate by the irrigation application rate for that crop results in an estimate for the net economic return per ML of water used. This represents the economic benefit attributable to the use of water for the production of this crop.

As stated above, the demand assessment identified three crops to be produced using water supplied from the pipeline – sugarcane; citrus; and avocadoes. The following sections assess the economic benefits of water use for each of these crops.

Sugarcane

Table 5.5 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for sugarcane production.

Table 5.5 **Key information for sugarcane production**

Metric	Parameter estimate	Source
Application rate	3 ML per hectare	4618.0 - Water Use on Australian Farms (Various editions)
Gross margin	$1,500 per hectare	Adjusted DAF Farm Economic Assessment Tool (FEAT).0
Opportunity cost of land	$2,500 per hectare	Synergies estimate of dryland sugarcane production based on the DAF Farm Economic Assessment Tool (FEAT).

Citrus crops

Table 5.6 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for citrus production.

Table 5.6 **Key information for citrus production**

Metric	Parameter estimate	Source
Application rate	9 ML per hectare	Based on https://www.daf.qld.gov.au/business-priorities/plants/fruit-and-vegetables/fruit-and-nuts/citrus/harvesting,-yields-and-prices
Gross margin	$25,000 per hectare	Based on a gross margin published by the Qld Government in 1997 under the Agrilink series
Production costs	Includes the following costs:	
	annual admin cost of $4,000	

	annual capital cost (excluding land) of $9,000 per hectare; and	
	an establishment cost of $20,000 per hectare.	Based on a gross margin published by the Qld Government in 1997 under the Agrilink series
Net annual return	$12,000 per hectare	Synergies calculation, i.e. gross margin less production costs (excluding establishment cost)
Opportunity cost of land	$3,000 per hectare	Synergies estimate.

Avocados

Table 5.7 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for avocado production.

Table 5.7 **Key information for avocado production**

Metric	Parameter estimate	Source
Application rate	8 ML per hectare	Queensland Government. Agrilink Avocado Information Kit ,2001.
Gross margin	$18,000 per hectare	Queensland Government. Agrilink Avocado Information Kit ,2001.
Production costs	Includes the following costs:	
	annual admin cost of $4,000	
	annual capital cost (excluding land) of $9,000 per hectare; and	
	an establishment cost of $20,000 per hectare.	Queensland Government. Agrilink Avocado Information Kit ,2001.
Net annual return	$5,000 per hectare	Synergies calculation, i.e. gross margin less production costs (excluding establishment cost)
Opportunity cost	$3,000 per hectare	Synergies Estimate

Summary of agricultural benefits

Table 5.8 sets out the estimated economic benefits, based on the demand profile and parameter estimates detailed above, to be derived from the use of water for agricultural production under reference project options 1A and 2A.

Table 5.8 **Economic benefits from increased agricultural production**

Project option	Description	Present Value estimate
Option 1A	Economic value derived from the use of 2,600 ML of medium priority water per annum for sugarcane production and 1,000 ML of high priority water per annum for increased production of citrus crops as well as avocados.	$16.78 million
Option 2A	Economic value derived from the use of 500 ML of high priority water per annum for avocado production	$1.75 million

5.5.3 Summary of economic benefits

Table 5.9 presents a summary of the economic benefits quantified under each reference project option. The table shows that Option 1A has a significantly higher total economic benefit compared to the other four options, due to this option involving the highest use of water for agricultural production (and the fact that all options result in the same benefit in terms of the avoided economic cost of water restrictions).

Table 5.9 **Summary of economic benefits (in PV terms)**

Option	Benefits ($ million, in PV terms)		
	Avoidance of severe water restrictions	Increased agricultural production	Total
Option 1A	$18.98	$16.78	$35.76
Option 1B	$18.98	-	$11.39
Option 2A	$18.98	$1.75	$20.73
Option 2B	$18.98	-	$11.39
Option 3	$18.98	-	$11.39

5.6 ECONOMIC COSTS

The economic costs to be incurred under the reference project options include:

- capital costs
- operating and maintenance costs, including electricity costs
- water allocation costs.

5.6.1 Capital costs

Significant capital expenditure is required under all reference project options. Based on the total capital costs in Section 4.6.2, the capital costs for each option are set out in Table 5.10, including the total PV estimates.

Table 5.10 **Capital costs by reference project option ($million)**

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
2020	$12.91	$12.16	$11.82	$11.27	$12.97
2021	$12.91	$12.16	$11.82	$11.27	$12.97
2022	$51.64	$48.64	$47.28	$45.08	$51.88
2023	$51.64	$48.64	$47.28	$45.08	$51.88
Total Present Value estimate	$104.89	$98.80	$96.04	$91.57	$105.38

5.6.2 Operating and maintenance costs

Table 5.11 sets out the PV totals for the annual operating and maintenance costs, fixed and variable, to be incurred under each reference project option. These costs relate to the operation and maintenance of the pipeline and associated infrastructure and the power costs to be incurred in supplying water via the pipeline.

Table 5.11 **Total operating and maintenance costs by reference project option ($million, PV terms)**

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Fixed O&M a	$6.43	$6.11	$5.69	$4.99	$5.84
Variable O&M b	$6.01	$3.19	$3.46	$2.83	$3.28
Total O&M cost	$12.43	$9.30	$9.15	$7.81	$9.11

a The fixed operating and maintenance (O&M) cost stream includes costs for pipeline, pump stations and balance tanks

b The variable O&M cost stream includes cost for intake PS power and transfer PS power.

5.6.3 Water allocation costs

The reference project options require the up-front purchase of water allocations from the Burnett River WSS. In addition to the up-front purchase of the allocations, costs are also to be incurred in relation to the ongoing fixed and variable charges (typically levied on an annual basis) associated with these allocations. Based on the water costs in Section 4.6, the costs associated with the acquisition of water allocations under the reference project options are illustrated in Table 5.12 below.

Table 5.12 **Total water allocation costs by reference project option ($million)**

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Purchase of water allocations (one-off cost)	$25.85	$22.97	$24.41	$22.97	$22.97
Total fixed costs	$30.60	$27.20	$26.24	$24.70	$24.70
Total variable costs	$0.22	$0.11	$0.12	$0.11	$0.11
Total Present Value estimate	$34.52	$30.65	$31.54	$29.68	$29.68

5.6.4 Summary of economic costs

Table 5.13 summarises the economic costs of the reference project options relative to the base case in PV terms.

Table 5.13 **Summary of economic costs (in PV terms)**

Option	Costs ($ million, PV terms)			
	Capital costs	O&M costs	Water allocation costs	Total
Option 1A	$104.89	$12.43	$34.52	$151.84
Option 1B	$98.80	$9.30	$30.65	$138.74
Option 2A	$96.04	$9.15	$31.54	$136.72
Option 2B	$91.57	$7.81	$29.68	$129.06
Option 3	$105.38	$9.11	$29.68	$144.17

Source: Synergies modelling.

The above table shows that Option 1A has the highest total cost, driven by the higher capital cost and variable operating and maintenance costs of this option relative to the other options. This is likely attributable to the requirements for this option to supply higher volumes of water for agricultural use compared to the other options.

5.7 RESULTS

This section summarises the results of the economic analysis relating to the reference project options against the base case.

5.7.1 Results of economic analysis

The PV estimates for the economic costs and benefits of the reference project options relative to the base case are summarised in Table 5.14 below.

Table 5.14 **Summary of results from the economic analysis ($millions, PV terms)**

Metric	Present Value Estimates ($million)				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Economic benefits					
Avoidance of severe water restriction	$18.98	$18.98	$18.98	$18.98	$18.98
Increased agricultural production	$16.78	n/a	$1.75	n/a	n/a
Total benefits	$35.76	$18.98	$20.73	$18.98	$18.98
Economic costs					
Capital costs	$104.89	$98.80	$96.04	$91.57	$105.38
Operating and maintenance costs	$12.43	$9.30	$9.15	$7.81	$9.11
Water allocation costs	$34.52	$30.65	$31.54	$29.68	$29.68
Total costs	$151.84	$138.74	$136.72	$129.06	$144.17
Benefit Cost Ratio	0.24	0.14	0.15	0.15	0.13
Net Present Value	($116.08)	($119.77)	($115.99)	($110.08)	($125.19)

Source: Synergies modelling.

The results in the table highlight the following:

- the NPV of all reference project options are significantly negative
- the BCRs are well below 1 under all reference project route options.

Despite having a significantly higher total economic benefit estimate than the other reference project options, the NPV for Option 1A is comparable to the other project options, with the exception of Option 3. This is attributable to the higher economic costs to be incurred under this option.

Given the absence of a major supply augmentation under the base case and the relatively low volumes of water to be used for agricultural production, the poor performance of the reference project options relative to the base case is not unexpected. It is noted that were the Hervey Bay region to suffer a prolonged drought in the short to medium term to the extent that a supply augmentation was required, the economic benefits of the reference project options would increase significantly (although unlikely to the extent necessary to result in a positive NPV).

5.7.2 Sensitivity and scenario analysis

Sensitivity analysis

Sensitivity analysis shows how the results of the analysis are affected by changes to key parameters and assumptions. This provides policy makers with an indication of the level of certainty associated with the modelled results in addition to identifying critical parameters and assumptions in terms of the impact on the net economic impact of the reference project options.

The following parameters have been subject to sensitivity analysis:

- discount rate (4 and 10 per cent)
- capital costs (±20 per cent)
- the economic cost of water restrictions (±50 per cent).

Table 5.15 presents the results from key parameter changes.

Table 5.15 **Results of sensitivity analysis**

Parameter estimate	Present Value Estimates ($million) % change				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Base result	($116.08)	($119.77)	($115.99)	($110.08)	($125.19)
Discount rate					
Low (4%)	($117.14) (-0.9%)	($127.66) (-6.6%)	($122.20) (-5.4%)	($116.11) (-5.5%)	($133.16) (-9.6%)
High (10%)	($111.73) (+3.8%)	($111.65) (+6.8%)	($108.88) (+6.1%)	($103.27) (+6.2%)	($116.86) (+8.3%)
Capital costs					
Low (-20%)	($95.11) (+18.1%)	($100.01) (+16.5%)	($96.78) (+16.6%)	($91.77) (+16.6%)	($104.12) (+16.8%)
High (+20%)	($137.06) (-18.1%)	($139.53) (-16.5%)	($135.20) (-16.6%)	($128.40) (-16.6%)	($146.27) (-16.8%)

Economic cost of water restrictions					
Low (-50%)	Low (-50%)	Low (-50%)	Low (-50%)	Low (-50%)	Low (-50%)
High (+50%)	High (+50%)	High (+50%)	High (+50%)	High (+50%)	High (+50%)

Source: Synergies modelling.

The outcomes from this sensitivity analysis are as follows:

- base NPV results are not overly sensitive to changes in the discount rate or the economic cost of water restrictions
- base NPV results are somewhat sensitive to changes in capital costs under all five reference project options, i.e. variation of around ±16-18 per cent.

These results are consistent with the significance of the capital cost of the reference project options in relation to the NPV of the five options.

Scenario analysis

The key scenario to be assessed is the net economic impact of the reference project options under the scenario in which the Maryborough to Hervey Bay Interconnector is constructed. As noted in Section 5.3.2, this project is currently under consideration and would enable up to 1,500 ML of water to be transported between Maryborough and Hervey Bay annually. This would increase the volumes of water available in the Hervey Bay region, hence reducing the incidence of level 3 and level 4 water restrictions in Hervey Bay.

The following assumptions have been applied to estimate the net economic impact of the reference project options under the scenario in which the interconnector is constructed under the base case:

- the interconnector is to be constructed by 2021 (over a two-year period), with a capital cost of $31 million (or $28.02 million in PV terms) and an annual energy pumping cost of $30,000 (or $0.31 million in PV terms)
- the total economic cost of level 3 and level 4 water restrictions over the study period under the scenario in which the interconnector is constructed is estimated at $33.11 million (in PV terms).

The results of the scenario analysis are presented in Table 5.16. Although the NPV outcomes are still found to be negative, they are positively impacted by the inclusion of the interconnector project under the base case. This is attributable to the benefit of avoiding the capital cost associated with this augmentation. It is important to highlight that the economic feasibility of the interconnector project has not been assessed in this analysis. This project would need to be subject to a separate economic evaluation that considered all relevant economic benefits and costs associated with the project.

Table 5.16 **Results of the scenario analysis**

Reference project option	Net Present Value		% Change
	Base results	Scenario results	
Option 1A			
Net Present Value	($116.08)	($97.63)	15.9%
Benefit Cost Ratio	0.24	0.36	
Option 1B			
Net Present Value	($119.77)	($101.31)	15.4%
Benefit Cost Ratio	0.14	0.27	
Option 2A			
Net Present Value	($115.99)	($97.53)	15.9%
Benefit Cost Ratio	0.15	0.29	
Option 2B			
Net Present Value	($110.08)	($91.63)	16.8%
Benefit Cost Ratio	0.15	0.29	
Option 3			
Net Present Value	($125.19)	($106.74)	14.7%
Benefit Cost Ratio	0.13	0.26	

5.8 KEY FINDINGS AND CONCLUSIONS

The analysis presented in the preceding sections shows that all reference project options for the construction of a pipeline from the Burnett River to the Burrum Weir Pump Station result in significantly negative NPVs (ranging from ($110.08 million) to ($125.19 million)) with BCRs of well below 1 (ranging from 0.13 to 0.24). These results are driven by the following:

- the absence of a water supply augmentation under the base case over the study period. This is due to urban water demand in the Hervey Bay region not exceeding the Burrum River extraction licence limit out to 2048
- the significant up-front cost associated with the reference project options, including the capital cost of construction of the pipeline and the purchase of the water allocations. The reference project options also involve significant ongoing costs in relation to operating and maintenance expenditure and the costs associated with water allocation charges
- the relatively low level of agricultural water use under the reference project options.

Whilst the reference project options perform better against the base case which includes the Maryborough to Hervey Bay Interconnector project, the NPVs for all reference project options remain significantly negative with BCRs of well below 1.

In conclusion, the urban water supply-demand balance in the Hervey Bay region over the next 30 years means that a major water supply augmentation in the short-to-medium term is unlikely to be feasible, particularly one with the significant up-front and ongoing costs as the development of a pipeline from the Burnett River to the Burrum Weir Pump Station.

6 Preliminary risk identification

Following the investigations completed as part of the Preliminary Evaluation process, the following key risks have been identified for the Burnett River (Paradise Dam) to Howard Water Supply Pipeline Project:

- Paradise Dam High Priority (HP) water not being available when required
- compliance works on Paradise Dam (lowering spillway) reducing available HP water location
- uncertainty over HP water costs from the Burnett River
- population growth figures in Hervey Bay and Maryborough surpassing current projections
- agricultural demands identified no longer required or not willing to pay for the water
- complications with servicing existing SunWater agricultural customers
- suitability of the extraction point for the proposed option
- issues with land access for the proposed pipeline alignments, including potential environmental constraints that may impact route selection
- issues with the pipeline tie-in (capacity of the existing Burgowan raw water main).

7 Conclusions and recommendations

7.1 CONCLUSIONS

Investigations have been undertaken as part of this Preliminary Evaluation, to reaffirm the project needs and drivers, and to assess the viability of the preferred option of the Burnett River to Burrum pipeline.

These investigations included:

- assessment of the existing source capacity in relation to the projected urban demands for the Hervey Bay region
- reviewing water demands against the frequency of water restrictions, and adopting a LOS Objectives approach for identifying extraction limits for the Burrum River system
- reviewing the existing infrastructure and treated water network for the Hervey Bay region
- undertaking a Stakeholder engagement process of identifying alternative demands in the Burnett to Burrum region, that could be serviced by the proposed project
- development of potential routes for the Burnett River to Burrum pipeline, and the identification of extraction and discharge points
- preliminary infrastructure sizing for the potential pipeline alignments, including pump stations, pipelines, reservoirs, and power
- development of cost estimates for the potential pipeline alignments, including capital and ongoing operating and maintenance costs
- economic analysis, including a cost benefit analysis of the proposed project to determine its economic viability
- preliminary identification of risks associated with the proposed project.

As a result of these investigations, the following conclusions have been reached:

1. Urban water demand in the Hervey Bay region is not expected to exceed the Burrum River extraction licence limit over the 30 year economic study period. The frequency of Level 3 and 4 water restrictions over this period will, however become more prevalent than what is commonly accepted by communities adopting a Levels of Service Objectives approach.
2. There are inherent risks associated with the proposed project, including the risks associated with the potential benefit of supplying agricultural demands in the Burnett – Burrum region. In particular, there is an uncertainty on both the availability and pricing of Medium and High Priority water in the region, and the willingness of the agricultural community to pay for it.
3. There is relatively low economic benefit of supplying agricultural water in the Burnett – Burrum region. Due to the preliminary level of investigations carried out on this PE assessment (and lack of available information), alternative demands such as potential pumped hydro schemes in the region have been discounted.
4. The urban water supply-demand balance in the Hervey Bay region over the next 30 years means that a major water supply augmentation in the short-to-medium term is unlikely to be feasible,

particularly one with the significant up-front and ongoing costs as the development of a pipeline from the Burnett River to the Burrum Weir Pump Station.

7.2 RECOMMENDATIONS

The following recommendations are presented as a consequence of the conclusions from these investigations:

1. Urban water demand in the Hervey Bay region is not expected to exceed the Burrum River extraction licence limit over the 30 year economic study period. As such, it is recommended that FCRC hold off on implementing an additional water source for the region, until such a time that it becomes economically viable to do so. In particular, as a result of the lack of economic benefit associated with supplying agricultural demands, the Burnett River to Burrum Pipeline is considered to be a less viable solution compared to alternative source options identified. As such it is recommended that FCRC progress studies to identify and assess alternative source options.
2. FCRC adopt the findings of this Preliminary Evaluation in their water supply strategy.
3. FCRC adopt a Levels of Service Objectives approach for water restrictions in the region to identify shortfalls in the current raw water source capacity.
4. FCRC continue to investigate serviceable demands in the region that have the potential to increase the economic benefit of a future source augmentation project.

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Appendix A

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Strategic Assessment of Service Requirements

We Deliver

KBR

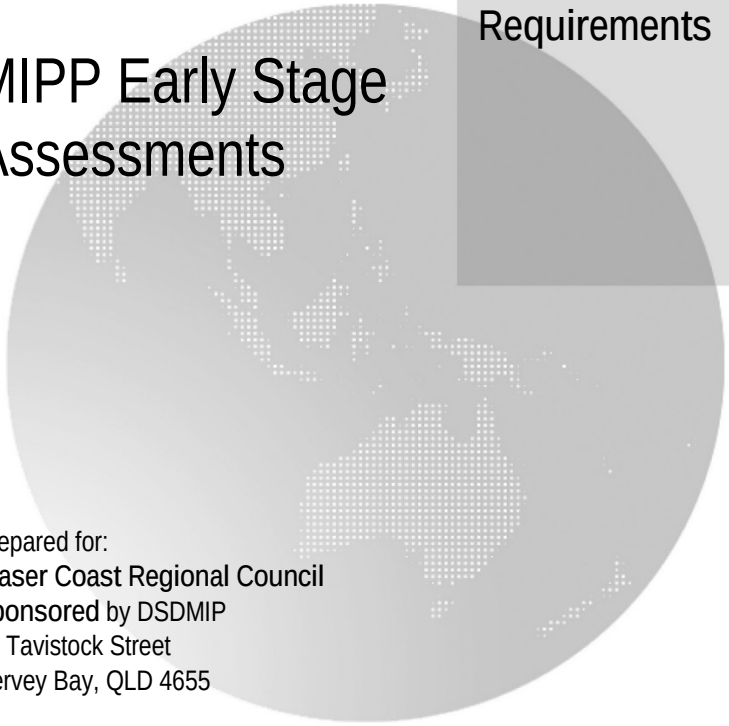
MIPP Early Stage Assessments

We Deliver

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Strategic Assessment of Service Requirements

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Strategic Assessment of Service Requirements

MIPP Early Stage Assessments



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Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to present future Hervey Bay water source options outlined in the 2015 Fraser Coast Water Supply Strategy, in the form of a Strategic Assessment of Service Requirements (SASR), in accordance with the scope of services set out in the contract between KBR and Fraser Coast Regional Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from the findings from the 2015 Fraser Coast Water Supply Strategy. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to existing infrastructure, existing water capacity, and future demands provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon Wide Bay Water Corporations 2015 Fraser Coast Water Supply Strategy in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	14/09/2018	Draft Issue	M. Herring	R. Populin	R. Populin	K. Fung
0	10/10/2018	Final	M. Herring	T. Belgrove	R. Populin	K. Fung

Contents

1 Introduction

1.1 PROJECT ASSURANCE FRAMEWORK (PAF) PROCESS

The Project Assurance Framework (PAF) provides tools and techniques to assess projects through the project lifecycle, ensuring a common approach to projects is undertaken, and that the project delivers value for money to the Queensland Government.

The PAF defines the lifecycle of a project, and includes:

- Strategic Assessment of Service Requirement (SASR). What is the need?
- Preliminary evaluation (development and assessment of options).
- Business case development (detailed assessment of options and option recommendation).
- Supply strategy development.
- Source supplier/s.
- Establish service capability.
- Deliver service.
- Benefits realisation.

1.1.1 Strategic Assessment of Service Requirement (SASR)

This report presents the investigations completed to date in the form of the first stage of the PAF process, the Strategic Assessment of Service Requirement (SASR). The SASR facilitates a strategic business decision of whether a project response is required to address an identified service need.

The key activities undertaken as part of the SASR are to:

- define the need to be addressed and outcome sought
- scope the outcome sought
- identify potential solutions to achieve the outcome
- develop a detailed plan and budget for conducting a Preliminary Evaluation (PE) of the potential solutions
- seek approval to proceed.

The document is an abbreviated SASR to support the intended development of the project Preliminary Evaluation for a new supply from the Burnett River. It presents works completed in the 2015 Fraser Coast Water Supply Strategy (August 2015) for the augmentation of the Fraser Coast Water Supply in the SASR format.

1.2 HERVEY BAY WATER SUPPLY

The Hervey Bay reticulation network is supplied by the Wide Bay Water Supply Scheme (Wide Bay WSS), which sources water from the Burrum River.

The Wide Bay WSS consists of the primary Lenthalls Dam storage on the Burrum River, and the downstream Burrum weirs No.1 and No.2. Water is extracted at Burrum Weir No.1 for treatment and delivery to the reticulation network, refer Figure 1.1.

- Lenthalls Dam Capacity: 28,400 ML
- Burrum Weir No.1 Capacity: 1,715 ML
- Burrum Weir No.2 Capacity: 2,242 ML.

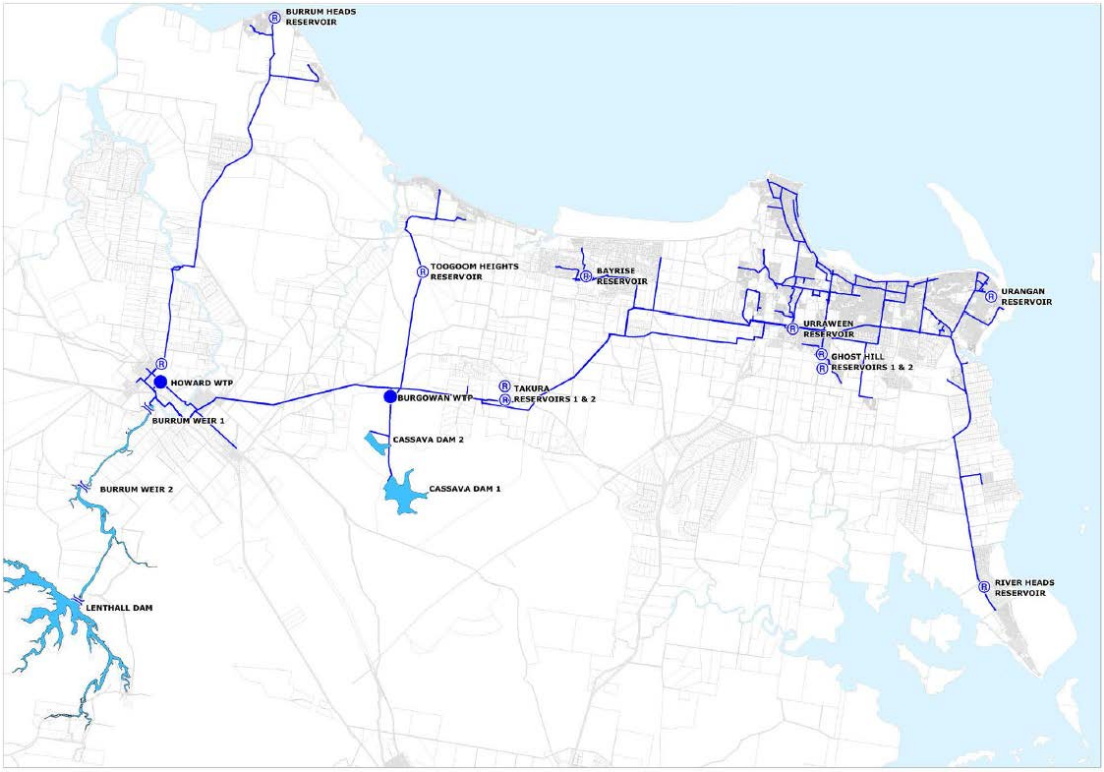

Figure 1.1 Hervey Bay Water Supply Infrastructure

2 Identified needs and opportunities

2.1 HERVEY BAY RAW WATER SOURCE

The Hervey Bay area water supply is sourced from a raw water source on the Burrum River. The 2015 Fraser Coast Water Supply Strategy identified that augmentation of its water resources would be required in 2046 when the existing source capacity is exceeded. At that time Hervey Bay's water demand is projected the Burrum River extraction licence limit of 14,020 ML/annum.

FCRC has subsequently updated demand projections to account for the Queensland Government Statistician's Office (QGSO) revised population projections based on the 2016 census. Based on these latest projections, Hervey Bay's projected demand is expected to exceed the Burrum River extraction limit by 2066, refer Figure 2.1.

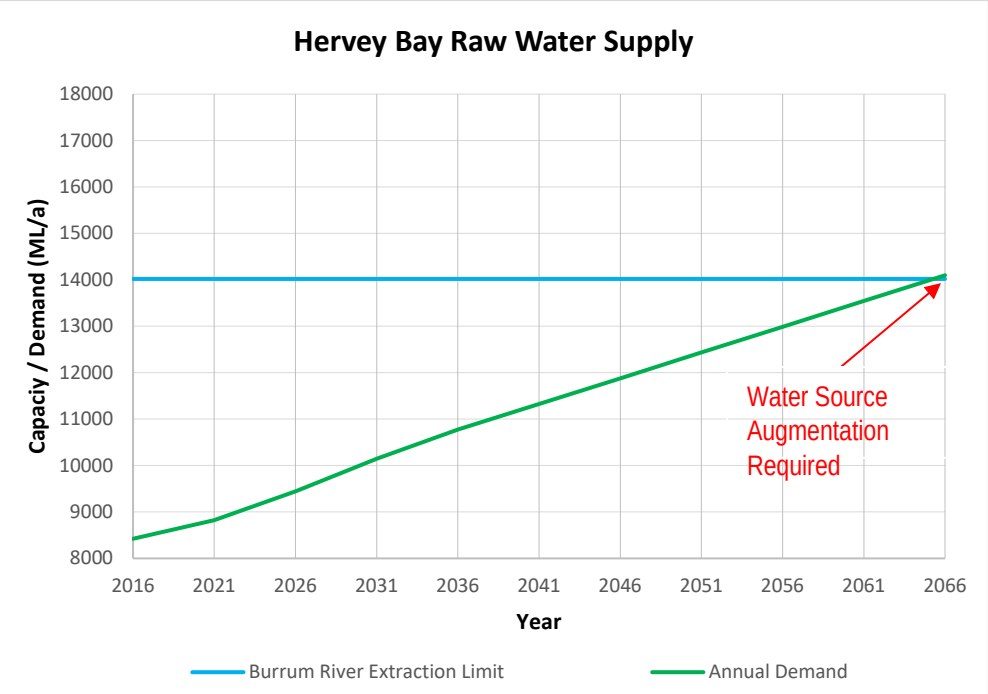

Figure 2.1 Hervey Bay Water Supply – Current Capacity and Projected Demand

Current water sources appear to be sufficient to meet the water supply needs for the Hervey Bay region over the next 45 years based on the Burrum River extraction licence limit of 14,020 ML/a. Beyond this timeframe, increasing demand will place further pressure on water supplies leading to increased water shortages and frequency of water restrictions.

2.2 OUTCOMES SOUGHT

Based on the above, the project need is defined as follows:

- the provision of sufficient water supplies to provide long-term water security for urban water supply in the region.

Council has also identified an opportunity associated with the development of additional water supply infrastructure in the region, with the potential for additional water to be used to facilitate the growth of agricultural production (e.g. sugar cane) in the region.

3 Scope development and assessment

In order to effectively identify potential solutions to achieve the project outcomes, it is first necessary to develop a set of success criteria that can be applied to the preliminary options identified. Two sets of criteria are proposed.

Primary criteria

- ability to meet the identified project needs, being the provision of long-term water security to the region
- technical feasibility.

Secondary criteria:

- cost, including both capital cost and ongoing operating costs per ML
- ability to realise the potential benefit, being the supply of water for agricultural production in the region
- environmental and social impacts, being the extent to which the options may have adverse impacts that could impact on the option's economic feasibility
- community acceptance, being the extent to which the options are impacted by community attitudes and perceptions relating to water supply and the impact of water supply infrastructure
- complexity, including complexities associated with water supply infrastructure, technology or equipment, and potential issues obtaining the necessary regulatory approvals.

To be considered for inclusion in the shortlist of options, options must satisfy both primary criteria. Those options that meet the two primary criteria are then assessed against the secondary criteria to determine which options are to be progressed to a Preliminary Evaluation.

4 Options analysis

4.1 OUTLINE OPTIONS

The 2015 Fraser Coast Water Supply Strategy identified a number of future water source options that have the potential to satisfy the project need, being the augmentation of Hervey Bay's water resources by the year 2066.

The following options are assessed:

- Option 1 – Base Case (maintain the Status Quo)
- Option 2 – Interconnection between Hervey Bay and Maryborough
- Option 3 – Indirect potable reuse
- Option 4 – Mary River
- Option 5 – Fraser Island
- Option 6 – Desalination
- Option 7 – Burnett River (Paradise Dam).

4.1.1 Option 1 – Base Case (maintain the Status Quo)

This option involves maintaining a 'Do Nothing' approach. This option does not meet the project need of providing sufficient urban water supplies for long-term water security in the region.

4.1.2 Option 2 – Interconnection between Hervey Bay and Maryborough

This option involves a proposed connection between Hervey Bay (Boys Avenue Reservoirs) and Maryborough (Burgowan WTP). Although it does not provide any additional capacity to the system, it allows for more effective management of the available water capacity across the region.

4.1.3 Option 3 – Indirect potable reuse

This option involves performing additional treatment processes (reverse osmosis and advanced oxidation) at Nikenbah WWTP. Water would then be transferred to Cassava Dam and, subsequently, used as a raw water source for the Burgowan WTP.

4.1.4 Option 4 – Mary River

This option involves the installation of a pipeline from the Mary River Barrage to the Burgowan WTP site. A pump station, main and 8,000ML/annum allocation would be required to realise this option.

4.1.5 Option 5 – Fraser Island

This option involves sourcing water from the Bogimbah Creek area either via a borefield or directly from the creek flow itself. The water would be transferred to the mainland through a submarine pipeline. The JWP (2001) report dismisses Fraser Island as a viable option due to environmental constraints and potential community resistance.

4.1.6 Option 6 – Desalination

Several suitable sites have been identified for the possible construction of two small desalination plants, e.g. River Heads, Booral, Dundowran and Burrum Heads. For Maryborough to have access to desalinated water, a pipeline (interconnection) from Hervey Bay to Maryborough would need to be constructed.

4.1.7 Option 7 – Burnett River (Paradise Dam)

This option involves the construction of a new pipeline and associated pump station to transport raw water from the Burnett River (Paradise Dam) to the Burrum Weir Pump Station in a two-staged process:

Stage 1: connection to the Isis system near Childers and the extension of a DN600 main to Burrum Weir Pump Station (approximately 27.5 km).

Stage 2: extension of the DN600 main to the Burnett River, which would require an additional 35km to a source extraction point at the Causeway Road west-south-west of Booyal and two pump stations owing to elevation differences.

4.2 OPTIONS ASSESSMENT

In order to identify a shortlist of options to be progressed to the next stage (Preliminary Evaluation), the options identified above are assessed against the criteria identified in Section 3.

To be considered for inclusion in the shortlist of options, options must satisfy both primary criteria. Those options that meet the two primary criteria are then assessed against the secondary criteria to determine which options are to be assessed in the PE.

Table 4.1 below presents a summary of the assessment of the long list of options against the identified criteria. Cells have been highlighted in either green or red, to indicate whether the option meets or does not meet the corresponding success criteria. Cells highlighted in orange indicate that the option has the potential to address the success criteria. A shortlist of options to be considered in the PE is to be identified based on the outcomes of this assessment.

Table 4.1 Options Assessment

Option	Primary Assessment Criteria		Secondary Assessment Criteria					
	Ability to meet project needs	Technical feasibility	Cost ($m)	$/ML	Ability to realise potential benefit	Environmental and social impacts	Community acceptance	Complexity
Option 1: Base Case (maintain the Status Quo)	Does not meet the project needs	N/A	Does not meet primary assessment criteria, not considered further					
Option 2: Interconnection between Hervey Bay and Maryborough	Does not meet the project needs, as it does not provide additional capacity to the network	Technically feasible	Does not meet primary assessment criteria, not considered further					
Option 3: Indirect Potable Reuse	Cannot supply the total volume required	Requires additional treatment at WWTP's	Does not meet primary assessment criteria, not considered further					
Option 4: Mary River	Concerns over availability of high priority water and ongoing reliability of the source	Technically feasible	Does not meet primary assessment criteria, not considered further					
Option 5: Fraser Island	Meets project needs	Technically feasible	56.0	1.5	N/A	Environmentally sensitive and heritage listed area	Potential community resistance to the project. Submarine pipeline crossing through Sandy Straits	Potential to require additional treatment to stabilise the water

Option	Primary Assessment Criteria		Secondary Assessment Criteria					
	Ability to meet project needs	Technical feasibility	Cost ($m)	$/ML	Ability to realise potential benefit	Environmental and social impacts	Community acceptance	Complexity
Option 6: Desalination	Meets project needs	Reverse Osmosis is a proven method of desalination. Requires specialist training for operators. Requires relatively clean input water	81.2	4.1	N/A	Process requires high energy consumption. Potential to produce high amounts of greenhouse gas emissions. Disposal of waste brine can be difficult to manage, resulting in potential contamination of the environment	High plant operating costs attribute to increased household water costs. Negative publicity surrounding the installation of desalination plants	Some components may require a minimum base load, and temporary decommissioning if not required
Option 7: Burnett River (Paradise Dam)	Meets project needs	Due to significant elevation difference, two pumping stations in series are required	91.0	4.1	Potential to make additional water available for agricultural production in the region	No expected issues with environmental/social impact	No expected issues with community impact. Has the potential to benefit agricultural production in the region	Low complexity project

Following the above assessment, a summary of the advantages and disadvantages for each option has been developed in Table 4.2 below.

Table 4.2 Summary of Options Advantages and Disadvantages

Option	Advantages	Disadvantages
Option 1: Base Case (maintain the Status Quo)	N/A	• Does not meet the project objectives of ensuring long term water security to the region.
Option 2: Interconnection between Hervey Bay and Maryborough	• Allows better distribution of capacity • Allows redirection of flow for drought or if specific treatment plant is out of service • Provides a link between the two systems for any new source augmentation.	• Does not offer any additional capacity (only ability to distribute existing capacity) • Expensive OPEX pumping costs
Option 3: Indirect Potable Reuse	• Does not rely on surface water storage which is susceptible to droughts • Higher class of use of resource to current irrigation • Can be used all year round as opposed to irrigation, therefore less storage required.	• Public resistance to the scheme. • A pipeline is required from Nikenbah WWTP to Cassava Dam • Cannot supply total volume required. Supplementary source only • Potentially expensive OPEX • Some components may require a minimum base load and if not required for use may need to be temporarily decommissioned.
Option 4: Mary River	• Relatively cheap water compared to other options.	• Long term security may be an issue if there is competition for water source in the upstream catchment. • Low diversity of water supply.
Option 5: Fraser Island	• Abundant water supply • Relatively close to mainland Hervey Bay • Low Total Dissolved Solids (TDS) and protected catchment.	• Environmentally sensitive and heritage listed area • Submarine water pipeline crossing through Sandy Straits • Potentially high in colour and potentially requiring additional treatment to stabilise the water.
Option 6: Desalination	• Does not rely on favourable rainfall for supply • Unlimited supply with production only limited by the size or number of plant and energy availability.	• Expensive CAPEX and OPEX • Disposal of waste brine may be difficult or problematic. • Requires specialist training in operation. • Requires relatively clean input water • Desalination plants require a minimum base load and if not required for use may need to be temporarily decommissioned.
Option 7: Burnett River (Paradise Dam)	• Full benefit of high priority water • Potential to supply additional water for agricultural production	• Expensive initial CAPEX outlay

4.3 OPTIONS SUMMARY

As summarised in Table 4.1, Options 1 to 4 do not provide sufficient capacity to meet the project need of providing long-term water security for urban water supply in the region, and as such are not considered for further evaluation.

Although Option 5 (Fraser Island) has low capital and operational costs, it has high risks associated with construction near environmentally sensitive and heritage listed areas, as well as community and stakeholder acceptance. This option does not realise one of the secondary criteria benefits of supplying water for agricultural production in the region.

Option 6 (Desalination) requires high operational costs, and may face potential environmental issues associated with disposal of waste brine. This option does not realise the potential benefit of supplying water for agricultural production in the region.

Although Options 1 to 6 have the potential to augment water supply and usage for the area, extending the use of Paradise Dam as a source of supply, there are significant obstacles (environmental approvals, community consultation), that must first be addressed.

Option 7 (Burnett River – Paradise Dam) has been identified as providing a suitable water source to address future demands in the Hervey Bay region. It is the only option identified that has the potential to offset operational costs by making additional water available for agricultural production in the region.

Based on the outcomes of the assessment of the above options, Option 7 (Burnett River – Paradise Dam) will be subject to the next stage of the PAF process, Preliminary Evaluation.

5 References

- JWP, 2001, *Hervey Bay Future Water Source Options Study*, John Wilson and Partners, Brisbane, QLD
- WBWC, 2015, *2015 Fraser Coast Water Supply Strategy*, Wide Bay Water Corporation, Urangan, QLD

Appendix B

Stakeholder Engagement Report

We Deliver

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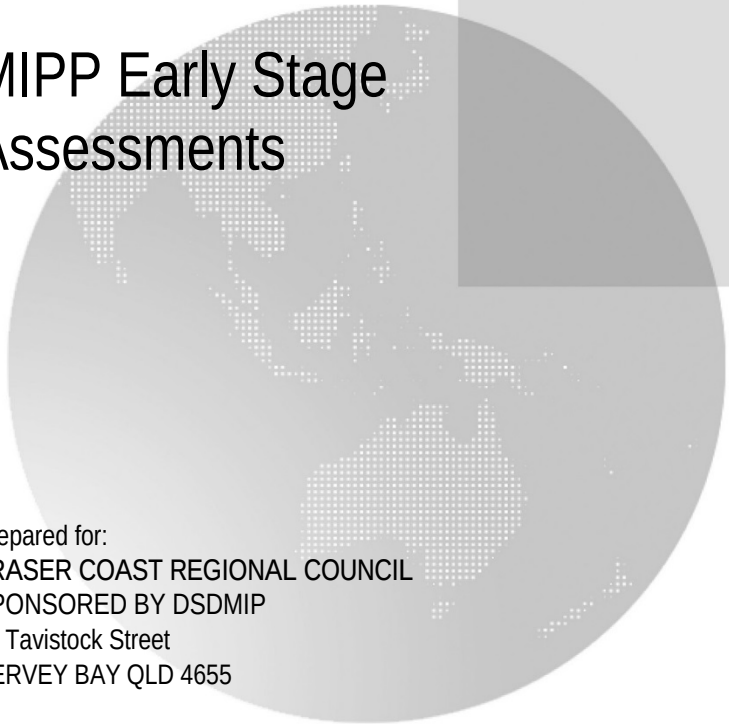
MIPP Early Stage Assessments

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Stakeholder Engagement Report

We Deliver

Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Stakeholder Engagement Report

MIPP Early Stage Assessments



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09 October 2018

BEG851-TD-OT-REP-0001. Rev. 0

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	06/09/2018	Draft Issue	P. Lopez	J. Lamb	K. Fung	K. Fung
0	09/10/2018	Issued for use	P.Lopez 	P. King 	K. Fung 	K. Fung 

Contents

1 Introduction

KBR has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) on behalf of Fraser Coast Regional Council (FCRC), to undertake an early stage assessment process for the following two projects:

- Project A: Preliminary Evaluation (PE) - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach.
- Project B: Strategic Assessment of Service Requirements (SASR) – Interconnection of Hervey Bay and Maryborough's water supply schemes.

This assessment falls under the Queensland Government's Maturing the Infrastructure Pipeline Program (MIPP) that supports the development of a robust project pipeline and enables projects to be matured from conceptually good ideas into solid proposals.

The early stage assessment activity component of the MIPP is delivering a pre-business case assessment for 39 local government proposals. Each proposal will take the form of one of the following assessments:

- analysis of the need for the proposal, referred to as a Strategic Assessment of Service Requirement (SASR)
- identification of a preferred option to progress the proposal, referred to as a Preliminary Evaluation (PE).

Both Project A and Project B were delivered concurrently.

This report details the feedback received on Project A.

2 Project background

KBR has been engaged by DSDMIP to undertake an early stage assessment process for the Burnett River (Paradise Dam) to Howard water supply pipeline staged approach. This project requires undertaking a Preliminary Evaluation to investigate water supply between Paradise Dam and Maryborough, thereby addressing the long-term water security for the Fraser Coast region. Fraser Coast Regional Council has indicated they do not anticipate requiring this pipeline before 2046.

2.1 COMMUNICATION GOALS AND OBJECTIVES

Given the project is in the early stages of assessment, the main focus of the engagement was to identify and engage key stakeholders, to provide technical input on options to be carried into the next phase of assessment – Business Case.

The aims of the engagement carried out were as follows:

- build awareness and understanding of the project with key stakeholders
- build understanding of the assessment process
- to obtain technical input to inform the options development
- identify any risks that would impact on the project
- identify any opportunities for the project to provide greater regional benefits
- ensure the engagement and communication activities are aligned and consistent with requirements outlined in the Queensland Government's Project Assessment Framework (PAF).

A Stakeholder Engagement Plan was drafted in collaboration with Fraser Coast Regional Council. A copy is included in Appendix 1

3 Methodology

Stakeholders were identified via desktop research and upon advice from FCRC and included the following groups:

- Local Government
- Local industry
- Water authorities
- Government agencies
- Elected representatives.

It was determined that the engagement would be tailored to the following groups:

- Key stakeholders
  Engagement with the Key Stakeholder group was designed to build awareness of and the need for the project. This engagement was also tailored to gather relevant technical input to inform the options development process as well as to identify any risks or opportunities.
- Wider stakeholder group
  Engagement with the wider stakeholder group was designed to build awareness of and the need for the project.

4 Communication activities

The following table outlines the activities undertaken as part of this project.

Activity	Purpose	Stakeholders	Timing
Letter 1 – Key stakeholders *(Copies of Letter 1 to key stakeholders are located in Appendix 2.)*	To introduce the project and invite stakeholders to meet with the project team.	• Bundaberg Regional Council • Isis Central Sugar Mill Co Ltd • Wide Bay Burnett Region of Councils • SunWater	12 June 2018
Meetings	To provide an overview of the project and gather relevant information to inform options development To identify any possible issues or risks	• Bundaberg Regional Council • Isis Central Sugar Mill Co Ltd • Wide Bay Burnett Region of Councils • SunWater	22 June 2018
Letter 2 – General stakeholders *(Copies of Letter 2 to the wider stakeholder group are located in Appendix 3)*	To build awareness of and the need for the project. To gather any feedback and gauge the level of interest in the project.	• Senator the Hon. James McGrath (Assistant Minister to the Prime Minister) • Hon. Josh Frydenberg MP (Minister for the Environment and Energy) • Hon. Leeanne Enoch Minister for the Environment & the Great Barrier Reef • Mr Llew O'Brien (Member for Wide Bay) • Hon. Keith Pitt MP (Member for Hinkler) • Mr Edward (Ted) Sorensen - Member for Hervey Bay • Mr Stephen Bennett - Member for Burnett • Mr Bruce Saunders - Member for Maryborough • Mr David Batt - Member for Bundaberg • Dan Galligan - CEO, QLD Cane Growers Organisation Ltd • Mr Stewart Norton - General Manager (Maryborough Region) MSF Sugar Pty Ltd • Trevor Harvey - General Manager Strategy, Innovation & Assets (North Burnett Regional Council)	22 June 2018

Letter 3 and Summary Report *This was originally planned to be follow up meetings however, following further discussions with FCRC, it was determined that a letter seeking feedback would be suitable.* *(A copy of the Summary Report and letters to Key Stakeholders is located at Appendix 4)*	To provide an update on the options development and seek further comment or feedback prior to finalisation To advise on the next steps and timeframes	• Bundaberg Regional Council • Isis Central Sugar Mill Co Ltd • Wide Bay Burnett Region of Councils • SunWater	September 2018
Letter 4 – All stakeholders *(to be drafted following finalisation of report)*	To provide an update on the options development To advise on the next steps and timeframes	• Bundaberg Regional Council • Isis Central Sugar Mill Co Ltd • Wide Bay Burnett Region of Councils • SunWater • Senator the Hon. James McGrath (Assistant Minister to the Prime Minister) • Hon. Josh Frydenberg MP (Minister for the Environment and Energy) • Hon. Leeanne Enoch Minister for the Environment & the Great Barrier Reef • Mr Llew O'Brien (Member for Wide Bay) • Hon. Keith Pitt MP (Member for Hinkler) • Mr Edward (Ted) Sorensen - Member for Hervey Bay • Mr Stephen Bennett - Member for Burnett • Mr Bruce Saunders - Member for Maryborough • Mr David Batt - Member for Bundaberg • Dan Galligan - CEO, QLD Cane Growers Organisation Ltd • Mr Stewart Norton - General Manager (Maryborough Region) MSF Sugar Pty Ltd • Trevor Harvey - General Manager Strategy, Innovation & Assets (North Burnett Regional Council)	October 2018 – Following finalisation of report

4.1 KEY STAKEHOLDER MEETINGS

Following discussions with Fraser Coast Regional Council, it was determined that the project team would conduct in person meetings with key stakeholders. These meeting were designed to provide an update to the stakeholders on the proposed project and understand any concerns they may have as well as to gather further information to inform the technical analysis of the options submitted.

The project team prepared a map with the proposed route options. A copy of the map is included in Appendix 5.

Bundaberg Regional Council

- Councillor Jason Bartels - Water & Wastewater Portfolio Councillor
- Narelle D'Amico - Water Services Branch Manager
- Tom McLaughlin - Water Services Planning and Delivery Manager
- Jeff Rohdmann - Water Services Manager Operations.

Isis Central Sugar Mill

- John Gorringe – Chief Executive Officer
- Peter Hawe - Company Secretary, Business Development Manager
- Paul Nicol – Chief Field Officer.

Wide Bay Burnett Regional Organisation of Councils Inc.

- Steve Brown - Regional Water Coordinator.

SunWater

- Peter MacTaggert - General Manager, Corporate Development.

Mr MacTaggert manages asset growth and water sales for SunWater and was on the steering committee for DSDMIP's Water for Economic Growth Study.

4.2 FEEDBACK FROM REPORT TO KEY STAKEHOLDER GROUP

Of the 12 letters sent to the general stakeholder group, the following responses were received with nil comment from SunWater:

Date	Stakeholder	Content
11 September 2018	Steve Brown Regional Water Coordinator Wide Bay Burnett Regional Organisation of Councils Inc	• Noted that SunWater's current interest surrounding Paradise Dam, including the potential reduction in wall height, might impact the viability of any supply offtake to other areas. This might pose significant uncertainty around the assessment's scope and circumvent any recommendations.
20 September 2018	Peter Hawes, Company Secretary, Business Development Manager Isis Central Sugar Mill	• Noted that there are other land areas that have a need for additional water of the SunWater systems were extended. • Provided further clarification about their proposed option. • Noted on Table 1 that sugarcane could have future demand requirements greater than 5000ML/a if the current SunWater systems were extended. • Noted that the Figure 2 mentioned in the report was not attached. KBR then sent them the figure and invited additional comments – none received.
24 September 2018	Tom McLaughlin Planning and Delivery Manager – Water Services (Bundaberg Regional Council)	Bundaberg Regional Council advised that they had no further comments to makes at the present stage.

A copy of the feedback received is located in Appendix 6.

4.3 FEEDBACK FROM LETTER TO GENERAL STAKEHOLDER GROUP

Of the 12 letters sent to the general stakeholder group, the following responses were received:

Date	Stakeholder	Content
3 July 2018	Member for Bundaberg – David Batt	Mr Batt advised that he was particularly interested in update don the Burnett River to Howard pipeline project and would appreciate further information once this phase of the assessment process has been completed.
2 July 2018	North Burnett Regional Council	Acknowledgement of receipt of letter
10 July 2018		Trevor Harvey (GM Strategy, Innovation and Assets) advised that North Burnett Council is interested in the progress of the pipeline project and requested to be included in notifications and project updates.

A copy of the feedback received is located in Appendix 7.

4.4 KEY ISSUES ANALYSIS

Stakeholders have generally been supportive of the project and have expressed interest in being kept updated as the project develops. Water security is a key issue in the area and there are several studies being run by various organisations to investigate different water sources for irrigation and urban water supply.

Below is a summary of the issues identified during the engagement process and through media/ literature scanning.

Issue/ feedback	Detail
Community service level expectations	The timing of the project does not take into account what service levels the community is willing to accept in the interim. FCRC has envisaged that during this time, the water supply and usage would be augmented in different ways including: • water restrictions • introduction of water efficient devices • reduction in leakage rates • treating reclaimed water to potable standards, • desalination technology It is likely that some of these options, such as reclaimed water, will not be palatable to the community and will result in a heightened level of concern.
Availability of water in Paradise Dam impacting on economic growth	SunWater advised that their dam remediation works may include lowering the level of the dam which will reduce storage capacity. If long term water supply is not addressed then the Fraser Coast Water Supply System may be at risk of preventing future economic developments within the area due to the fact that there would be insufficient secure water to support the accompanying population increase.
Possible negative feedback to perceived prioritisation of urban over agricultural water needs	Anecdotal feedback has been that constructing a pipeline from Paradise Dam to secure a potable water source for Fraser Coast may be seen as politically unpalatable when there are struggling agricultural communities who are suffering due to lack of available irrigation sources.

Perceived impacts on Bundaberg Water Supply Scheme	Former Member for Bundaberg, Ms Leanne Donaldson raised concerns that the pipeline could jeopardise the Bundaberg Water Supply Scheme. (Media Jan/ Feb 2017). The Bundaberg Water Supply Scheme supplies water to farmlands located in the Burnett, Kolan and Isis shires and for the city of Bundaberg and communities in the Burnett, Kolan and Isis. Paradise Dam is one of the major storages.
Perceived impacts to Bundaberg's growth	Bundaberg Regional Council advised that while it does not currently require additional water sources, their future planning is based around 1-1.5% yearly population growth. If growth increases beyond the predicted levels, Bundaberg Council will need to bring forward negotiations around water sources and security. Additional water allocation would need to come from Paradise Dam or the Burnett system as there are no ground water allocations remaining.
Environmental benefits	During the 2017 elections, Roger Currie from the Wide Bay Burnett Environment Council said that the pipeline would allow for spilling events to be reduced, taking the pressure off vulnerable aquatic species. The group also felt that the pipeline would take pressure off the dam structure which was impacted by the 2011-2013 floods.

4.5 OTHER STUDIES BEING CONDUCTED IN THE REGION

The following studies were discussed during engagement but do not currently impact on the assessment process of this project.

Gayndah Regional Irrigation Development (GRID)

The $1.2 million GRID feasibility study is part of a $150 million funding commitment to fast-track water infrastructure projects across Queensland as part of the National Water Infrastructure Development Fund. Funding was announced on 27 May 2016 by then Deputy PM and Minister for Agriculture and Water Resources, Barnaby Joyce.

The study by Isis Central Sugar Mill will investigate the feasibility of developing water resources through reinstating the crest level of Claude Wharton Weir, utilising existing water reserves and the transfer of un-utilised water allocations to service priority irrigation areas in the Reids Creek and Byrnestown/ Wetherton areas.

The study will also look at the feasibility of new water storage and irrigation infrastructure options that could provide up to an additional 28,000 million litres to develop 6,800 hectares of land for sugarcane in the Gayndah region, of the Burnett River catchment, which will boost production by almost 500,000 tonnes.

The final report is expected to be provided to the Department of Natural Resources, Mines and Energy by late-2018.

Hydro station

Australia National University - Researchers at ANU have identified about 5,000 sites in Queensland, Tasmania, and the Canberra district and in and around Alice Springs as potentially suitable for pumped hydro storage. The area relevant to this project has potential for a pumped hydro site along the alignment from Paradise Dam to Burrum (around the Dallarnil / Golden Fleece range Mt Woowoonga). Structuring the project this way would ensure water infrastructure serviced both urban and industrial use and makes it viable from a CAPEX perspective.

5 Conclusion

Priority engagement in the Preliminary Evaluation phase was aimed at current and future potential water users to obtain technical information to inform the options developed. More general information was also provided to a wider stakeholder group to ensure they were kept informed of the progress. Overall the stakeholders were generally supportive of both projects and expressed an interest in being kept updated on developments to Burnett River (Paradise Dam) to Howard water supply pipeline project.

5.1 RECOMMENDATIONS

Should this project be deemed a priority and potentially affordable, it will progress to the next phase in the assessment process, which is development of the Business Case. The purpose of the Business Case development stage is to undertake a more detailed comparative analysis of the shortlisted project options and delivery models identified during the PE stage, to identify the most likely option to achieve the required level of service and best value for money.

The work completed during the PE phase identified the majority of key stakeholders, however this will need to be re-evaluated and expanded to reflect the specific requirements of each option being evaluated.

Future stakeholder communication and consultation activities should be highly detailed, taking into account:

- how it will be conducted, by whom, and when
- the purpose of the communication / consultation and what is hoped to be achieved
- how any disagreement between stakeholders will be managed.

The following aspects should be considered when planning engagement in the Business Case development phase.

Directly impacted stakeholders

Engagement in the Business Case development phase will need to identify and engage with the stakeholders impacted by the shortlisted options. This includes, but is not limited to, private landowners, community groups, indigenous groups, environmental groups and commercial agricultural properties. A comprehensive engagement plan will also be required to ensure that these key stakeholders are fully informed of the project, any potential impacts and how they can provide input to the process. This minimises the risk of conflict between the proponent and impacted stakeholders and ensures the evaluation process runs smoothly.

The Business Case development requires a detailed environment, planning cultural heritage and native title analysis. This is likely to involve both desktop and field investigations of each option. Where field investigations on private properties are required, access will need to be organised in negotiation with the individual landowners. Ensuring these stakeholders are suitably engaged increases the likelihood that the project team will be allowed access to complete the required field investigations.

Community impacts

As mentioned previously, timing of the project does not factor in the levels of service the community will accept in the interim. It is possible to alleviate these concerns by running public education campaigns to raise community awareness of the need for interim solutions and the efficiency of these methods to provide a safe potable water supply.

Suggested engagement methods

Effective engagement can be conducted through several methods including:

- Printed collateral (letter, newsletter etc.)
  Distributed to the wider stakeholder group at key points to provide information on the project, the assessment process being undertaken, key findings and timelines.
- One-on-one meetings
  Generally held with highly impacted stakeholders early in the engagement process.
- Land Access meetings
  To organise access for field investigations.
- Community Information Sessions
  To provide the community with information on the project and provide an opportunity for them to raise any questions and concerns they may have and minimise the risk of misinformation in the community.
- Community 'Pop-Ups'
  Project team members roving in high-traffic areas, asking community to complete a short, snappy survey to help surface issues and concerns, and to determine a level of sentiment for the identified water security options.
- Community Consultative Committees (CCC)
  CCC memberships are designed to facilitate broader community involvement in the project and to seek community feedback and input to project outcomes. CCC members are nominated and evaluated carefully as they are meant to act as a conduit between the project team and the community.
- Community 'De-Briefs'
  Small group meetings to discuss the project, feedback received and how decisions were made. These meetings involve technical members of the project team, and have the purpose of ensuring key impacts or perceptions are addressed in a smaller forum, where differing opinions may be present.
- Online Surveys
  Could be used to test community sentiment for some of the interim water options being considered by FCRC.
- Website
  Provides general information on the project and process. It should be updated at key milestones Wide Bay Water has a comprehensive Community Education page that can be utilised to disseminate

Social Impact

Stakeholder Engagement is a key component in developing a robust Business Case as it is critical for a social impact evaluation and is a key principle of the Social Return on Investment Analysis approach.

Appendix 1

Stakeholder Engagement Plan

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DSDMIP Maturing the Infrastructure Pipeline Program – Early Stage Assessment Project

We Deliver

Stakeholder Engagement Plan

Stakeholder Engagement Plan

DSDMIP Maturing the Infrastructure Pipeline Program – Early Stage Assessment Project

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20 April 2018

BEG851-TD-OT-PLN-0001 Rev. 0

Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to detail the Stakeholder Engagement Strategy in accordance with the scope of services set out in the contract between KBR and DSDMIP and FCRC ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from meetings with the Client and desktop research. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to nominate: e.g. provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	20/4/2018	Draft Issue for client review	P Lopez	J Lamb	K Fung	K Fung
0	10/05/2018	Issued for use	P Lopez	J Lamb	K Fung	K Fung

Contents

1 Purpose

This Stakeholder Engagement Plan has been developed to guide the stakeholder engagement and communication activities undertaken as part of the Maturing the Infrastructure Pipeline Program – Early Stage Assessment for the following two projects.

- Project A: Preliminary Evaluation (PE) - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach
- Project B: Strategic Assessment of Service Requirements (SASR) – Interconnection of Hervey Bay and Maryborough's water supply schemes.

The project is for the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) in conjunction with Fraser Coast Regional Council (FCRC).

This plan will:

- ensure the engagement and communication activities are aligned and consistent with requirements outlined in the Queensland Government's Project Assessment Framework (PAF)
- outline tools and methods to build awareness and understanding of the project with key stakeholders
- identify key stakeholders, issues and risks, and appropriate mitigation strategies to ensure the project is successful through the assessment process
- outline a variety of ways to engage with key stakeholders.

1.1 DEFINITIONS

Engagement refers to the **process** by which an organisation involves those who may be impacted by operational decisions or projects, whereby they can influence, understand or become aware of such decisions and projects.

Communication is a **tool** that enables engagement with interested stakeholders to take place, and can take on many varying forms (i.e. verbal, written, visual).

Consultation is another **tool** within the engagement process that enables interested stakeholders to contribute to or provide input on decisions or projects. Feedback obtained from the consultation process helps the organisation refine its decisions or helps understand how stakeholders feel about decisions, a project or operations. Consultation is not suited to all projects and is best employed when there are negotiable elements of the project that stakeholders can influence.

2 Project context

2.1 PROJECT BACKGROUND

KBR has been engaged by DSDMIP to undertake an early stage assessment process for the following two projects:

- Project A: Preliminary Evaluation (PE) - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach:
  - This option involves undertaking a PE (and reviewing prior SASR) to investigate water supply between Paradise Dam and Maryborough, thereby addressing the long-term water security for the Fraser Coast region.
- Project B: Strategic Assessment of Service Requirements (SASR) – Interconnection of Hervey Bay and Maryborough's water supply schemes:
  - This interconnection between the townships of Maryborough and Hervey Bay does not provide any additional capacity to the system as such, it does however, allow the available water capacity to be managed across the region thereby improving security by ensuring more than one raw water source is available for the whole Fraser Coast water supply scheme.
  - Project B will enable the FCRC to move risk from individual water storage facilities to the regional level and to efficiently coordinate the utility of water sources.

The assessment process will be delivered in conjunction with FCRC.

2.2 PROJECT DELIVERY

The projects will be delivered concurrently, with Project A requiring a cross-check of previous assessment phases to ensure the information and outcomes are still relevant.

Key stakeholders will be engaged with on both projects simultaneously, with feedback being provided in one, all-encompassing stakeholder feedback report.

3 Stakeholder analysis

Stakeholders were identified and analysed via desktop research, and upon advice from FCRC.

Tables 3.1 and 3.2 outline the various internal and external stakeholders that should be engaged with as part of the project. The Government's Project Assessment Framework (PAF) outlines the level of engagement required as a Consult level.

3.1 INTERNAL STAKEHOLDERS

Table 3.1: Internal Stakeholders

Organisation	Name/ Role/ Department	Level of interest/ influence
Fraser Coast Regional Council	Councillor George Seymour	High
	Councillors, particularly Cr Denis Chapman (Planning and Infrastructure), Cr James Hansen (Division 1), Cr Anne Maddern (Division 2), Cr Daniel Sanderson (Division 4), Cr Stuart Taylor (Division 9)	High
	Ken Diehm Chief Executive Officer	High
	Executive Management Team	Medium
	Communications & Media Unit	High/ Low (Inform only)
Wide Bay Water	Water Advisory Committee	High
	Leadership Team, Management	High
	Peter Care Director - Wide Bay Water & Waste Services	High

3.2 EXTERNAL STAKEHOLDERS

Table 3.2: External Stakeholders

Stakeholder category	Name/ Role/ Department	Level of interest/ influence
North Burnett Regional Council	Councillor Rachel Chambers Mayor	High
	Mark Pitt Chief Executive Officer	High
	Councillors, particularly Cr Robbie Radel (Division 6)	High
	Trevor Harvey General Manager Strategy, Innovation & Assets	Medium/ Low
Bundaberg Regional Council	Cr Jack Dempsey Mayor	High/ Medium
	Steve Johnston Chief Executive Officer	High
	Councillors, particularly Cr Bill Trevor (Division 2)	High
	Stuart Randle General Manager Infrastructure	Medium/ Low
Water sector	Sunwater	High
Government agencies	Regional Organisation of Councils – Burnett Region	High
	Department of Environment and Science (DES)	High
	Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP)	High
	Department of Natural Resources, Mines and Energy (DNRME)	High
Local industry – high water users	Mr Stewart Norton General Manager (Maryborough Region) MSF Sugar Pty Ltd (Maryborough Sugar)	High/ Low
	Isis Central Sugar Mill Co Ltd	High/ Low
	Canegrowers	High/ Low
Elected representatives	Mr Bruce Saunders. Member for Maryborough	High
	Mr David Batt Member for Bundaberg	High

Stakeholder category	Name/ Role/ Department	Level of interest/ influence
	Mr Stephen Bennett Member for Burnett	High
	Mr Edward (Ted) Sorensen Member for Hervey Bay	High
	Hon. Leeanne Enoch Minister for the Environment & the Great Barrier Reef	High
	Hon. Keith Pitt MP (Member for Hinkler)	High/ Medium
	Mr Llew O'Brien (Member for Wide Bay)	High/ Medium
	Senator the Hon. James McGrath	High/ Medium
	Hon. Josh Frydenberg MP (Minister for the Environment and Energy)	High/ Medium
Other	Stakeholders consulted as past studies	Medium
Media	• Fraser Coast Chronicle • Hervey Bay Independent • Courier Mail • The Australian • The Financial Review • Channel 7, 9, 10 • ABC News Radio • Radio National • Fraser Coast Chronicle • ABC Local Radio • Local Independent Newspaper	High/ Low

4 Issues analysis

Stakeholder issues can be managed through effective engagement that enables opportunities for stakeholders to learn more, ask questions and then input to the project. Table 4.1 outlines some of the identified issues. Emerging issues will be included in future reviews of this plan.

Table 4.1: Issues and mitigations

Stakeholder group	Potential issues raised by Stakeholders	Possible mitigation
Elected representatives	• Concerns about impacts on individual electorates • Impacts to industry within the region	• Briefings to ensure representatives are kept informed about the process and to answer any questions/ address concerns • Regular briefing notes, updates, email alerts, meetings • Key messages
Local Councils	• Perception that projects may impact access to water • Potential for increased water access costs (i.e. Sunwater access charges) • Potential for flow-on of access costs for rate payers • Project uncertainty	• Early engagement • Regular briefings, updates, email alerts, meetings • Workshops • Key messages
Industry and water sector	• Concern that the projects will not guarantee water security in the long term • Perception that access to water will be impacted • Potential for increased water use costs • Project uncertainty	• Early engagement to determine concerns and obtain information on future plans that may impact on water requirements • Regular project information updates that are factual and timely • Key messages
Government agencies	• Engagement process is too 'light' and doesn't meet regulatory expectations • Project uncertainty	• Early engagement to ensure that government agencies are aware of the level of engagement to be carried out. Regular briefings, updates, email alerts, meetings • Workshops • Key messages
Media	• Engagement does not include broader community • Lack of project understanding	• Key messages • Website information • Media releases • Media Liaison support (to FCRC)

5 Key messages

Key messages will be used throughout communication and engagement tools to describe the project, providing a level of awareness and understanding about the project to all stakeholders.

5.1 OVERARCHING MESSAGING

- KBR has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to undertake an early stage assessment on two water security projects in conjunction with Fraser Coast Regional Council (FCRC).
- The early stage assessment is across two projects:
  - Project A: Preliminary Evaluation (PE) - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach
  - Project B: Strategic Assessment of Service Requirements (SASR) – Interconnection of Hervey Bay and Maryborough's water supply schemes.
- KBR will complete the assessment and provide a final report to FCRC for further consideration.

5.2 PROJECT SPECIFIC

5.2.1 Interconnection of Hervey Bay and Maryborough Water Supply Schemes

- The proposed pipeline connecting Hervey Bay and Maryborough water systems will provide improved water system resilience and reduce operational risks associated with the Fraser Coast Water Supply Network.
- The pipeline will deliver the following benefits:
  - Reduced risk of water shortages – The ability to be able to source water from two separate basins will reduce the operational risk that exists when a network is reliant on a sole source. This has been the primary driver by such projects as the SEQ Watergrid.
  - Multiple alternate sources of water in the event of unplanned outages– While key infrastructure has operational safeguards including duty standby arrangements, backup power supplies, there are obvious benefits in having alternate sources, raw water transfer, and treatment systems that can be utilised.
  - Overcoming localised water quality issues – Should adverse water quality issues arise in the Mary River, Tinana Creek, or Burrum River system/s there would be considerable benefit in being able to access an alternate source in the short to medium term until such time as water quality improves.
- The project aims to provide increased water security by providing all residents supplied from the FCWSN geographically separate water sources and three separate treatment facilities: (Tinana Creek, Mary River, Burrum River, and Cassava Dams / Teddington WTP, and Burgowan WTP).

- The project objective will be achieved by interconnecting the Hervey Bay and the Maryborough schemes through a new pipeline and two associated pumping stations, to achieve bi-directional transfer between the two water supply systems.
- The investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.
- This will allow a more thorough future planning report/ business case to underpin funding applications, route determination and land acquisition, detailed design, and delivery and operation of the interconnection.
- Further work will be required to prepare a concept design which will determine such aspects as:
  - pipeline sizing
  - route selection
  - pumping station configurations and sizing
  - rules of operation
  - modification required to existing assets (treatment plants, reservoirs, trunk networks).

5.2.2 Burnett River (Paradise Dam) to Howard Water Supply Pipeline - Staged Approach

- The project to link the Paradise Dam to the Howard raw water system (DN600/DN450) is an option to secure a suitable water supply solution into the future.
- While the additional water supply is not required until after 2046 securing this water source will ensure that water issues to do not impact on the economic development of the region.
- The proposal will primarily address long term water security for the Fraser Coast region.
- It may also be possible to configure the infrastructure to provide medium priority allocation from the Burnett River to a new irrigation area that could be developed south of Childers.
- Investigations works are required to thoroughly investigate the proposed future infrastructure works to:
  - ascertain the operating requirements of the system including determining required capacities
  - undertake a route assessment and determine the most suitable preliminary route
  - determine and document all constraints/issues and what actions should be taken to resolve/manage such constraints
  - investigate whether opportunity exists to deliver this infrastructure in partnership with the irrigation industry (Sunwater)
  - review the proposal against the objectives to make sure that the infrastructure will meet the communities needs in the short, medium, and long terms
  - detail the anticipated operational regime of the system
  - determine whether there are alternate solutions that will also meet the communities' needs
  - determine whether a valid case exists for the proposed infrastructure.

5.3 OTHER OPTIONS CONSIDERED

- A number of other solutions have been considered to secure the future water supply for the Fraser Coast including:

- Indirect Potable Reuse – This option involves performing additional treatment to the wastewater produced at existing wastewater treatment plants.
- Fraser Island – This option involves sourcing water from the Bogimbah Creek area either via a bore field or directly from the creek flow itself.
- Desalination – A report by WBWCC in 2009 identified several potential sites for the construction of desalination plants including River Heads, Booral, Dundowran and Burrum Heads.
- Mary River – This option involves the installation of a pipeline from the Mary River Barrage to the Burgowan Water Treatment Plant Site.
- All of these alternate options have significant obstacles including:
  - community acceptance (Indirect Potable Reuse and Fraser Island)
  - environmental approvals (Fraser Island and Desalination)
  - high operational cost (Desalination)
  - issues with high priority water allocations (Mary River).

5.4 ENVIRONMENTAL

- Environmental factors will be taken into account when analysing options for delivering both projects.
- Detailed environmental investigations will be required as part of the approvals process for the selected delivery option.

5.5 COMMUNITY FACTORS

- Both projects will provide increased water security across the Fraser Coast Regional Council area.
- Water security is required for both community health and wellbeing as well as for improved economic development.

5.6 STAKEHOLDER ENGAGEMENT PROCESS

- Key stakeholders have been identified and will be engaged as part of this process.
- Stakeholders will include representatives from various areas including community, agricultural industry, irrigation industry, elected representatives and environmental and indigenous groups.

6 Implementation Plan

6.1 ONGOING ACTIVITIES

Timing	Activity/ Description	Stakeholder/s	Responsible
Fortnightly	Project Meetings	Project Team	All
Monthly	Project reporting, issues review	Project Team	All

6.2 SPECIFIC ACTIVITIES

Timing	Activity/ Description	Stakeholder/s	Responsible	Date completed
May 2018	Approval of the Stakeholder Engagement Plan	Project Team	FCRC	
	Draft collateral including: • Stakeholder letters and emails • Phone calls and meeting schedule • Revised key messages • Q&As Collateral is to support options identification discussions	Targeted key stakeholders and agencies	KBR	
	Approval of draft collateral	Project Team	FCRC	
	Stakeholder letters and emails out Introducing the project, requesting engagement on options identification	Targeted key stakeholders and agencies	KBR	
	Phone calls (if required)		KBR FCRC	
Early June 2018	Face-to-face meetings or workshop on options identification	Targeted key stakeholders and agencies	KBR FCRC	
	Collate feedback received into an interim feedback report – Options Identification	Project Team	KBR	
	HOLD POINT Review feedback received to date, emerging issues, revise implementation plan, Q&As, and to reassess next steps	Project Team	KBR	
By late June 2018	Draft collateral including: • Stakeholder letters and emails • Phone calls and meeting schedule	Targeted key stakeholders and agencies	KBR	

Timing	Activity/ Description	Stakeholder/s	Responsible	Date completed
	• Revised key messages • Q&As Collateral is to support preferred option discussion			
	Approval of draft collateral	Project Team	FCRC	
July 2018	Stakeholder letters and emails out About upcoming preferred option discussion	Targeted key stakeholders and agencies	KBR	
	Phone calls (if required)		KBR FCRC	
	Face-to-face meetings or workshop on preferred option		KBR FCRC	
August 2018	Collate feedback and include in final feedback report	Project Team	KBR	
	Stakeholder letter or email out Close the information loop with stakeholders, detailing outcomes and next steps	Targeted key stakeholders and agencies	FCRC	

7 Protocols and reporting

7.1 INTERNAL APPROVALS PROCESS

For project relevant communication materials, a minimum of five (5) working days must be planned for to obtain all FCRC approvals.

Communication materials include, but are not limited to:

- Stakeholder Engagement Plan (this document) and subsequent updates
- key messages, Questions and Answers (Q&As), Frequently Asked Questions (FAQs)
- letters
- media releases, holding statements, scripts.

7.2 COMMUNICATION PROTOCOL

All communication with key stakeholders is to be at the direction of FCRC. This includes addressing stakeholder enquiries.

7.3 MEDIA PROTOCOL

All media enquiries will be managed by FCRC. The purpose of this instruction is to:

- manage FCRC's reputational risk and enhance stakeholder and community views
- enable compliance with media communication requirements as stipulated by FCRC.

No employee, contractor or consultant is permitted to make a statement to the media regarding any of the activities required as part of this project.

Media releases or statements will be issued by FCRC, following internal approval.

If any enquiry is received from the media, the project team, employee, contractor or consultant is to take the following steps:

- ascertain the nature of the enquiry, the person calling and the media group they represent
- advise the journalist that they are not an authorised spokesperson and that they will organise to have an appropriate person contact them as soon as possible
- record the journalists details (name, phone number, publication, date and time of the enquiry, questions and deadline)
- resist attempts by the enquirer to draw any further comment
- inform FCRC immediately of the enquiry, who will then liaise with the Media and Communication team.

The project team requests that any media monitoring undertaken by FCRC for the purposes of this project, be provided to the project team to record as part of the project, and to scan for any emerging issues.

The project team will support the media and communication unit to develop content for media releases, statements or responses to media enquiries where required.

7.4 BRANDING

All project materials will adhere to FCRCs branding protocols and templates, and will align with the relevant style guidelines.

All appropriate logos will be included on all external communication materials.

7.5 ELECTED REPRESENTATIVES

Engagement with local, state and federal elected representatives will be conducted by FCRC officers, through the agreed communication and government liaison channels.

The project team will provide support to FCRC in developing briefings or responses as appropriate. Any unplanned communication with elected representatives by the project team is to be documented and forwarded immediately to FCRC.

7.6 REPORTING

7.6.1 Interim reporting

The project team will complete an interim feedback report to FCRC, which will include:

- communication and engagement activities undertaken
- programmed activities for the next reporting period
- project risks
- stakeholder issues
- summary of media enquiries (as advised by FCRC).

7.6.2 Final Report

At project completion, a final Stakeholder Engagement feedback report will be prepared and will include the following:

- a summary of the project and the overall community engagement approach
- details of engagement with stakeholders and the issues raised
- number of stakeholders engaged, and how their involvement was facilitated
- qualitative and quantitative representation of stakeholder and community feedback
- evaluation and analysis of the enquiries and feedback received
- how the feedback was reported and applied
- risk and opportunities assessment and recommendations for future stages of the project.

Appendix 2

Letter 1 to Key Stakeholders

We Deliver

WIDE BAY water

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Mr Stuart Randle
General Manager Infrastructure
Bundaberg Regional Council
PO Box 3130,
BUNDABERG QLD 4670

8 June 2018

Dear Mr Randle,

RE: MEETING INVITATION: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to undertake an early stage assessment process for the following two water security projects with Fraser Coast Regional Council:

- **Project A: Preliminary Evaluation (PE)** - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach;

- **Project B: Strategic Assessment of Service Requirements (SASR)** – Interconnection of Hervey Bay and Maryborough's water supply schemes.

The Burnett River (Paradise Dam) to Howard Water Supply Pipeline project will investigate a link between the Paradise Dam and the Howard raw water system as an option to secure a suitable water supply solution into the future. While the additional water supply is not required until after 2046 securing this water source will ensure that water issues to do not impact on the economic development of the region. The proposal will primarily address long term water security for the Fraser Coast region.

The second project involves investigating an interconnection of the Hervey Bay and Maryborough water supply schemes through a pipeline, to improve water system resilience and reduce operational risks with the Fraser Coast Water Supply Network.

This current investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.

The project team, in collaboration with Fraser Coast Regional Council and DSDMIP, is currently investigating a number of options to be progressed for both projects as part of the early stage assessment process.

The project team would like to organise a meeting with representatives from Bundaberg Regional Council on Friday 22 June 2018 to discuss the options identified.

Attending the meeting will be Ron Populin, (KBR Technical Lead) and Prema Lopez (KBR Senior Stakeholder Engagement Consultant).

If you could kindly advise your availability on Friday 22 June 2018 via reply email, it would be most appreciated.

Yours faithfully

TREVOR DEAN
ACTING DIRECTOR – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Mr John Gorringe
General Manager
Isis Central Sugar Mill
Kevin Livingston Drive,
ISIS CENTRAL QLD 4660

Email: isimill@isissugar.com.au

8 June 2018

Dear Mr Gorringe,

RE: MEETING INVITATION: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to undertake an early stage assessment process for the following two water security projects with Fraser Coast Regional Council:

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The second project involves investigating an interconnection of the Hervey Bay and Maryborough water supply schemes through a pipeline, to improve water system resilience and reduce operational risks with the Fraser Coast Water Supply Network.

This current investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.

The project team, in collaboration with Fraser Coast Regional Council and DSDMIP, is currently investigating a number of options to be progressed for both projects as part of the early stage assessment process.

The project team would like to organise a meeting with representatives from Isis Central Sugar Mill on Friday 22 June 2018 to discuss the options identified.

Attending the meeting will be Ron Populin, (KBR Technical Lead) and Prema Lopez (KBR Senior Stakeholder Engagement Consultant).

If you could kindly advise your availability on Friday 22 June 2018 via reply email, it would be most appreciated.

Yours faithfully

TREVOR DEAN
ACTING DIRECTOR – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Attention: Darren Large
SunWater Area Operations Manager
SunWater
PO Box 15536,
CITY EAST QLD 4002

Email – Darren.Large@sunwater.com.au

8 June 2018

Dear Darren,

RE: MEETING INVITATION: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to undertake an early stage assessment process for the following two water security projects with Fraser Coast Regional Council:

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The second project involves investigating an interconnection of the Hervey Bay and Maryborough water supply schemes through a pipeline, to improve water system resilience and reduce operational risks with the Fraser Coast Water Supply Network.

This current investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.

The project team, in collaboration with Fraser Coast Regional Council and DSDMIP, is currently investigating a number of options to be progressed for both projects as part of the early stage assessment process.

The project team would like to organise a meeting with representatives from SunWater on Friday 22 June 2018 to discuss the options identified.

Attending the meeting will be Ron Populin, (KBR Technical Lead) and Prema Lopez (KBR Senior Stakeholder Engagement Consultant).

If you could kindly advise your availability on Friday 22 June 2018 via reply email, it would be most appreciated.

Yours faithfully

TREVOR DEAN
ACTING DIRECTOR – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Mr Steve Brown
Regional Water Coordinator
Wide Bay Burnett Regional Organisation of Councils Inc
c/- Gympie Regional Council
PO Box 155,
GYMPIE QLD 4570

8 June 2018

Dear Mr Brown,

RE: MEETING INVITATION: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to undertake an early stage assessment process for the following two water security projects with Fraser Coast Regional Council:

- **Project A: Preliminary Evaluation (PE)** - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach;

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The second project involves investigating an interconnection of the Hervey Bay and Maryborough water supply schemes through a pipeline, to improve water system resilience and reduce operational risks with the Fraser Coast Water Supply Network.

This current investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.

The project team, in collaboration with Fraser Coast Regional Council and DSDMIP, is currently investigating a number of options to be progressed for both projects as part of the early stage assessment process.

As discussed in an earlier conversation, the project team would like to organise a meeting with yourself on Monday 25 June 2018 to discuss the options identified.

Attending the meeting will be Ron Populin, (KBR Technical Lead) and Jodie Lamb (KBR Principal Stakeholder Engagement Consultant).

If you could kindly advise your availability on Monday 25 June 2018 via reply email, it would be most appreciated.

Yours faithfully

TREVOR DEAN
ACTING DIRECTOR – WIDE BAY WATER & WASTE SERVICES

Appendix 3

Letter 2 to wider Stakeholder Group

We Deliver

Fraser Coast
REGIONAL COUNCIL

PO Box 1943
Hervey Bay Qld 4655

T 1300 79 49 29
F (07) 4197 4455
E enquiry@frasercoast.qld.gov.au

www.frasercoast.qld.gov.au

Attention: Mr Bruce Saunders
Member for Maryborough
Shop 1, Comet Place
133 Lennox Street
MARYBOROUGH QLD 4650

22 June 2018

Dear Mr Saunders

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to work with Fraser Coast Regional Council to undertake an early stage assessment process for the following two water security projects:

- **Project A: Preliminary Evaluation (PE)** - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach;
- **Project B: Strategic Assessment of Service Requirements (SASR)** – Interconnection of Hervey Bay and Maryborough's water supply schemes.

The Burnett River (Paradise Dam) to Howard Water Supply Pipeline project will investigate a link between the Paradise Dam and the Howard raw water system as an option to secure a suitable water supply solution into the future. While the additional water supply is not required until after 2046, securing this water source will ensure that water issues do not impact on the economic development of the region. The proposal will primarily address long term water security for the Fraser Coast region.

The second project involves investigating an interconnection of the Hervey Bay and Maryborough water supply schemes through a pipeline, to improve water system resilience and reduce operational risks with the Fraser Coast Water Supply Network.

This current investigation phase seeks to expand on the work of the 2015 Fraser Coast Water Strategy by clarifying assumptions on the need and benefits through a detailed investigation.

The project team, in collaboration with Fraser Coast Regional Council and DSDMIP, is currently investigating a number of options to be progressed for both projects as part of the early stage assessment process.

The early stage assessment process will take approximately four months to complete. Wide Bay Water is committed to keeping all stakeholders informed about the process and will provide further updates as the options develop further.

In the meantime, please do not hesitate to contact me if you have any questions about the projects.

Yours faithfully

KEN DIEHM
CHIEF EXECUTIVE OFFICER

Contact Officer: Trevor Dean
Phone: 1300 79 49 29
Docs Reference: #35730001

Fraser Coast REGIONAL COUNCIL

PO Box 1943
Hervey Bay Qld 4655

T 1300 79 49 29
F (07) 4197 4455
E enquiry@frasercoast.qld.gov.au

www.frasercoast.qld.gov.au

22 June 2018

Attention: Mr David Batt
Member for Bundaberg
PO Box 935
BUNDABERG QLD 4670

Dear Mr Batt

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

I am writing to advise that Kellogg Brown and Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) to work with Fraser Coast Regional Council to undertake an early stage assessment process for the following two water security projects:

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Attention: Mr Stephen Bennett
Member for Burnett
Shop 7 Bargara Beach Plaza,
15-19 See Street,
BARGARA QLD 4670

22 June 2018

Dear Mr Bennett

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Mr Edward (Ted) Sorensen
Member for Hervey Bay
PO Box 5049
TORQUAY QLD 4655

Dear Mr Sorensen

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Hon. Leeanne Enoch MP
Minister for the Environment & the Great Barrier Reef
GPO Box 5078
BRISBANE QLD 4001

Dear Minister

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Hon. Keith Pitt MP
Member for Hinkler
PO Box 535
BUNDABERG QLD 4670

Dear Mr Pitt

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Mr Llew O'Brien MP
Federal Member for Wide Bay
PO Box 283
MARYBOROUGH QLD 4650

Dear Mr O'Brien

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Senator the Hon. James McGrath
Assistant Minister to the Prime Minister
PO Box 772
NAMBOUR QLD 4560

Dear Senator McGrath

RE: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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22 June 2018

Attention: Hon. Josh Frydenberg MP
Minister for the Environment and Energy
Parliament House
CANBERRA ACT 2600

Dear Minister

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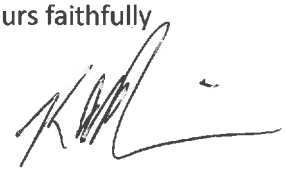

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Attention: Mr Trevor Harvey
General Manager Strategy, Innovation & Assets,
North Burnett Regional Council,
PO Box 390
GAYNDAH QLD 4625

22 June 2018

Dear Mr Harvey

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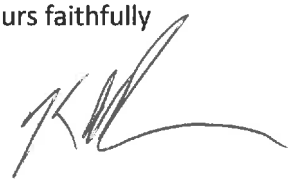

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Attention: Mr Stewart Norton
General Manager (Maryborough Region)
MSF Sugar Pty Ltd
PO Box 119
MARYBOROUGH QLD 4650

22 June 2018

Dear Mr Norton

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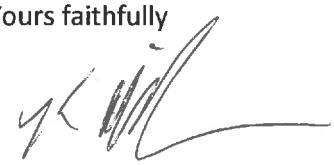

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Attention: Mr Dan Galligan
Chief Executive Officer
Queensland Cane Growers Organisation Ltd
GPO Box 1032
BRISBANE QLD 4000

22 June 2018

Dear Mr Galligan

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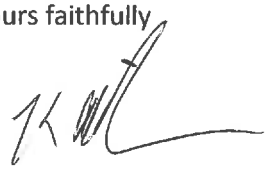

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Appendix 4

Summary Report and Letter 3 to Key Stakeholder

We Deliver

KBR

DSDMIP Early Stage Assessment - Fraser Coast Regional Council

We Deliver

Technical Summary

Technical Summary

DSDMIP Early Stage Assessment - Fraser Coast Regional Council

Prepared for:
FRASER COAST REGIONAL COUNCIL

Prepared by:
Kellogg Brown & Root Pty Ltd
ABN 91 007 660 317
Level 11, 199 Grey Street | South Brisbane
Qld 4101 | Australia
GPO Box 633 | Brisbane Qld 4001 |
Australia

04 September 2018

BEG851-TD-EV-REP-0001 Rev. 0

Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is in accordance with the scope of services set out in the contract between KBR and **Fraser Coast Regional Council** ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	30/8/2018	Draft issue for client review	P Lopez	J Lamb	K Fung	K Fung
0	4/9/2018	Issued for use	P Lopez	J Lamb	K Fung	K Fung

Contents

1 Summary

Kellogg Brown & Root Pty Ltd (KBR) has been engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) on behalf of Fraser Coast Regional Council (FCRC) to undertake an early stage assessment process for the following two projects:

- Project A: Preliminary Evaluation (PE) – Burnett River (Paradise Dam) to Howard water supply pipeline staged approach.
- Project B: Strategic Assessment of Service Requirements (SASR) – Interconnection of Hervey Bay and Maryborough's water supply schemes.

The assessment process for these projects included engagement with key stakeholders nominated by FCRC. This document provides a summary of feedback received to date.

2 Engagement

KBR has been engaged by DSDMIP to undertake an early stage assessment process for the Burnett River (Paradise Dam) to Howard water supply pipeline staged approach. This project requires undertaking a Preliminary Evaluation to investigate water supply between Paradise Dam and Maryborough, thereby addressing the long-term water security for the Fraser Coast region. Fraser Coast Regional Council has indicated they do not anticipate requiring this pipeline before 2046.

Engagement undertaken as part of the assessment process was designed to brief stakeholders on the project, and to determine interest in water demands that could potentially be supplied by Project A – Burnett River (Paradise Dam) to Howard water supply pipeline.

Stakeholders were also briefed on Project B – Interconnection of Hervey Bay and Maryborough's water supply schemes however there were no specific issues or comments received about this project. As this is an interconnector between two water treatment plants, this was not unexpected as it has little impact on the stakeholders consulted.

Stakeholders consulted by the project team via one-on-one meetings include:

- Bundaberg Regional Council
- Isis Central Sugar Mill
- Wide Bay Burnett Regional Organisation of Councils Inc.
- SunWater.

Further discussions around needs identification were also held via phone and email with the Maryborough Sugar Factory.

This summary details the feedback received as part of these discussions, which will assist with the future options development of these projects.

2.1 FEEDBACK ON PROJECT A – BURNETT RIVER (PARADISE DAM) TO HOWARD WATER SUPPLY PIPELINE

Proposed Scheme Options

Three proposed route options were presented for the Burnett River to Howard pipeline:

- Option 1 – Supply from Ned Churchward Weir

- Option 2 – Supply from Causeway Road extraction point
- Option 3 – Supply from Paradise Dam storage direct

All options deliver to the Burrum River raw water pump station site allowing for further on-transfer to Burgowan water treatment plant.

Bundaberg Regional Council

Representatives

Councillor Jason Bartels – Water & Wastewater Portfolio Councillor

Narelle D'Amico – Water Services Branch Manager

Tom McLaughlin – Water Services Planning and Delivery Manager

Jeff Rohdmann – Water Services Manager Operations

The principle Bundaberg Regional Council (Bundaberg Council) urban centres located along the pipeline routes are Childers and Woodgate. Both centres are currently supplied from groundwater and the Gregory River Water Treatment Plant. These will be upgraded in the future to be supplied from a combined scheme. The scheme will source water from the SunWater irrigation channels system. Bundaberg Council has an existing pump station into the channels (previously constructed as a drought contingency). This will be used as the source point. There was no interest in water from a Burnett River pipeline, given the extent of the raw water infrastructure that already exists.

Opportunity for combined scheme

The Bundaberg City area expects to obtain future water sources from the Burnett River source. This area is remote from any pipeline routes to Hervey Bay, and not does not present any opportunity for a combined scheme.

Isis Central Sugar Mill

Representatives

John Gorringe – Chief Executive Officer

Peter Hawe – Company Secretary, Business Development Manager

Paul Nicol – Chief Field Officer

Isis Central Sugar Mill (ICSM) indicated there was limited need for additional water in the current areas served by the SunWater channel system. They did outline a desire for water to the Coalstoun Lakes area, which is an area of good agricultural land they are considering for expansion. The area is south-east of the Paradise Dam wall.

Opportunity for a combined scheme

During the meeting with ICSM, a potential option was proposed for a pipeline heading south from Paradise Dam wall to Coalstoun Lakes, then east to the headwaters of the Burrum River catchment. Water for Fraser Coast could be released into the Burrum River and would drain to Lenthalls Dam.

The proposed route is shown in Figure 1.

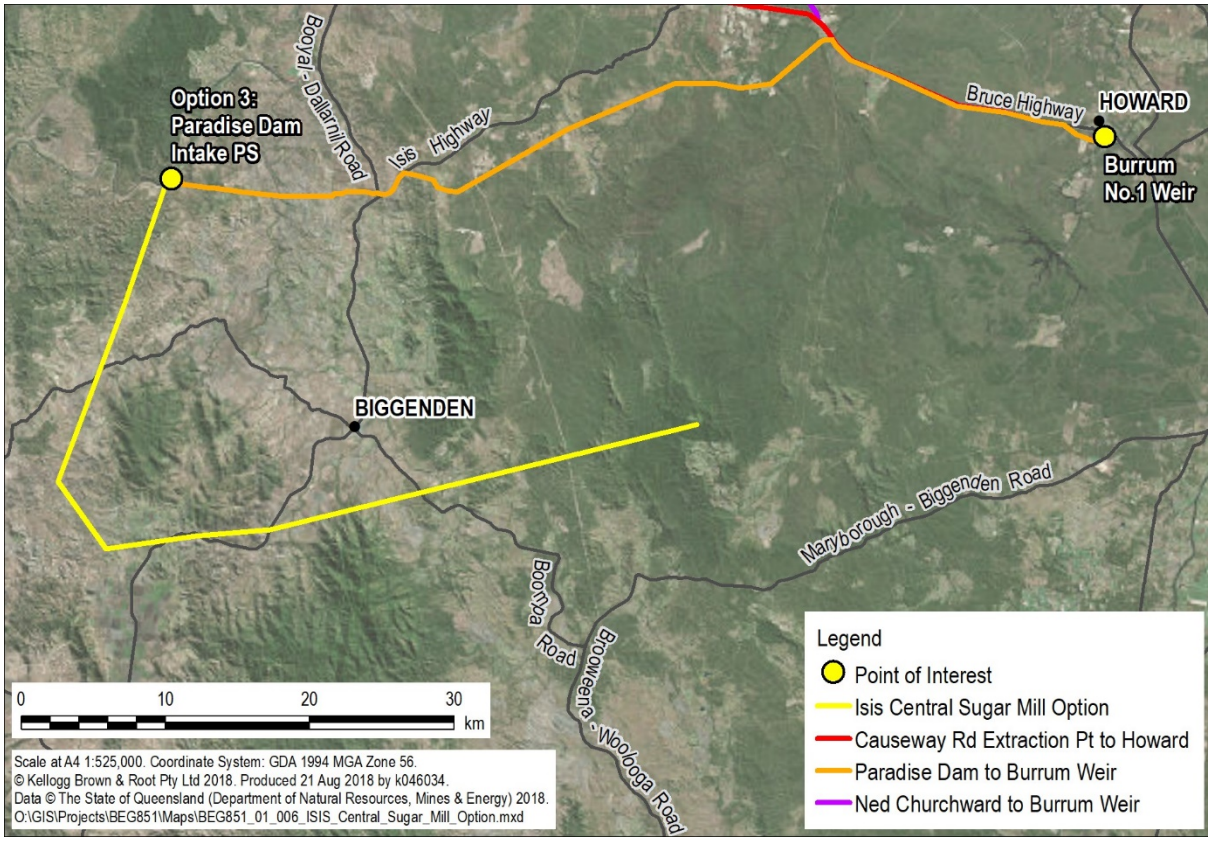


Figure 1 Route of Isis Central Sugar Mill option

The route shown is approximately 70 km long to the headwaters of the Burrum River System. The proposal has a number of significant drawbacks as a combined scheme with FCRC:

- The proposed route is longer than all the alternative routes being considered.
- Coalstoun Lakes area is elevated at about RL 250 mAHD, with the pipeline route required to traverse above RL 300 mAHD. This would require substantially more energy input for pumped water to Hervey Bay compared to other options.
- The option also involves discharging to headwaters of the Burrum River, resulting in substantial river flow losses up to Lenthalls Dam. There would be further evaporation losses from water stored in the Lenthalls Dam. This would multiply both the cost for allocation purchase and water usage costs for FCRC. Delivering into a live storage also reduces the air space available for capturing of future flood waters, which is effectively the loss of otherwise storable runoff water. As the option would substantially increase the purchase and operating costs of water for FCRC this is not considered viable for further consideration.

ICSM indicated that the SunWater irrigation channel system was at full capacity south of the Gregory River. There is some spare capacity between the Balancing Storage and the Gregory River. These comments have not been confirmed with SunWater at this stage.

This segment of channels is approximately 20–25 km north of Options 2 and 3, and therefore would not present a suitable connection point for these options. It is located approximately 5 km north of Option 1 (from Ned Churchward Weir). It would not be ideal for a temporary connection point given that it potentially delays construction of about 15 km of pipeline to the Ned Churchward Weir for a staged implementation case.

Gayndah Regional Irrigation Development

ICSM is currently undertaking the Gayndah Regional Irrigation Development (GRID) feasibility study. This $1.2 million study is part of a $150 million funding commitment to fast-track water infrastructure projects across Queensland as part of the National Water Infrastructure Development Fund.

The GRID area is to the west of Paradise Dam which makes it impractical to integrate with a pipeline to Howard.

Wide Bay Burnett Region of Councils

Representative

Steve Brown – Regional Water Coordinator

The Wide Bay Burnett Region of Councils (WBBROC) is in the process of undertaking a regional assessment of urban, industrial and irrigation water needs. An urban water deficiency has been identified at Biggenden, however as Biggenden is approximately 20 km south of the most southern option proposed, it is not a practical beneficiary of a combined scheme to Hervey Bay. It is understood a study by North Burnett Regional Council is also underway to investigate potential water supply to Biggenden.

Opportunities for a combined scheme

WBBROC referenced a study by the Australian National University that identified about 5,000 sites in Queensland, Tasmania, the Canberra district and around Alice Springs as potentially suitable for pumped hydro storage. WBBROC advised that there are potential pumped hydroelectric sites on the route from Paradise Dam to Hervey Bay.

A feasible pumped hydro scheme would require a number of features – significant elevation (approximately 300 m) between two potential sites for high and low storages, proximity to the high voltage power grid and a supply of water to fill the storages and provide top-up water lost to evaporation. In that respect there would be synergies with a pipeline to Hervey Bay, with an initial large volume needed to fill the storages and then minor volumes to provide make-up water.

Please note that the quantity of continual demand has not been quantified at this stage.

The proposed hydro sites were not defined but suitable elevated land is about 20 km south of the southern-most option for a Burnett River to Howard pipeline and benefits from a common pipeline solution as questionable. As the location was not defined, the likely long connection branch main required and unknown quantity of water required this demand point will not be considered as part of the study.

SunWater

Representatives

Peter MacTaggart – General Manager Corporate Development

SunWater is undertaking a study of supplies from the Burnett River Dam, as a study for the National Water Infrastructure Fund, to look at opportunities to distribute the water from Paradise Dam.

A draft of the report has been submitted to the Government (to DNRME for submission to the Federal Government), however the report is not available for release until approved by government.

Opportunities for a combined scheme

SunWater advised that the Isis Channel System is at capacity under peak flow, and suggested a pipeline to specific demands would be more feasible.

The issue of operation of the pipeline would need to be resolved if water was delivered to the channel system and there were not specific customers that had an independent demand from other allocated irrigation demands.

Maryborough Sugar Factory

The Maryborough Sugar Factory (MSF) was consulted to their desire for additional water. They have expressed interest in up to 20,000 ML/a demand delivered to the Mary River system to irrigate current cropped lands.

Opportunities for a combined scheme

The Mary River is approximately 24 km south of any proposed routes for a pipeline to Hervey Bay, with no obvious route compromises available that would not significantly impact upon pipeline length to service Hervey Bay.

Alternative pipeline routes to the south necessitate crossing additional elevated areas, adding to the pumping energy required. Supply is not considered practical without significantly increasing cost to FCRC, so they have not been considered further.

Options identified

Option 1: Ned Churchward Weir to Burrum

Ned Churchward Weir, previously known as Walla Weir, was completed in September 1998, and is located at Jonson's Rocks, 74 km from the mouth of the Burnett River. It is a concrete gravity structure with a storage capacity of 29,000 ML. The weir is equipped with a state-of-the-art fish lock to enhance fish migration in both upstream and downstream directions.

Option 2: Causeway Road to Burrum

The 2017 Early Stage Assessment – Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Stage Approach report identified a potential source extraction point at Causeway Road, Booyal.

Option 3: Paradise Dam to Burrum

Paradise Dam is located north west of Childers on the Burnett River. Construction of the dam was completed in 2005, with a maximum storage capacity of 300,000ML. It has 20,000ML high priority allocation available.

SunWater has advised that major works are required to address safety issues with Paradise Dam, and there is consideration in lowering the spillway (hence reducing the storage volume and yields) to reduce the capital expenditure required to make it compliant.

The routes for all three options are shown in Attachment 1.

Other irrigation demands

The private irrigator demands shown in Table 1 have been identified in the Wide Bay Burnett Region, focusing on areas potentially serviceable by Burnett River/Paradise Dam water.

Table 1

Area	Crop	Priority	Average Annual Demand (ML/a)
A	Citrus/Avocado	High	1000
B	Sugar Cane	Medium	800
C	Avocado	High	500
D	Sugar Cane	Medium	1800

The general locations of the demands are shown in Figure 2.

2.2 SYSTEM SIZING

Fraser Coast Demand

Sizing of the Fraser Coast demand will be based on 8,000 ML/a, with water drawn at a constant rate over the year (i.e. 22 ML/d). Infrastructure sizing will be based on 20 hours per day operation in accordance with typical Queensland based pipeline systems.

Other demands

Irrigation demands

Pipeline Options 1 and 2 will consider supplying the irrigation demands of

- Area A – 1,000 ML/a (Option 1)
- Area B – 800 ML/a (Option 2)
- Area C – 500 ML/a (Option 1)
- Area D – 1800 ML/a (Option 1).

Irrigation demands will be assumed to be drawn over a six month period and therefore have an instantaneous demand factor of twice the annual average.

Next steps

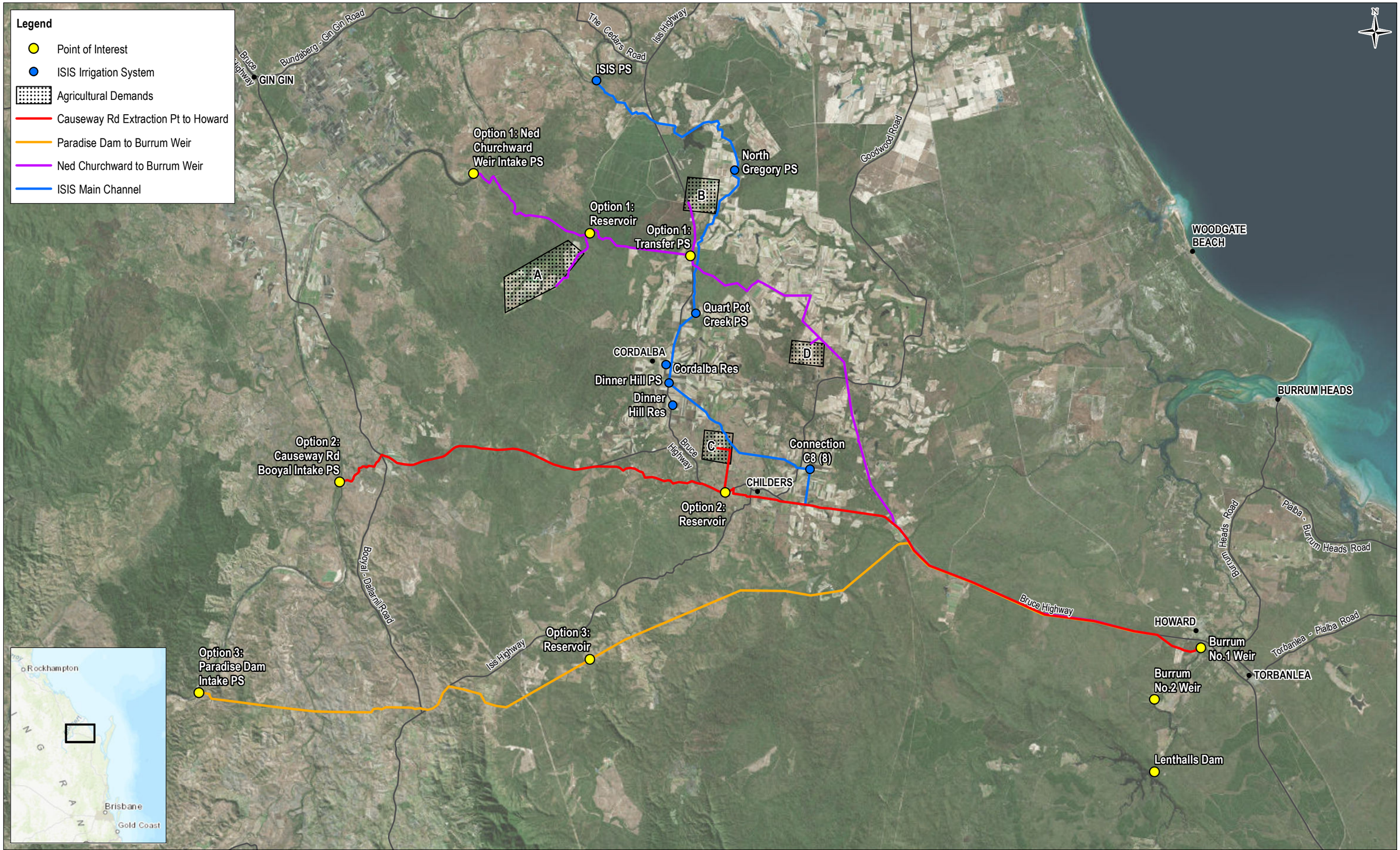
KBR is currently in the process of finalising the investigations into these options and will provide a final report to Fraser Coast Regional Council and the Department of State Development, Manufacturing, Infrastructure and Planning in the next month.

This summary report has been provided to you as an update on the investigations and how your feedback has been considered in the evaluation process.

This is also an opportunity for you to provide further comments and/ or feedback if desired.

Please note that all comments will need to be received by 14 September 2018.

Once the investigations have been completed, you will also receive a copy of the final report.



0 5 10 15 km

Scale at A3 1:225,000

SOURCE
© The State of Queensland (Department of Natural Resources and Mines) 2015
Imagery © ESRI 2018

FILE PATH	COORDINATE SYSTEM	DATE
O:\GIS\Projects\BEG851\Maps\ BEG851_01_001_Alignment_Project_A_v2.mxd	GDA 1994 MGA Zone 56	21 Aug 2018

KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Pipeline Route Overview

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0101	A

WIDE BAY water
A Business Unit of Fraser Coast Regional Council

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Attention: Mr Jeff Rohdmann
Manager Water & Wastewater Process
Bundaberg Regional Council
PO Box 3130
BUNDABERG QLD 4670

By Email - jeffrey.rohdmann@bundaberg.qld.gov.au

11 September 2018

Dear Mr Rohdmann,

RE: REPORT FEEDBACK: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

As you are aware, Kellogg Brown and Root Pty Ltd (KBR) was engaged by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) on behalf of Fraser Coast Regional Council (FCRC), to undertake an early stage assessment process for the following two long term water security projects:

- **Project A: Preliminary Evaluation (PE)** - Burnett River (Paradise Dam) to Howard water supply pipeline staged approach;

- **Project B: Strategic Assessment of Service Requirements (SASR)** – Interconnection of Hervey Bay and Maryborough's water supply schemes.

The evaluation process included technical investigations and meetings with key stakeholders, including yourself, to discuss the project and review the options being investigated. KBR is currently in the midst of finalising the report findings to be complete by late-September 2018. The attached summary is attached for your information and comment.

If you could kindly provide any comments by **Tuesday, 18 September 2018** via reply email to Prema Lopez (Prema.Lopez@kbr.com), it would be most appreciated.

Both projects are currently not funded to progress beyond this current evaluation phase however we will endeavour to keep you updated on any future planning.

I would like to take this opportunity to thank you for taking the time to meet with the project team and provide your feedback. I look forward to working with you in the future.

Yours faithfully

TREVOR DEAN
EXECUTIVE MANAGER ENGINEERING – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water
A Business Unit of Fraser Coast Regional Council

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Attention: Mr John Gorringe
General Manager
Isis Central Sugar Mill Co Ltd
Kevin Livingstone Drive
ISIS CENTRAL QLD 4660

By Email - isismill@isissugar.com.au

11 September 2018

Dear Mr Gorringe,

RE: REPORT FEEDBACK: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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Yours faithfully

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EXECUTIVE MANAGER ENGINEERING – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water
A Business Unit of Fraser Coast Regional Council

29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Attention: Mr Peter MacTaggart
General Manager Corporate Development
SunWater Limited
PO Box 15536
CITY EAST QLD 4002

By Email - Peter.MacTaggart@sunwater.com.au

11 September 2018

Dear Mr MacTaggart,

RE: REPORT FEEDBACK: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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EXECUTIVE MANAGER ENGINEERING – WIDE BAY WATER & WASTE SERVICES

WIDE BAY water
A Business Unit of Fraser Coast Regional Council
29-31 Ellengowan St, PO Box 5499
Hervey Bay Queensland 4655
t 1300 79 49 29 f 07 4197 4455
e enquiry@fraser.coast.qld.gov.au

Attention: Mr Steve Brown
Regional Water Coordinator
Wide Bay Burnett Regional Organisation of Councils Inc.
c/-Gympie Regional Council
PO Box 155
GYMPIE QLD 4570

BY EMAIL - steve.brown@wbbroc.org.au

11 September 2018

Dear Steve,

RE: REPORT FEEDBACK: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM - EARLY STAGE ASSESSMENT PROJECT

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Yours faithfully

TREVOR DEAN
EXECUTIVE MANAGER ENGINEERING – WIDE BAY WATER & WASTE SERVICES

Appendix 5

Proposed route options

We Deliver

DRAFT FOR CONSULTATION ONLY

Legend

- Point of Interest
- ISIS Irrigation System
- Demands (Psi Delta Analysis) - Avocados
- Demands (Psi Delta Analysis) - Citrus
- Demands (Psi Delta Analysis) - Sugar Cane
- Causeway Rd Extraction Pt to Howard
- ISIS Main Channel
- Paradise Dam to Burrum Weir
- Ned Churchward Weir to Burrum Weir
- Ned Churchward Weir to Burrum Weir (Indicative Route)

ISIS PS
Ned Churchward Weir
North Gregory PS
Sugar Cane - 'ISIS - Tower Block'
Citrus - 'Stens Farm'
Avocados - 'Promisedland development'
Quart Pot Creek PS
Sugar Cane - 'Russo'
Sugar Cane - 'Santalucia'
CORDALBA
Dinner Hill PS
Cordalba Res
Dinner Hill Res
Avocados - 'Dorian'
Connection C8 (8)
Extraction Pt, Causeway Rd Booyal
Paradise Dam
Burrum No.1 Weir
Burrum No.2 Weir
HOWARD
TORBANLEA
WOODGATE BEACH
BURRUM HEADS
Lenthalls Dam

The Cedars Road
Isis Highway
Goodwood Road
Bruce Highway
Booyal - Dallarnil Road
Isis Highway
Burrum Heads Road
Pialba - Burrum Heads Road
Torbanlea - Pialba Road

Rockhampton
Brisbane
Gold Coast

0 5 10 15 km

Scale at A3 1:225,000

SOURCE
© The State of Queensland (Department of Natural Resources and Mines) 2015
Imagery © ESRI 2018

FILE PATH	COORDINATE SYSTEM	DATE
\\BNEFILE300\Data$\GIS\Projects\BEG851\Maps\ BEG851_01_001_Alignment_Project_A.mxd	GDA 1994 MGA Zone 56	12 Jun 2018

KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: PL

TITLE
Maturing the Infrastructure Pipeline Program
Early Stage Assessment Project
Project A: Burnett River (Paradise Dam) to Howard Water Supply Pipeline Staged Approach

DOCUMENT NO.	REV.
BEG851-0001-TD-WE-GIS-0001-0001	A

Appendix 6

Feedback from Key Stakeholder Group

We Deliver

From: Steve Brown <steve.brown@wbbroc.org.au>
Sent: Tuesday, 11 September 2018 12:20 PM
To: Prema Lopez
Subject: [External] Feedback Request

Hi Prema,

My only comment is that Sunwater's current interest surrounding Paradise Dam including the potential reduction in wall height might impact the viability of any supply offtake to other areas. This might pose significant uncertainty around the assessment's scope and circumvent any recommendations.

Kind Regards

Steve Brown

Regional Water Coordinator
Wide Bay Burnett Regional Organisation of Councils Inc
c/- Gympie Regional Council
PO Box 155, Gympie QLD 4570
Mob: 0421951929
Email: steve.brown@wbbroc.org.au
Web: www.wbbroc.org.au
Facebook: https://www.facebook.com/WideBayBurnett

From: Nicole Nissen <Nicole.Nissen@frasercoast.qld.gov.au>
Sent: Tuesday, 25 September 2018 7:45 AM
To: Prema Lopez
Cc: Jodie Lamb
Subject: [External] FW: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Attachments: DOCSHBCC-#3633710-v1-WBW_-_Letter_-_DSDMIP_Maturing_the_Infrastructure_P....pdf

Importance: High

Hi Prema,

Please find below the response from Tom McLaughlin from BRC.

Kind regards

Nicole Nissen
Infrastructure Delivery Systems Officer
Engineering – Wide Bay Water & Waste Services
T: (07) 4194 7721 | E nicole.nissen@frasercoast.qld.gov.au

From: Tom McLaughlin [mailto:Thomas.McLaughlin@bundaberg.qld.gov.au]
Sent: Monday 24 September 2018 8:29 PM
To: Nicole Nissen
Cc: Jeff Rohdmann
Subject: FW: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Importance: High

Hi Nicole

BRC has reviewed the attached KBR report and have no additional comments to make at this stage.

Regards

TOM MCLAUGHLIN
Planning and Delivery Manager – Water Services
T 1300 883 699 **M** 0438 539 983
E Thomas.McLaughlin@bundaberg.qld.gov.au

BUNDABERG
REGIONAL COUNCIL

From: Jeff Rohdmann
Sent: Tuesday, 11 September 2018 12:47 PM
To: Nicole Nissen
Cc: Tom McLaughlin; Angelina Nakhuda; 'Prema Lopez'; Narelle D'Amico
Subject: FW: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Importance: High

Hi Nicole,

I commence leave this afternoon returning on Monday – 8th October 2018 and have forwarded attached letter and report to Manager of Planning and Delivery – Mr Tom McLaughlin to review and provide comments back to Prema Lopez by Tuesday – 18th September 2018.

Please liaise directly with Tom if you wish to discuss or require further action.

Regards,

Jeff.

JEFF ROHDMANN
Operations Manager – Water Services
T 1300 883 699 **M** 0429 348 860
E jeffrey.rohdmann@bundaberg.qld.gov.au

BUNDABERG
REGIONAL COUNCIL

From: Nicole Nissen [mailto:Nicole.Nissen@frasercoast.qld.gov.au]
Sent: Tuesday, 11 September 2018 12:01 PM
To: Jeff Rohdmann
Cc: 'Prema Lopez'

Subject: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Importance: High

Dear Jeff,

Please find the attached letter and report for your attention, in relation to DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project.

If you could kindly provide any comments by Tuesday, 18 September 2018 via reply email to Prema Lopez (Prema.Lopez@kbr.com), it would be most appreciated.

Kind regards

Nicole Nissen
Infrastructure Delivery Systems Officer
Engineering – Wide Bay Water & Waste Services
T: (07) 4194 7721 | E nicole.nissen@frasercoast.qld.gov.au

Fraser Coast REGIONAL COUNCIL Building better communities.

PO Box 1943, HERVEY BAY Q 4655
T 1300 79 49 29 | F (07) 4197 4455
Keep up to date with Council activities and have your say at frasercoast.qld.gov.au

Fraser Coast REGIONAL COUNCIL Building better communities.

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From: Peter.Hawe@isissugar.com.au
Sent: Thursday, 20 September 2018 5:18 PM
To: Prema Lopez; 'Nicole.Nissen@frasercoast.qld.gov.au'
Cc: Ken Fung; Jodie Lamb; Paul.Nicol@isissugar.com.au
Subject: [External] RE: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Attachments: Isis Mill Comments KBR Report re FCRC Howard Water Supply.pdf

Hi Prema,

I have reviewed the report and how discussion was represented and have made some handwritten changes in the attached PDF for your consideration.

Kind regards, Peter

Peter Hawe
Company Secretary
Business Development Manager

Isis Central Sugar Mill Company Limited
PMB 1, CHILDERS QLD 4660

P:(07) 4126 4424
M: 0419 659 325
E: Peter.Hawe@isissugar.com.au

From: Nicole Nissen [mailto:Nicole.Nissen@frasercoast.qld.gov.au]
Sent: Tuesday, 11 September 2018 12:02 PM
To: Reception <reception@isissugar.com.au>
Cc: 'Prema Lopez' <Prema.Lopez@kbr.com>
Subject: DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project – Report Feedback Request
Importance: High

Dear John,

Please find the attached letter and report for your attention, in relation to DSDMIP Maturing the Infrastructure Pipeline Program - Early Stage Assessment Project.

If you could kindly provide any comments by Tuesday, 18 September 2018 via reply email to Prema Lopez (Prema.Lopez@kbr.com), it would be most appreciated.

Kind regards

Nicole Nissen
Infrastructure Delivery Systems Officer
Engineering – Wide Bay Water & Waste Services
T: (07) 4194 7721 | E nicole.nissen@frasercoast.qld.gov.au

Fraser Coast REGIONAL COUNCIL Building better communities.

PO Box 1943, HERVEY BAY Q 4655
T 1300 79 49 29 | F (07) 4197 4455
Keep up to date with Council activities and have your say at frasercoast.qld.gov.au

- Option 2 – Supply from Causeway Road extraction point
- Option 3 – Supply from Paradise Dam storage direct

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Bundaberg Regional Council

Representatives

Councillor Jason Bartels – Water & Wastewater Portfolio Councillor

Narelle D'Amico – Water Services Branch Manager

Tom McLaughlin – Water Services Planning and Delivery Manager

Jeff Rohdmann – Water Services Manager Operations

The principle Bundaberg Regional Council (Bundaberg Council) urban centres located along the pipeline routes are Childers and Woodgate. Both centres are currently supplied from groundwater and the Gregory River Water Treatment Plant. These will be upgraded in the future to be supplied from a combined scheme. The scheme will source water from the SunWater irrigation channels system. Bundaberg Council has an existing pump station into the channels (previously constructed as a drought contingency). This will be used as the source point. There was no interest in water from a Burnett River pipeline, given the extent of the raw water infrastructure that already exists.

Opportunity for combined scheme

The Bundaberg City area expects to obtain future water sources from the Burnett River source. This area is remote from any pipeline routes to Hervey Bay, and not does not present any opportunity for a combined scheme.

; but there were other land areas that have a need for additional water if the SunWater systems were extended.

Isis Central Sugar Mill

Representatives

John Gorringe – Chief Executive Officer

Peter Hawe – Company Secretary, Business Development Manager

Paul Nicol – Chief Field Officer

X Isis Central Sugar Mill (ICSM) indicated there was limited need for additional water in the current areas served by the SunWater channel system. They did outline a desire for water to the Coalstoun Lakes area, X which is an area of good agricultural land ~~they are considering for expansion~~. The area is south-east of the Paradise Dam wall.

that is currently mostly dry farmed.

Opportunity for a combined scheme

(With a diversion to service Biggenden town water needs)

X During the meeting with ICSM, a potential option was proposed for a pipeline heading south from Paradise Dam wall to Coalstoun Lakes, then east to the headwaters of the Burrum River catchment. Water for Fraser Coast could be released into the Burrum River and would drain to Lenthalls Dam.

The proposed route is shown in Figure 1.

Table 1

Area	Crop	Priority	Annual Demand (ML/a)
A	Citrus/Avocado	High	1000
B	Sugar Cane	Medium	800
C	Avocado	High	500
D	Sugar Cane	Medium	1800 *

* Sugarcane could have future demand requirements >5,000ML/a MP if the current SunWater systems were extended.

The general locations of the demands are shown in Figure 2. - not supplied

Figure 2 has been provided in follow up email. No further comments provided - Prema

2.2 SYSTEM SIZING

Fraser Coast Demand

Sizing of the Fraser Coast demand will be based on 8,000 ML/a, with water drawn at a constant rate over the year (i.e. 22 ML/d). Infrastructure sizing will be based on 20 hours per day operation in accordance with typical Queensland based pipeline systems.

Other demands

Irrigation demands

Pipeline Options 1 and 2 will consider supplying the irrigation demands of

- Area A – 1,000 ML/a (Option 1)
- Area B – 800 ML/a (Option 2)
- Area C – 500 ML/a (Option 1)
- Area D – 1800 ML/a (Option 1).

Irrigation demands will be assumed to be drawn over a six month period and therefore have an instantaneous demand factor of twice the annual average.

Next steps

KBR is currently in the process of finalising the investigations into these options and will provide a final report to Fraser Coast Regional Council and the Department of State Development, Manufacturing, Infrastructure and Planning in the next month.

This summary report has been provided to you as an update on the investigations and how your feedback has been considered in the evaluation process.

This is also an opportunity for you to provide further comments and/ or feedback if desired.

Please note that all comments will need to be received by 14 September 2018.

Once the investigations have been completed, you will also receive a copy of the final report.

Appendix 7

Feedback from General Stakeholder Group

We Deliver

NORTH BURNETT
REGIONAL COUNCIL

Mailing Address: *PO Box 390, Gayndah Qld 4625*
Street Address: *34-36 Capper Street, Gayndah Qld 4625*
Telephone: *1300 696 272*
Facsimile: *(07) 4161 1425*
Email: *admin@northburnett.qld.gov.au*
Web: *northburnett.qld.gov.au*
ABN: *23 439 388 197*

02 July 2018

Our reference: 880475

Fraser Coast Regional Council
PO Box 1943
Hervey Bay QLD 4655

Dear Sir/Madam

RE: INFRASTRUCTURE PIPELINE PROGRAM - PARADISE DAM TO HOWARD WATER SUPPLY

Council acknowledges receipt of your letter received at this office on 02 July 2018. Your correspondence has been forwarded to the relevant department for an appropriate response.

If you have any further enquiries regarding this matter, do not hesitate to contact Council on 1300 696 272. Please quote reference **880475** and you will be referred to the appropriate officer for further assistance.

Yours faithfully

Elly Pusen
Records Coordinator

On behalf of R Burton PSM
Interim Chief Executive Officer

FRASER COAST REGIONAL COUNCIL
To: TREVOR DEAN ☐ Make Record
File: FOQ6602 ☐ Restricted
☐ Complaint
9 JUL 2018
Plan - Lot:
Comments:
Officer: ACS

Address all correspondence to the Chief Executive Officer

David BATT MP

Member for Bundaberg

3 July 2018

Ken Diehm
Chief Executive Officer
Fraser Coast Regional Council
PO Box 1943
HERVEY BAY QLD 4655

Dear Ken

Re: DSDMIP Maturing the Infrastructure Pipeline Program – Early Stage Assessment Project

Thank you for your letter of 22 June 2018 providing information on the early stage assessment processes being undertaken for the Burnett River (Paradise Dam) to Howard water supply pipeline and the interconnection of Hervey Bay and Maryborough's water supply schemes.

I am particularly interested in receiving updates on the Burnett River (Paradise Dam) to Howard water supply pipeline project and would appreciate receiving further information once the early stage assessment process has been completed.

Yours sincerely

David Batt MP
Member for Bundaberg

Building a Better Bundaberg
WIN Tower, Cnr Quay and Barolin Streets, Bundaberg Qld 4670 PO Box 935 Bundaberg Qld 4670
07 4111 3100 bundaberg@parliament.qld.gov.au DavidBattMP

NORTH BURNETT
REGIONAL COUNCIL

Mailing Address: PO Box 390, Gayndah Qld 4625
Street Address: 34-36 Capper Street, Gayndah Qld 4625
Telephone: 1300 696 272
Facsimile: (07) 4161 1425
Email: admin@northburnett.qld.gov.au
Web: www.northburnett.qld.gov.au
ABN: 23 439 388 197

10 July 2018

Your Reference: #35730001
Our Reference: TJH:MKB 880475

Mr Ken Diehm
Chief Executive Officer
Fraser Coast Regional Council
PO Box 1943
Hervey Bay Qld 4655

FRASER COAST REGIONAL COUNCIL
To: Trevor Dean ☐ Make Record
File: FOI\doc2 ☐ Restricted
☐ Complaint
13 JUL 2018
Plan - Lot:
Comments:
Officer:

Attention: Mr Trevor Dean

Dear Mr Diehm

Re: DSDMIP MATURING THE INFRASTRUCTURE PIPELINE PROGRAM – EARLY STAGE ASSESSMENT PROJECT

Thank you for providing information on the DSDMIP maturing the infrastructure pipeline program – early stage assessment project.

Council is interested in knowing more about the project (specifically Project A) and would appreciate being included in notifications on any updates/progress with the project.

Should you have any further enquiries please contact the undersigned on 1300 696 272.

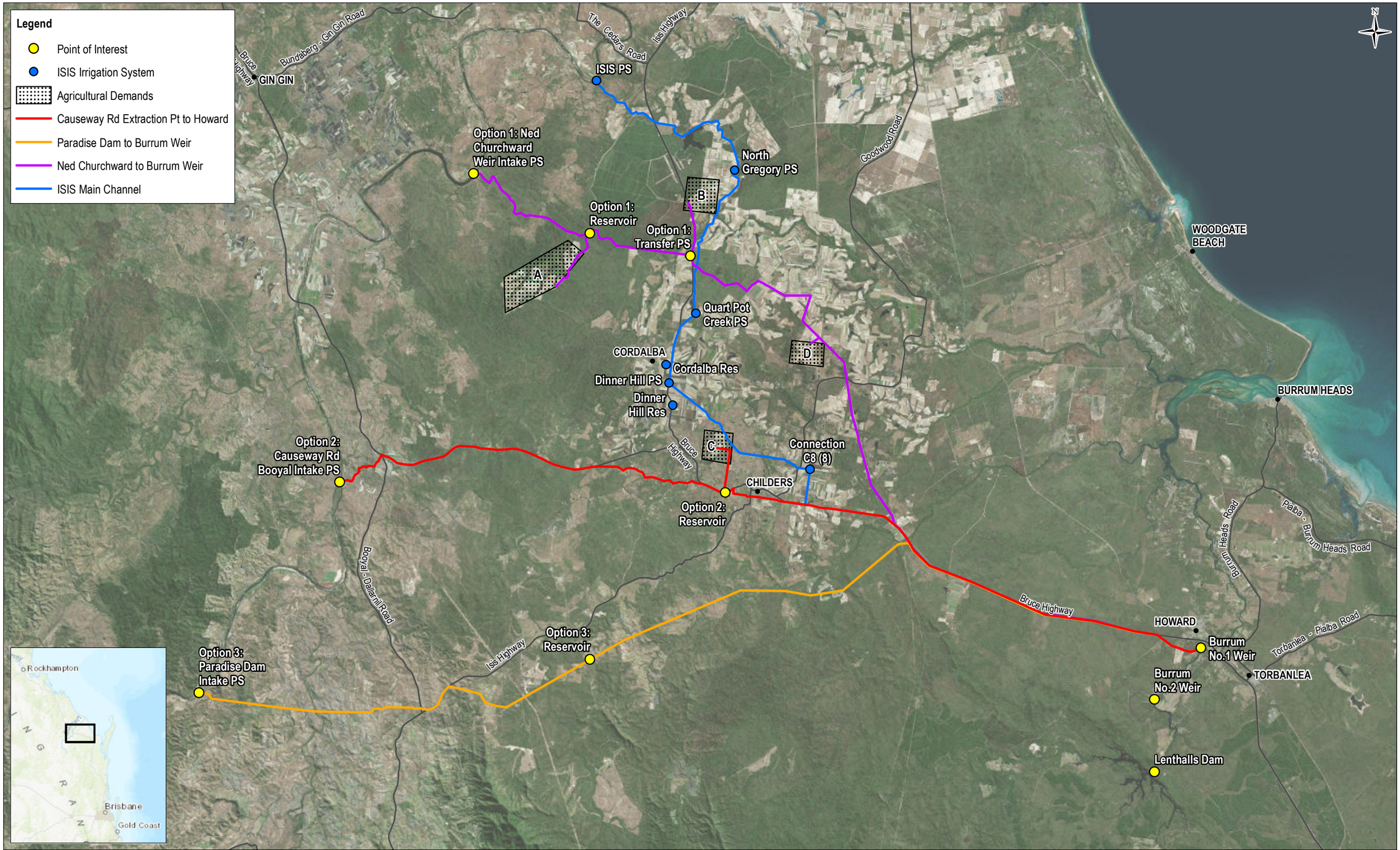
Yours faithfully

Trevor Harvey
General Manager of Strategy, Innovation and Assets
On behalf of R Burton PSM
Interim Chief Executive Office

Appendix C

Pipeline Alignments

We Deliver



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SOURCE
© The State of Queensland (Department of Natural Resources and Mines) 2015
Imagery © ESRI 2018

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KBR

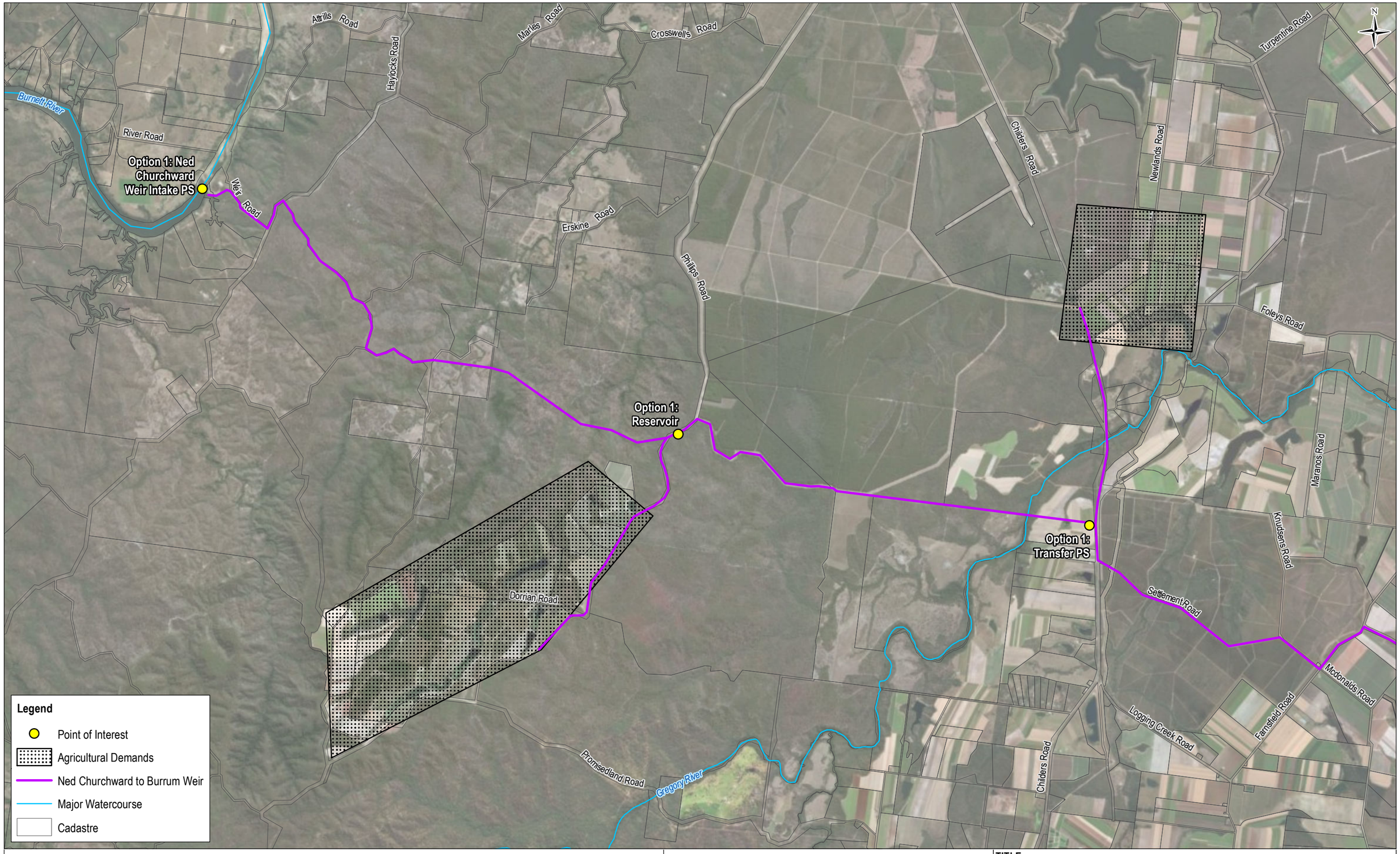
Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Pipeline Route Overview

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0101	A



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© The State of Queensland (Department of Natural Resources and Mines) 2015
Imagery © ESRI 2018

FILE PATH	COORDINATE SYSTEM	DATE
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Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE
Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 1 - Page 1 of 4

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0103	A

SOURCE
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FILE PATH	COORDINATE SYSTEM	DATE
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE
Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 1 - Page 2 of 4

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0103	A

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FILE PATH	COORDINATE SYSTEM	DATE
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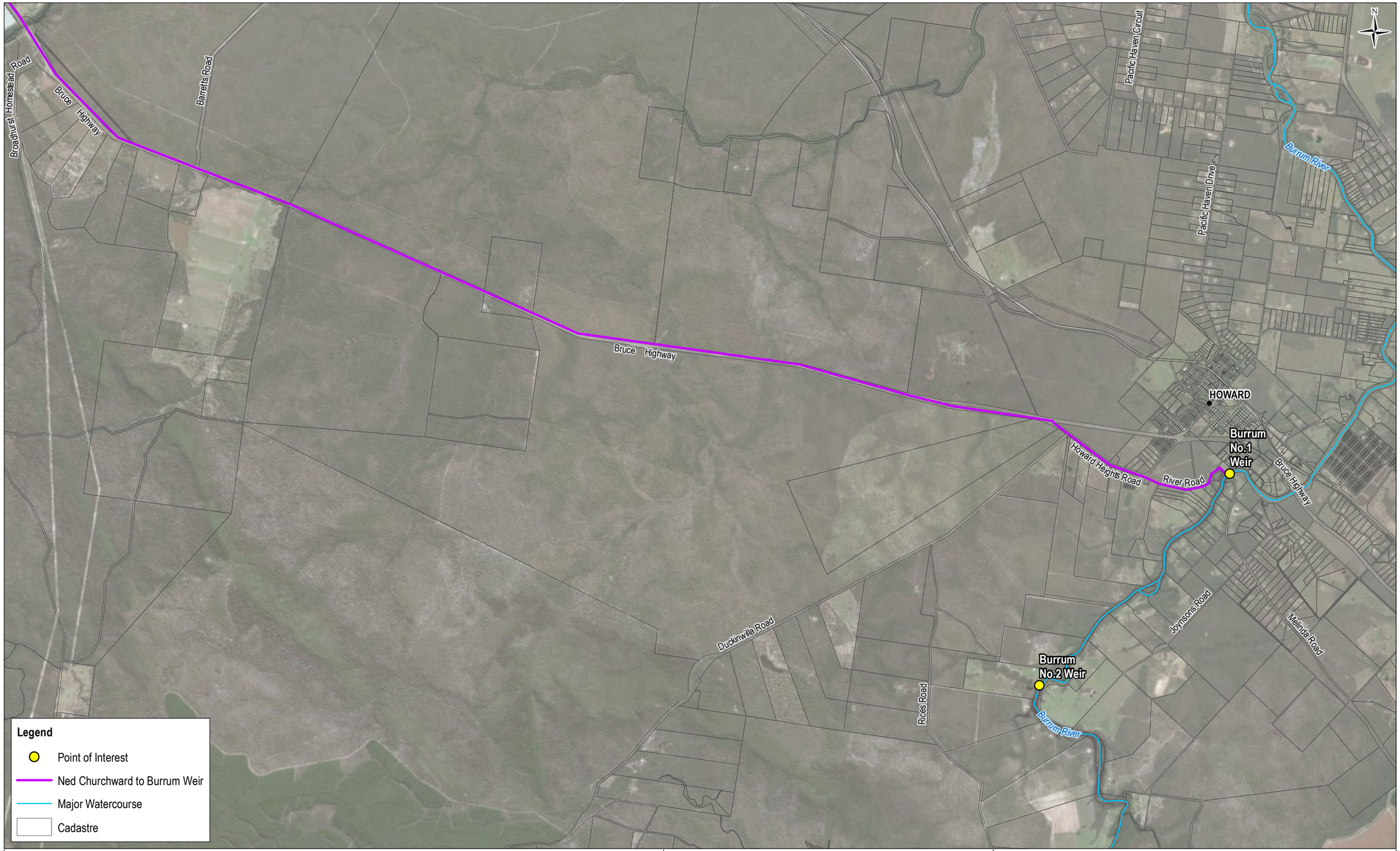
KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE
Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 1 - Page 3 of 4

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0103	A



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© The State of Queensland (Department of Natural Resources and Mines) 2015
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 1 - Page 4 of 4

DOCUMENT NO.	REV.
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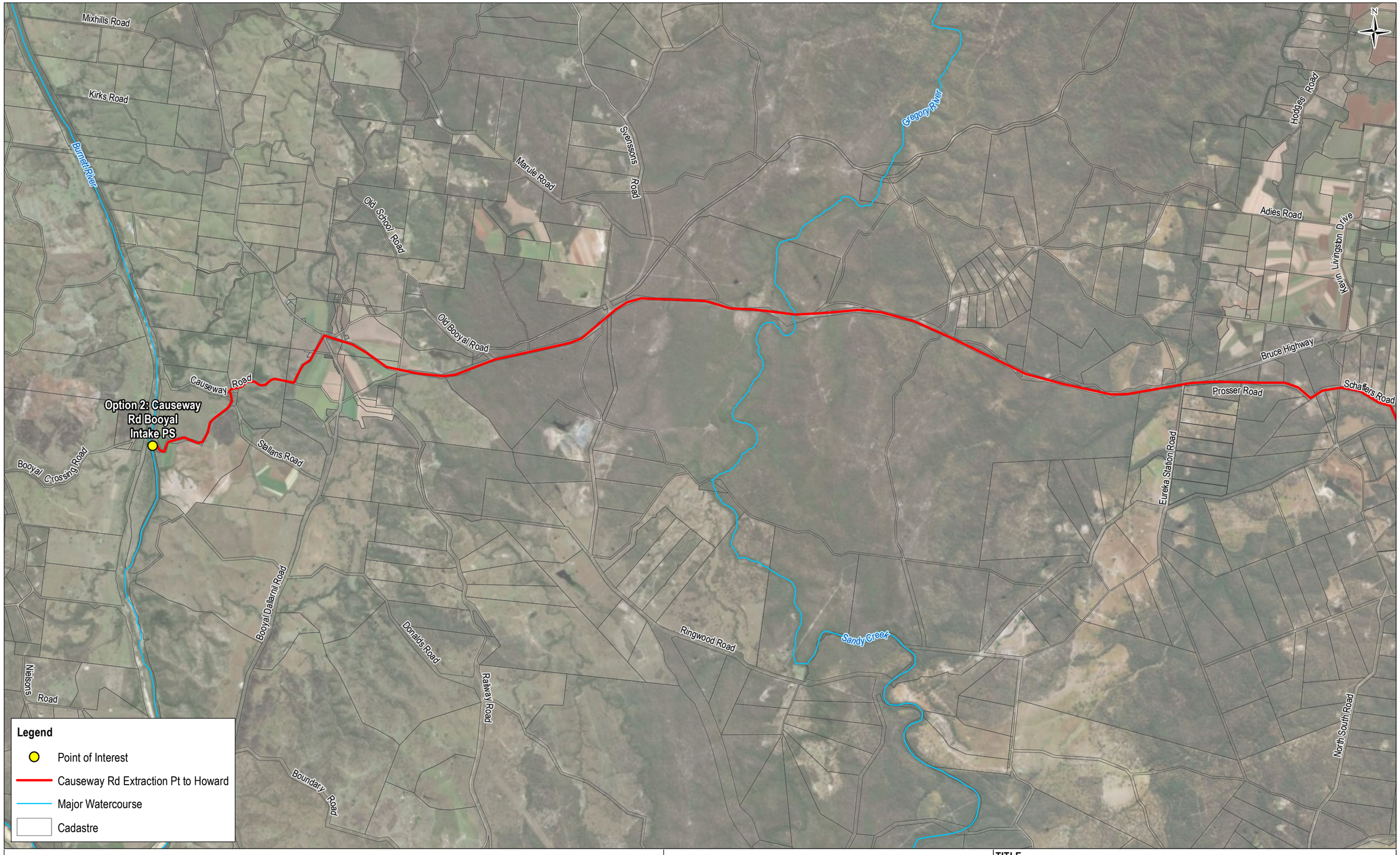

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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 2 - Page 1 of 3

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0104	A

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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 2 - Page 2 of 3

DOCUMENT NO.	REV.
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SOURCE
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 2 - Page 3 of 3

DOCUMENT NO.	REV.
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SOURCE
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 3 - Page 1 of 4

DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0105	A

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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE
Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 3 - Page 2 of 4

DOCUMENT NO.	REV.
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 3 - Page 3 of 4

DOCUMENT NO.	REV.
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KBR

Level 11, 199 Grey Street, South Bank Qld 4101

Prepared: PC
Checked: MH

TITLE

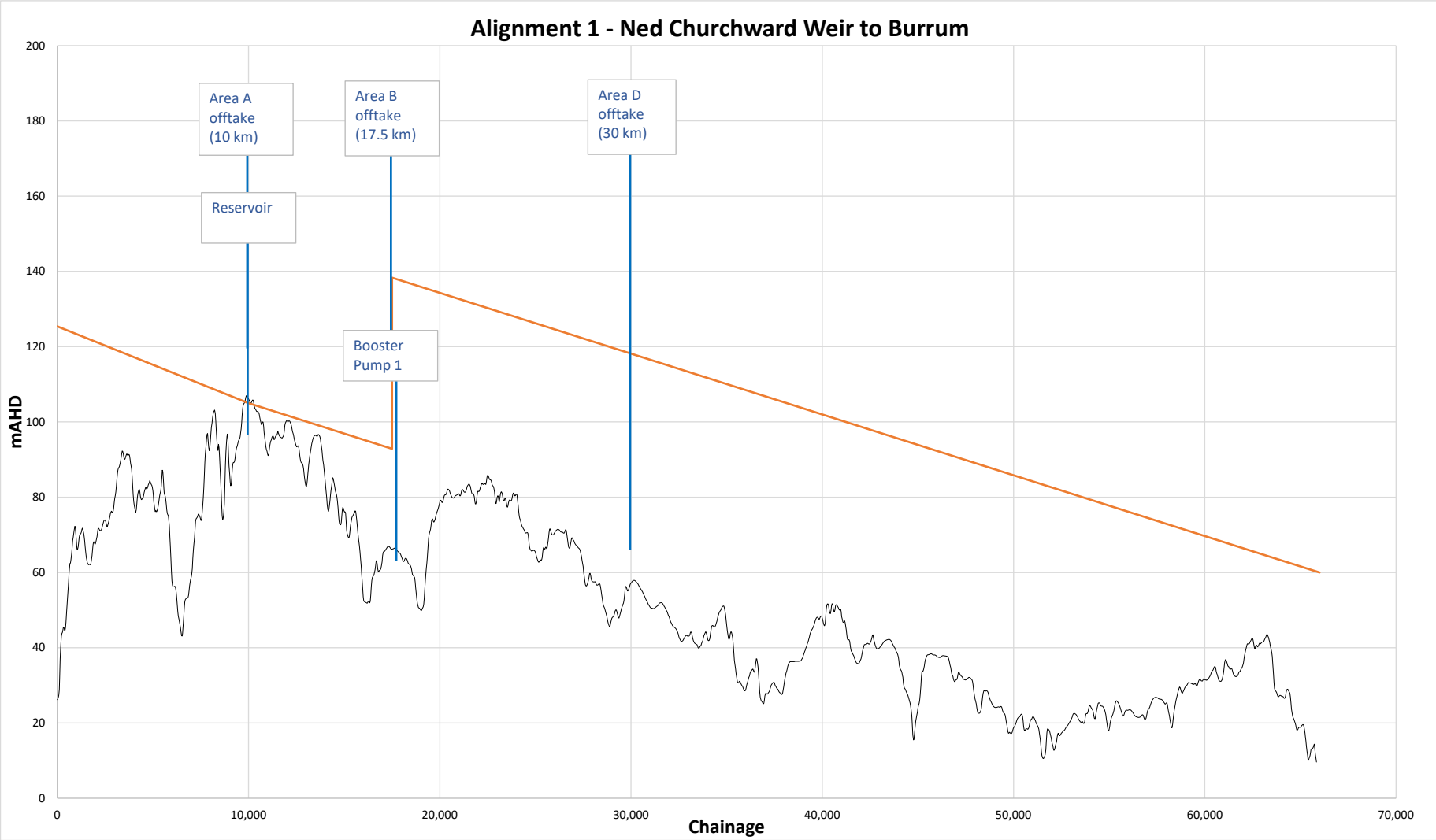
Fraser Coast Regional Council
MIPP - Project Evaluation
Burnett River to Howard Water Supply Pipeline
Option 3 - Page 4 of 4

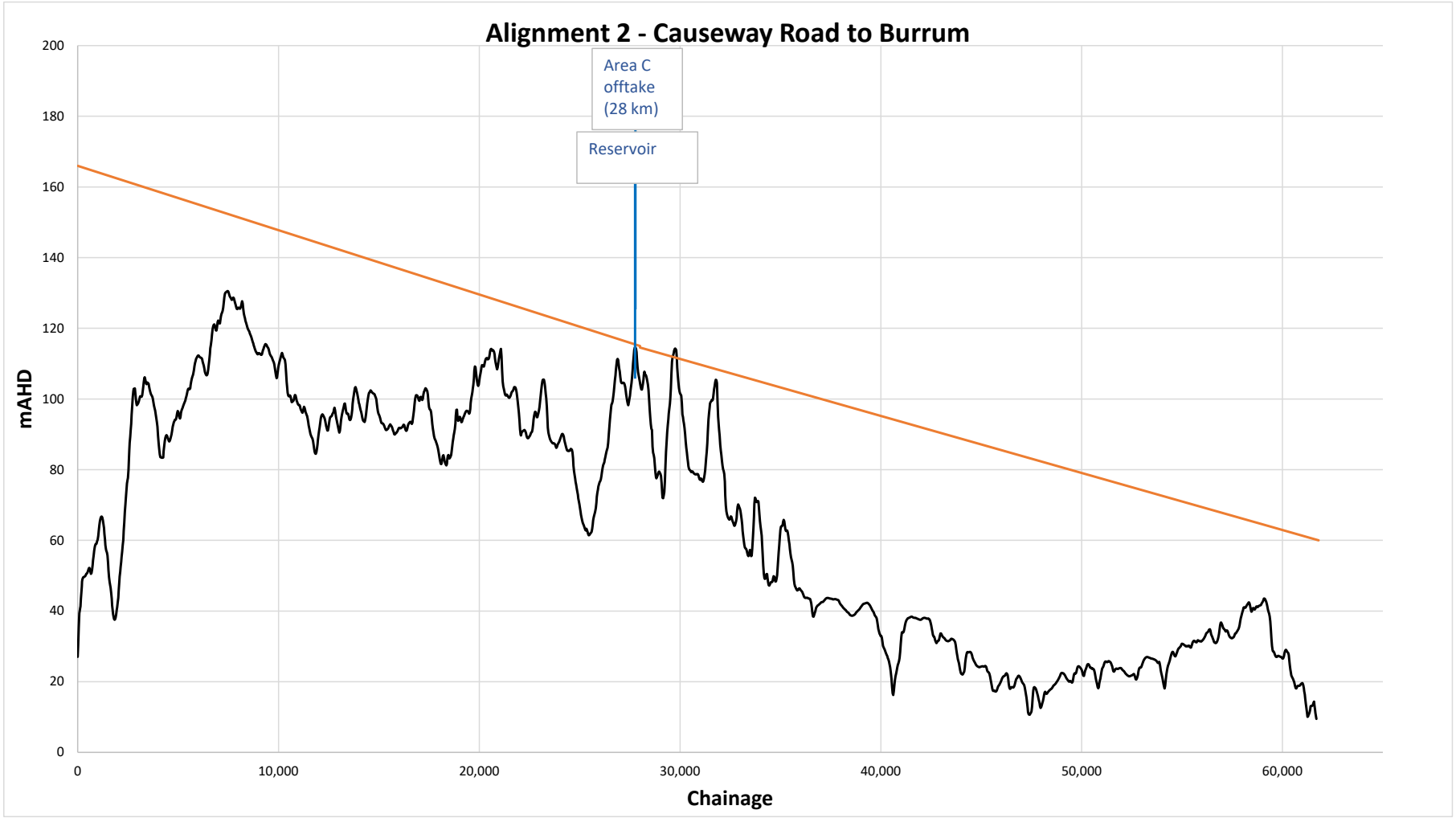
DOCUMENT NO.	REV.
BEG851-TD-WE-GIS-0105	A

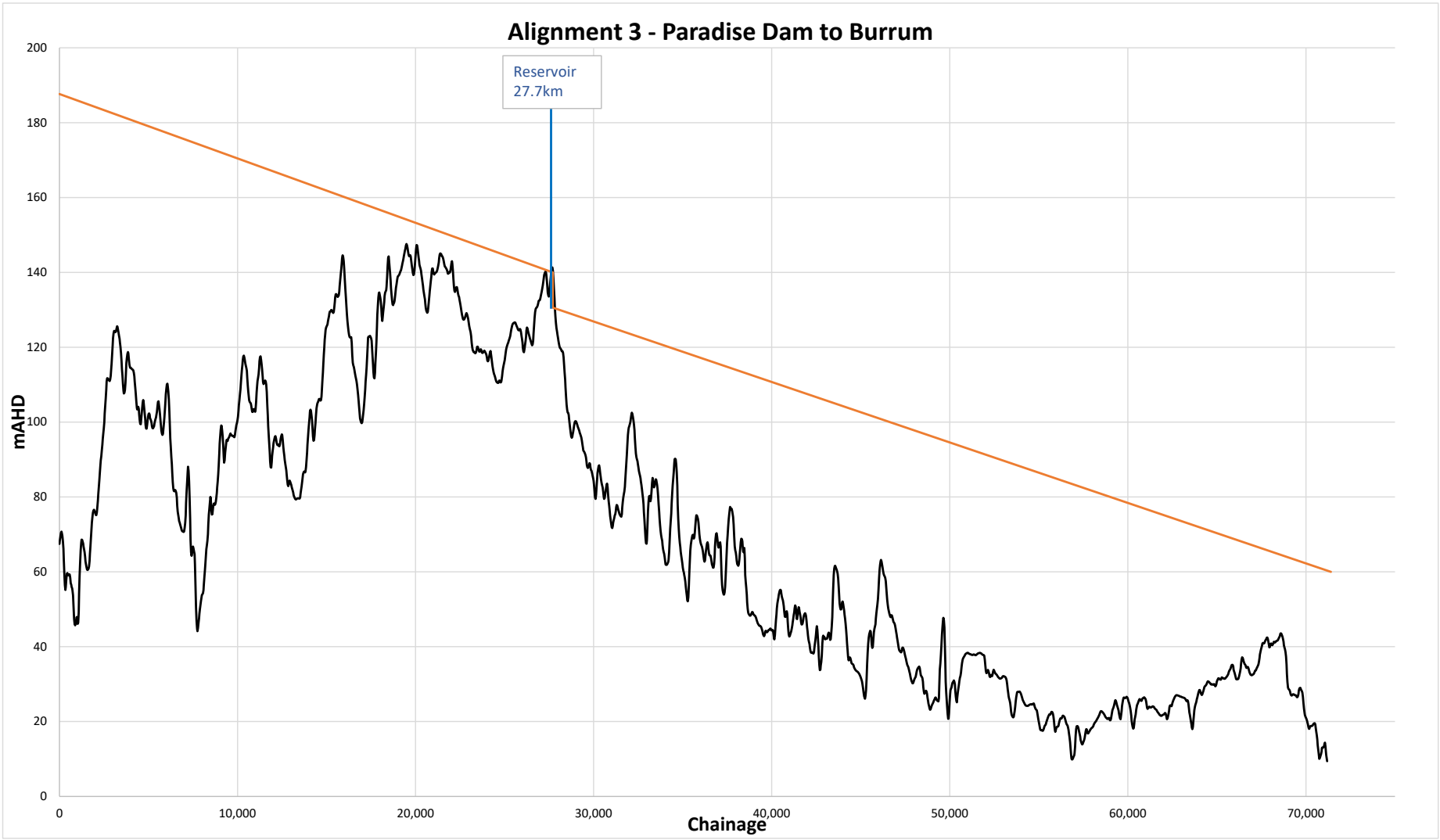
Appendix D

Pipeline Profiles

We Deliver


Alignment 1 - Ned Churchward Weir to Burrum
Area A offtake (10 km)
Area B offtake (17.5 km)
Area D offtake (30 km)
Reservoir
Booster Pump 1
mAHD
Chainage
0
20
40
60
80
100
120
140
160
180
200
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000


Alignment 2 - Causeway Road to Burrum
Area C offtake (28 km)
Reservoir
mAHD
Chainage
200
180
160
140
120
100
80
60
40
20
0
0
10,000
20,000
30,000
40,000
50,000
60,000


Alignment 3 - Paradise Dam to Burrum
Reservoir
27.7km
mAHD
Chainage
200
180
160
140
120
100
80
60
40
20
0
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000

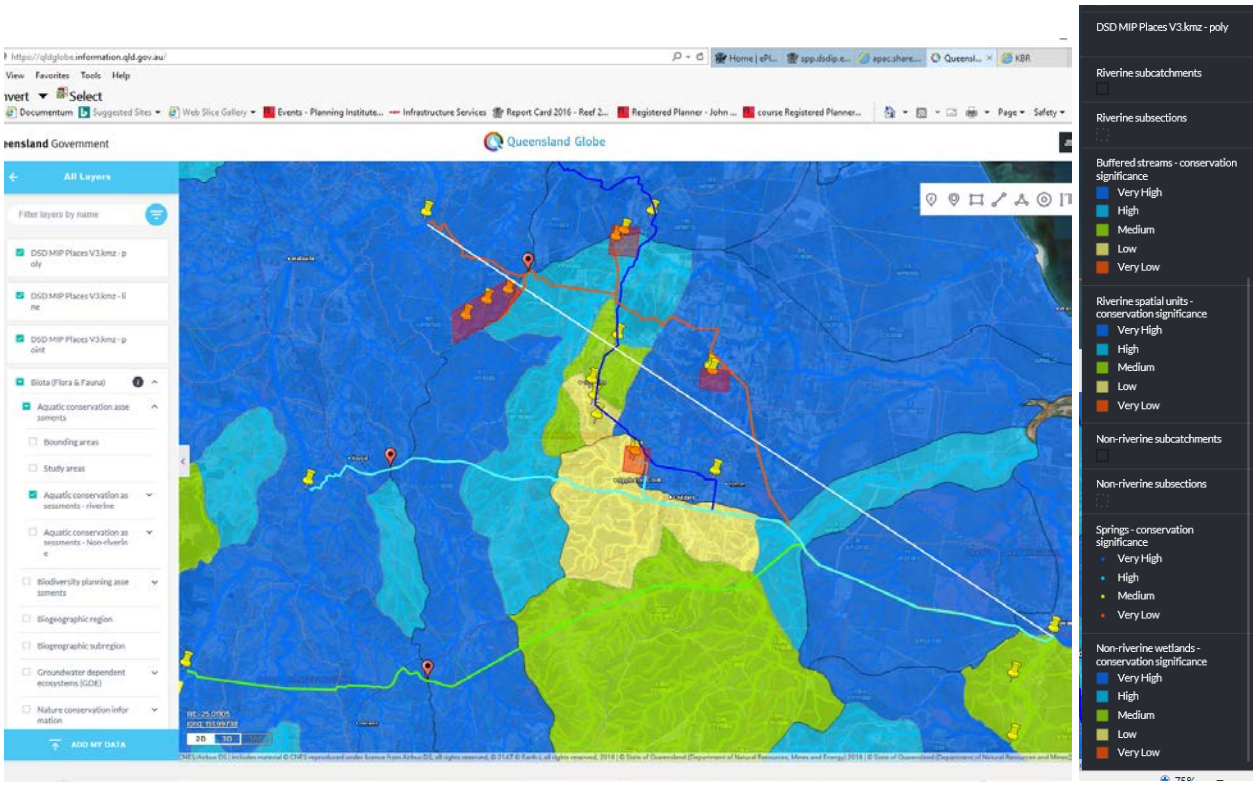
Appendix E

QLD Globe Mapping Results

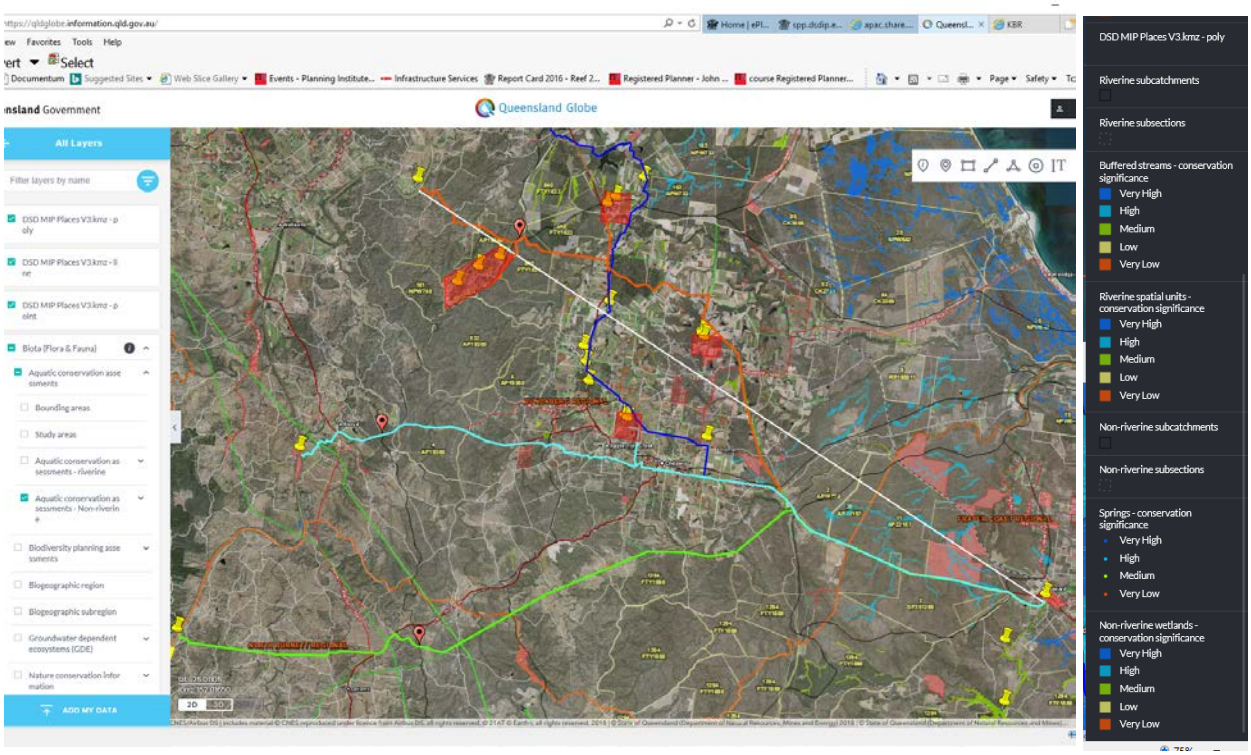
We Deliver

Burnett River to Burrum Pipeline Routes Queensland Globe Mapping

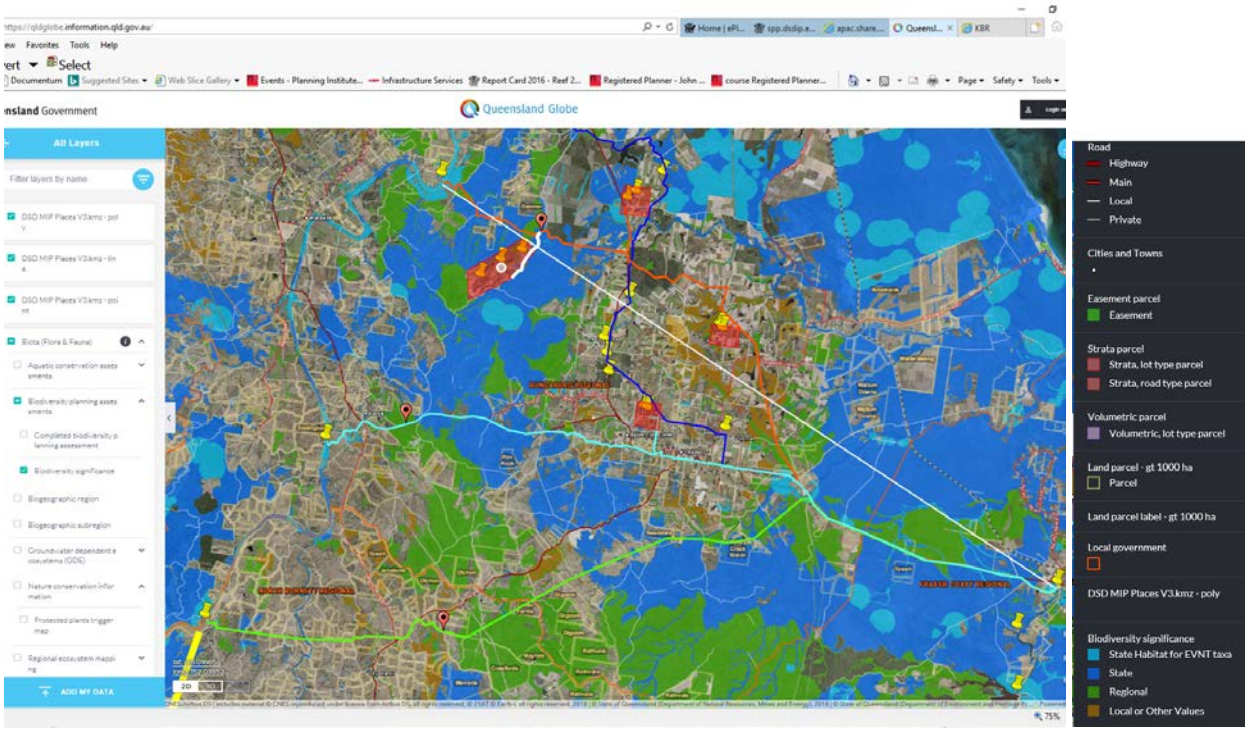
Biota – Aquatic conservation assessments - Riverine



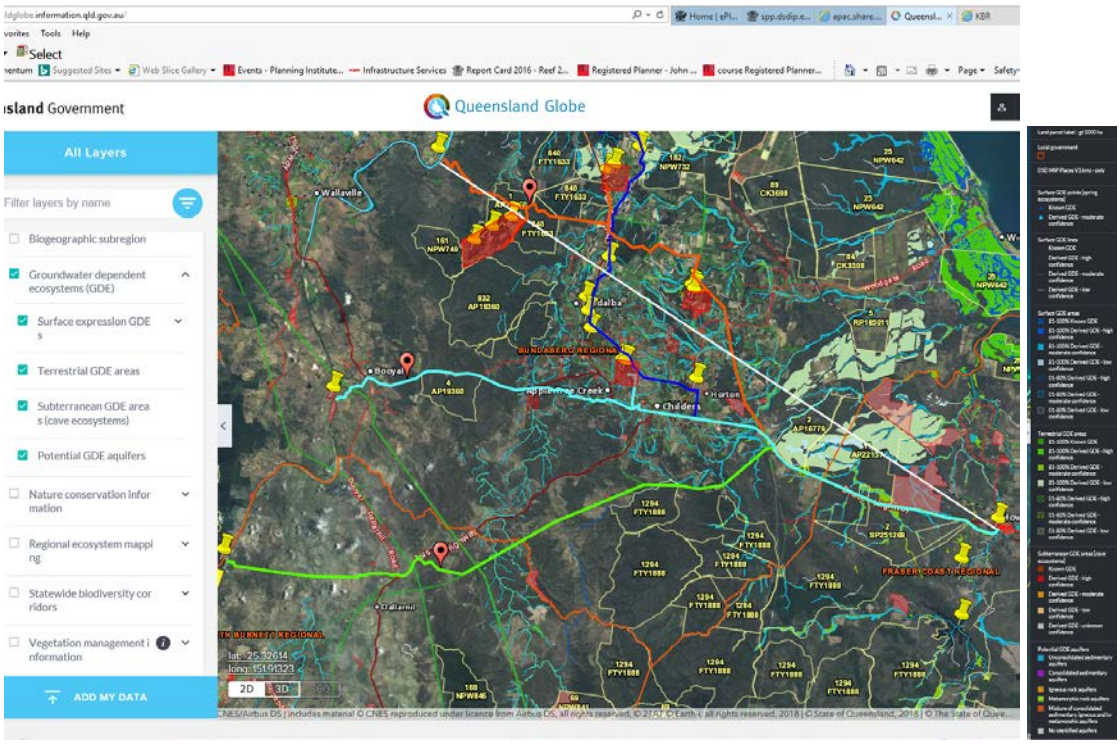
Biota – Aquatic conservation assessments – Non-riverine



Biota – Biodiversity planning assessments – Biodiversity significance

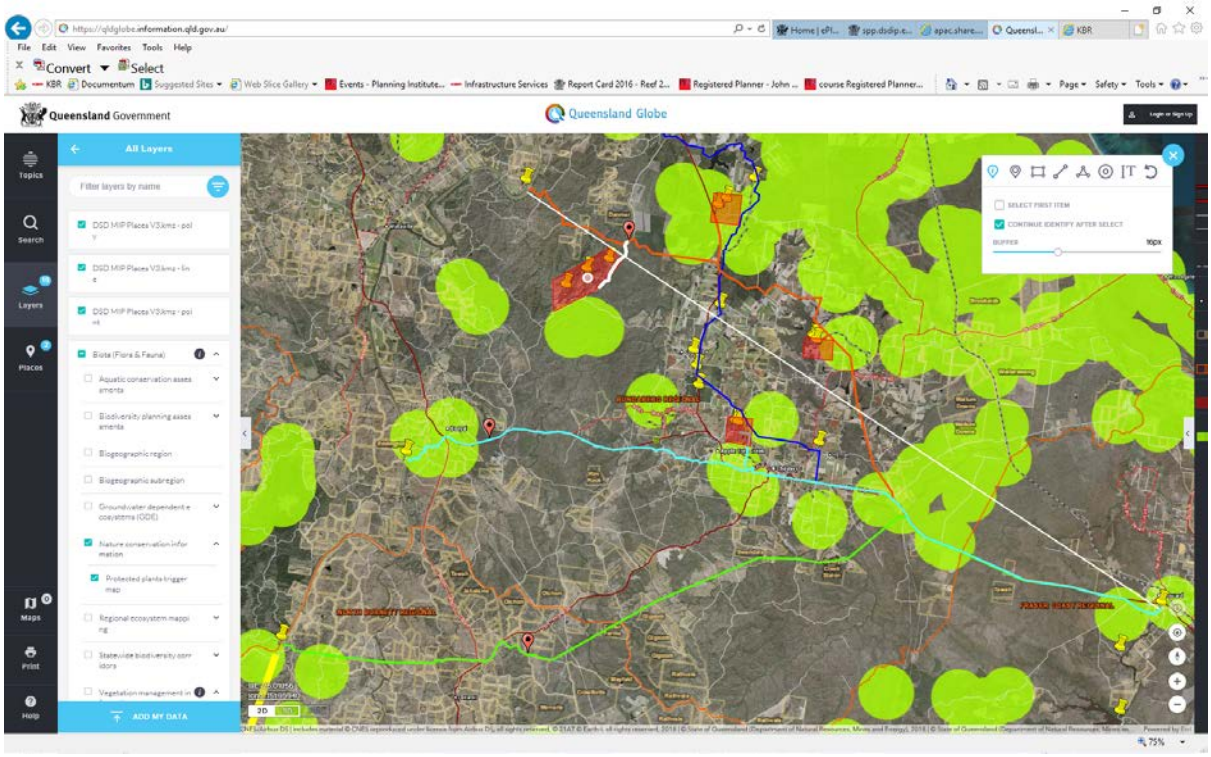


Biota – Groundwater dependent ecosystems

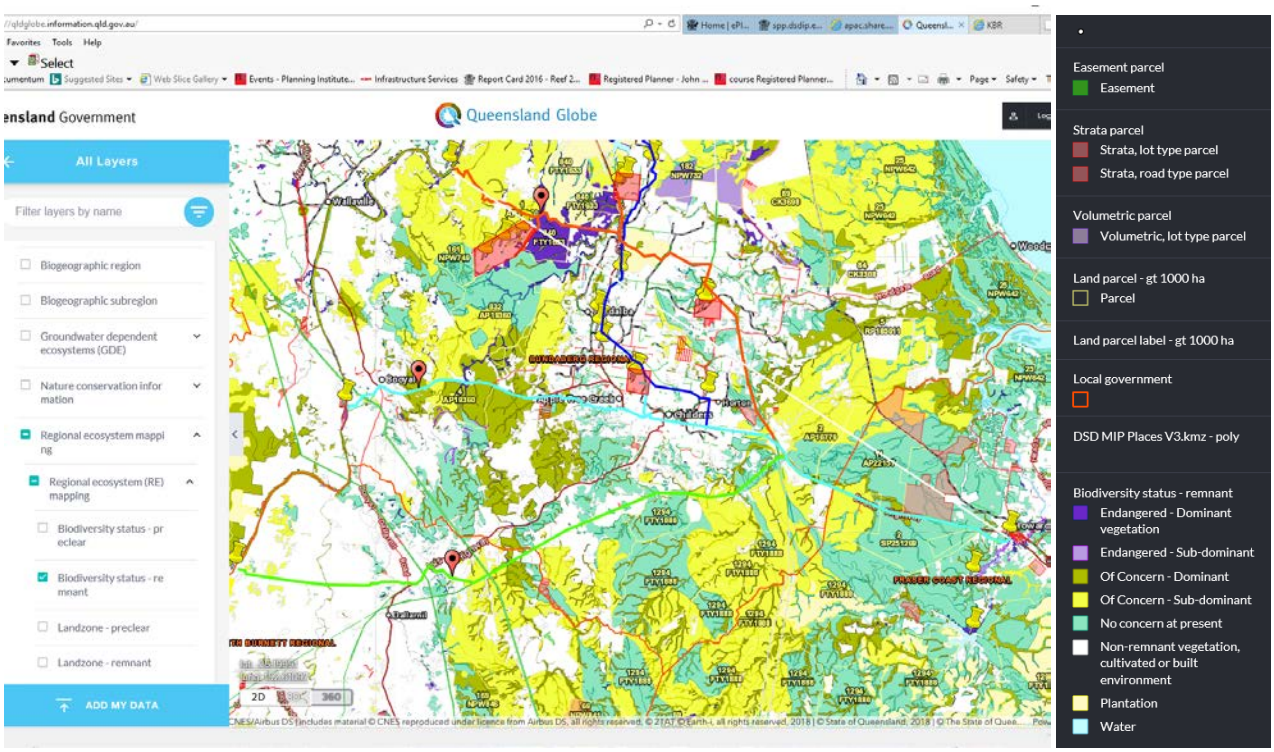


Biota – Nature Conservation Information – Protected plants trigger map

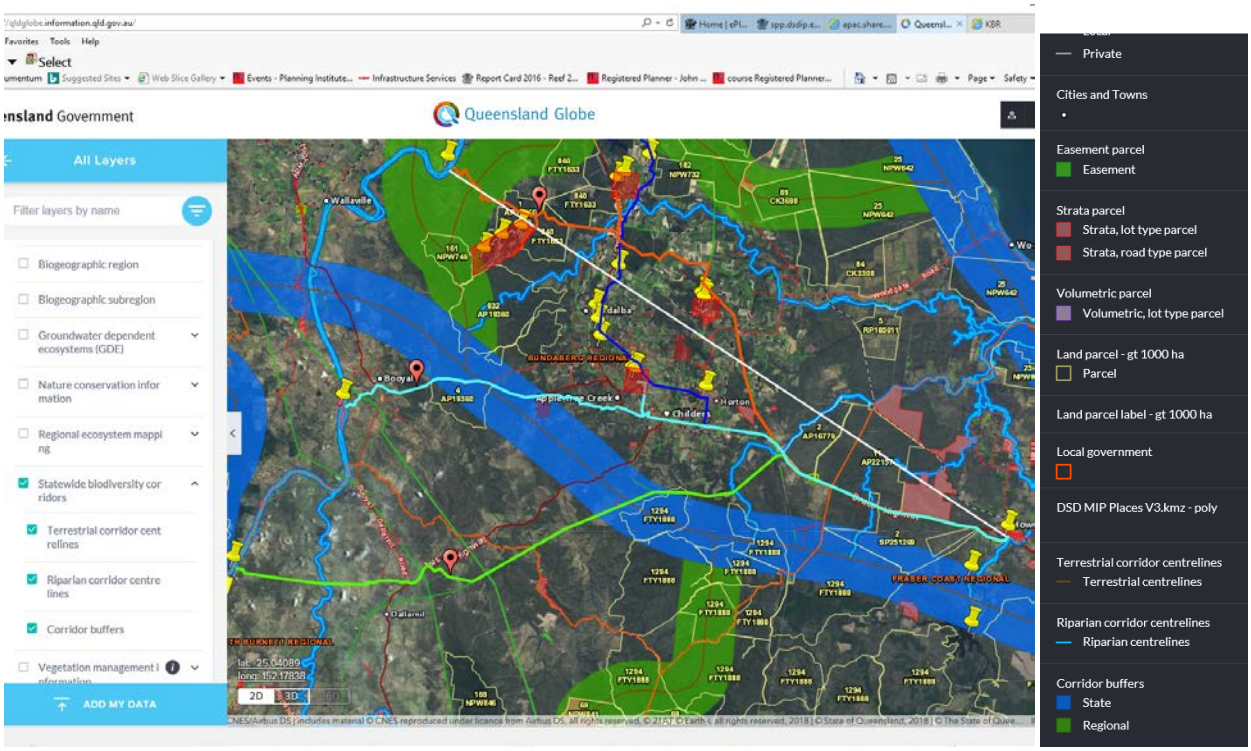
Green areas are parts of the corridors where a detailed flora survey in accordance with DES guidelines has to be undertaken if vegetation is to be cleared.



Biota – Regional ecosystem mapping – Biodiversity status – Remnant

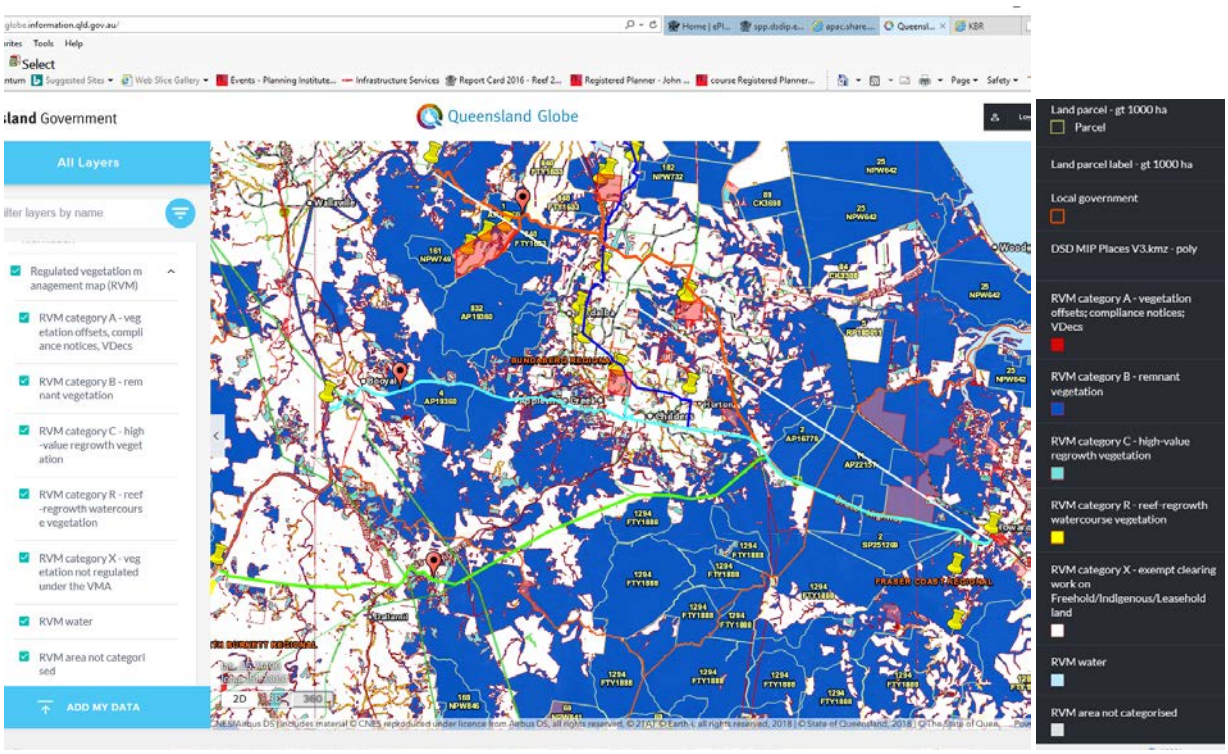


Biota – Statewide biodiversity corridors – Terrestrial and riparian corridors and buffers



Biota – Vegetation management information

RVM Categories A, B, C, R, X, RVM Water and RVM area not categorised



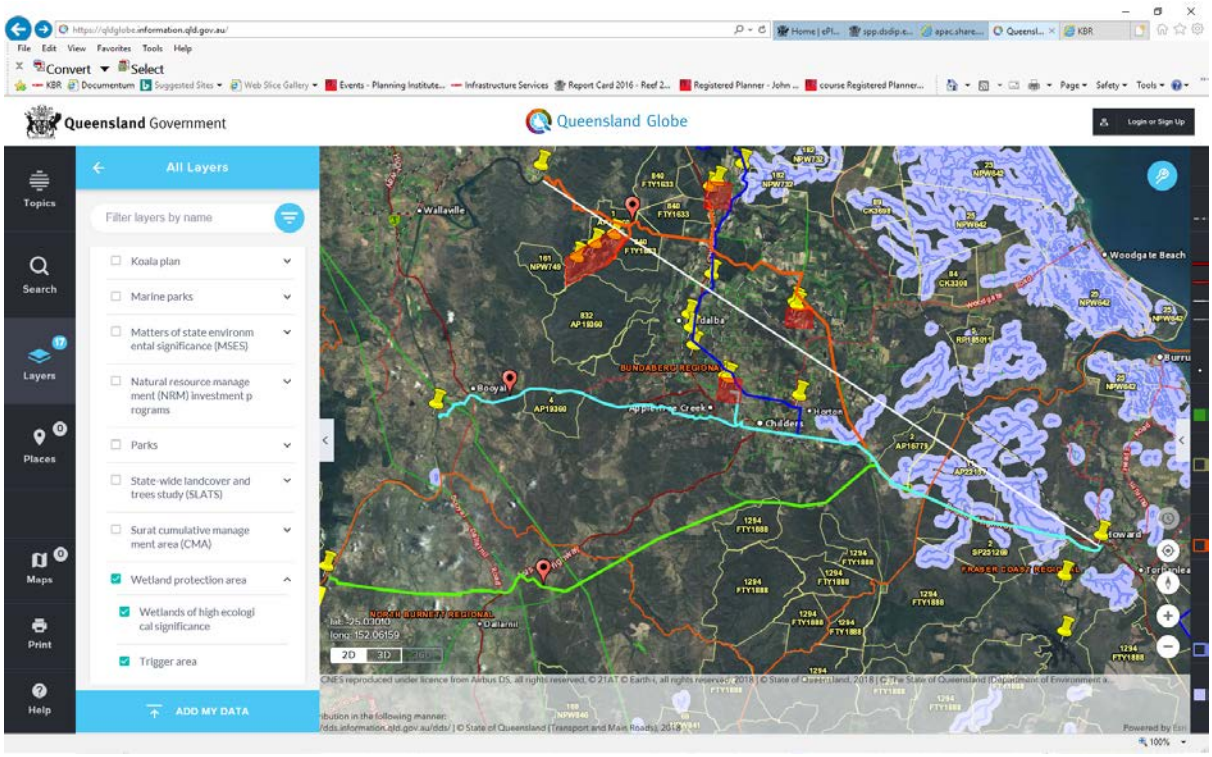
Environment - MSES Conservation Areas – Nil

Environment - MSES Wetland Values – a few high ecological significance wetlands along streams in the common section north-west of Howard. Most stream crossings along the routes are listed as MSES regulated vegetation (defined watercourse)

Environment - MSES vegetation and habitat and Wetland Protection Areas

There are areas of MSES wildlife habitat (threatened and special least concern animal) on the common section and along some creeks elsewhere. Most of the common area and scattered areas along the separate routes comprise MSES regulated vegetation (essential habitat).

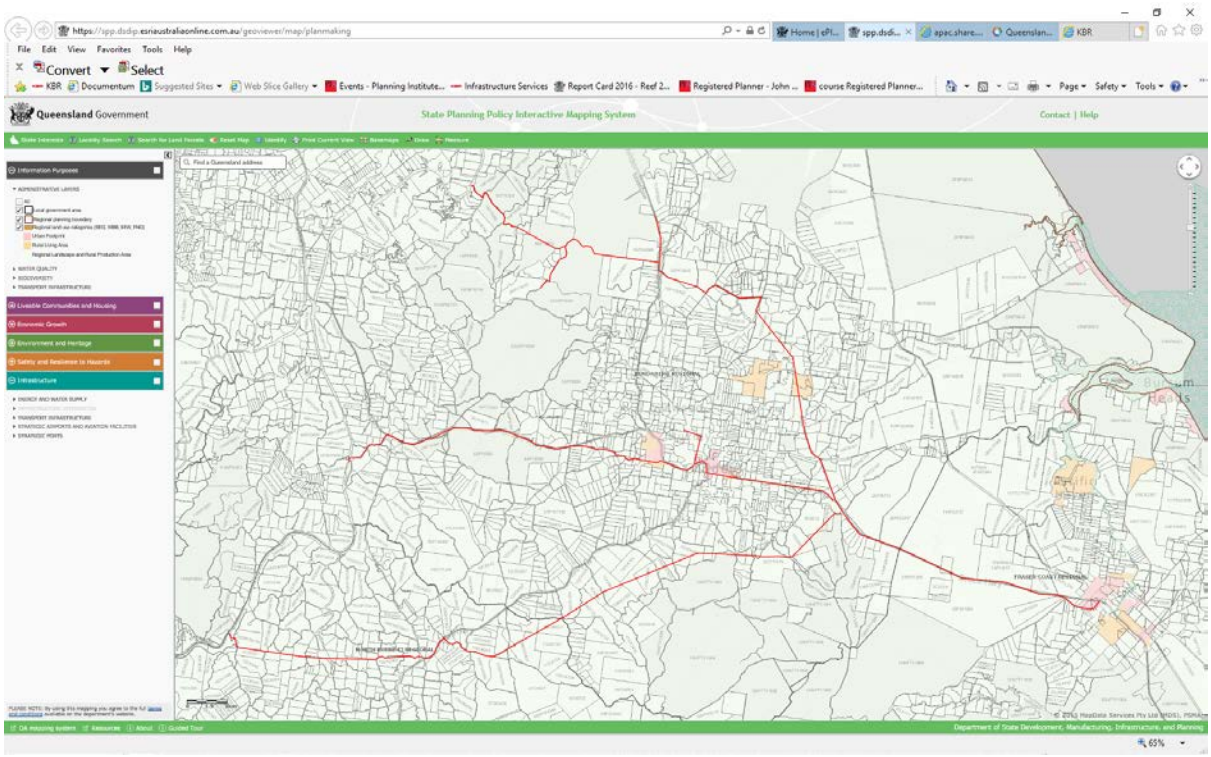
There are creek crossings in MSES regulated vegetation (100m from wetland) mainly in the common area. These coincide with Wetland protection area – Wetlands of high ecological significance and a trigger area around them



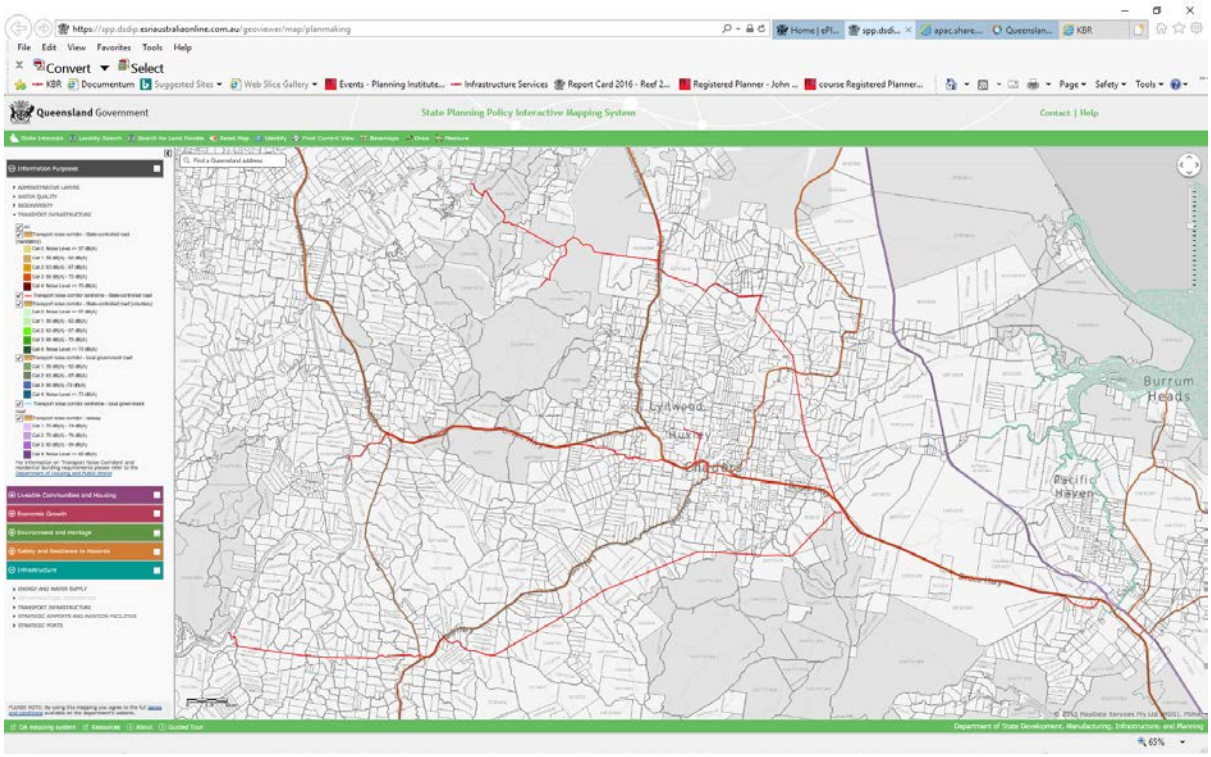
SPP Mapping – Wide Bay Region

GENERAL

Regional Land Use

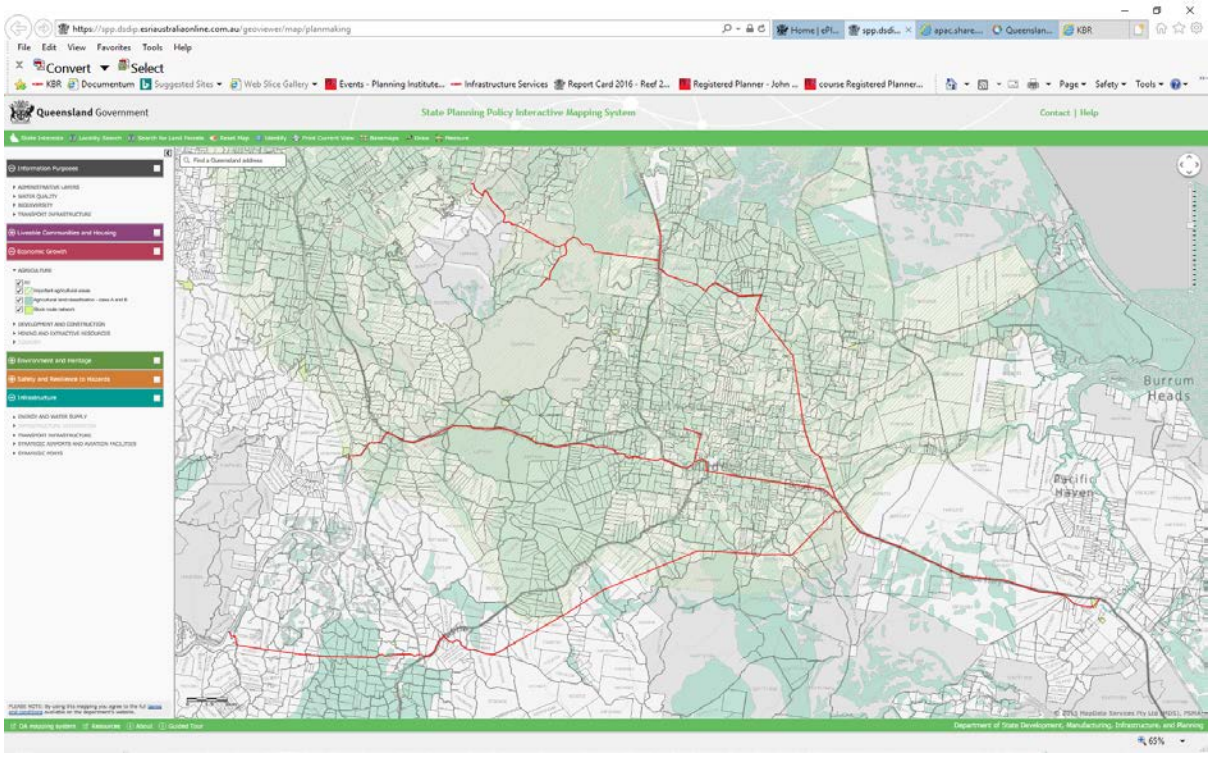


Transport Infrastructure

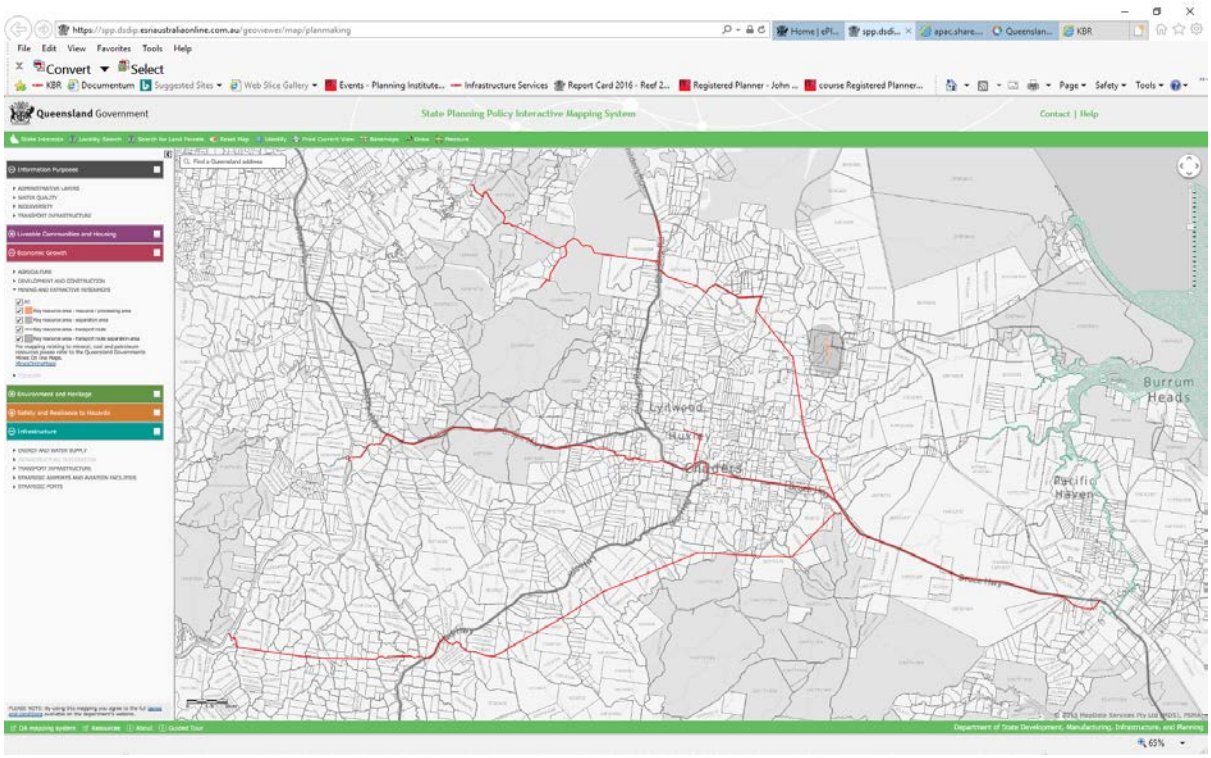


ECONOMIC GROWTH

Agriculture

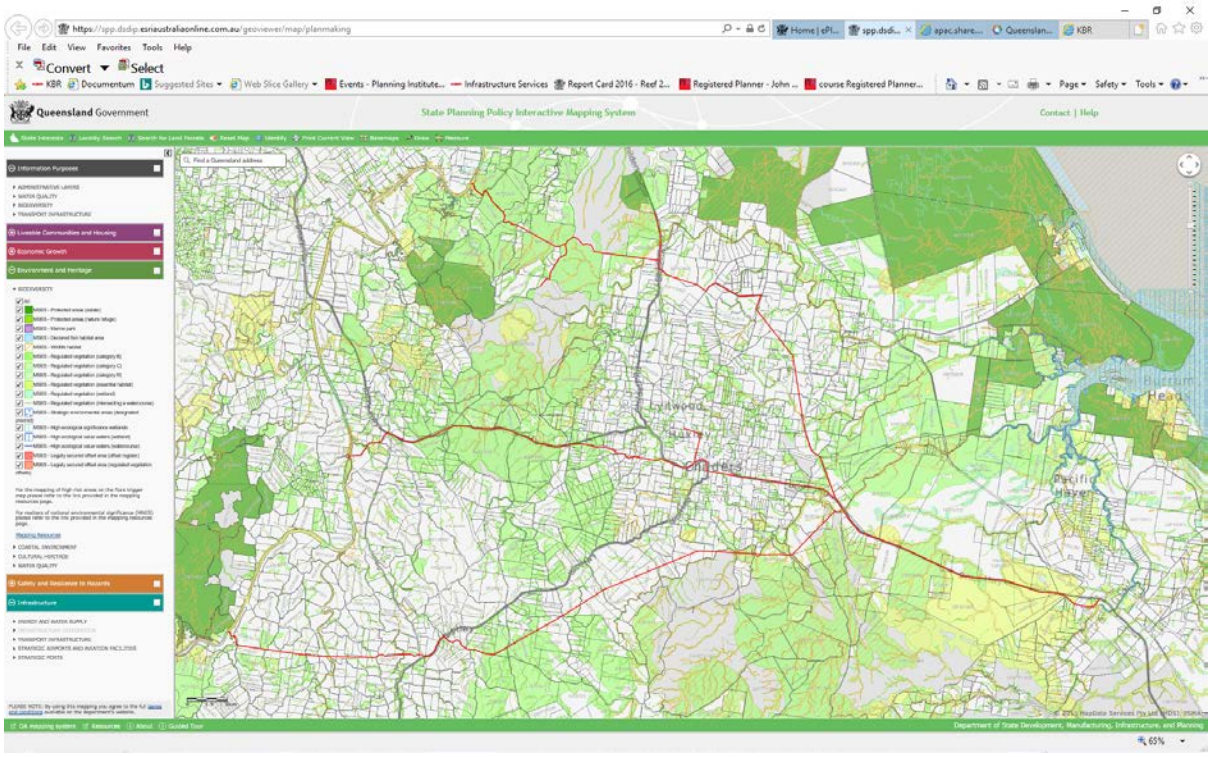


Mining and Extractive Resources



ENVIRONMENT AND HEITAGE

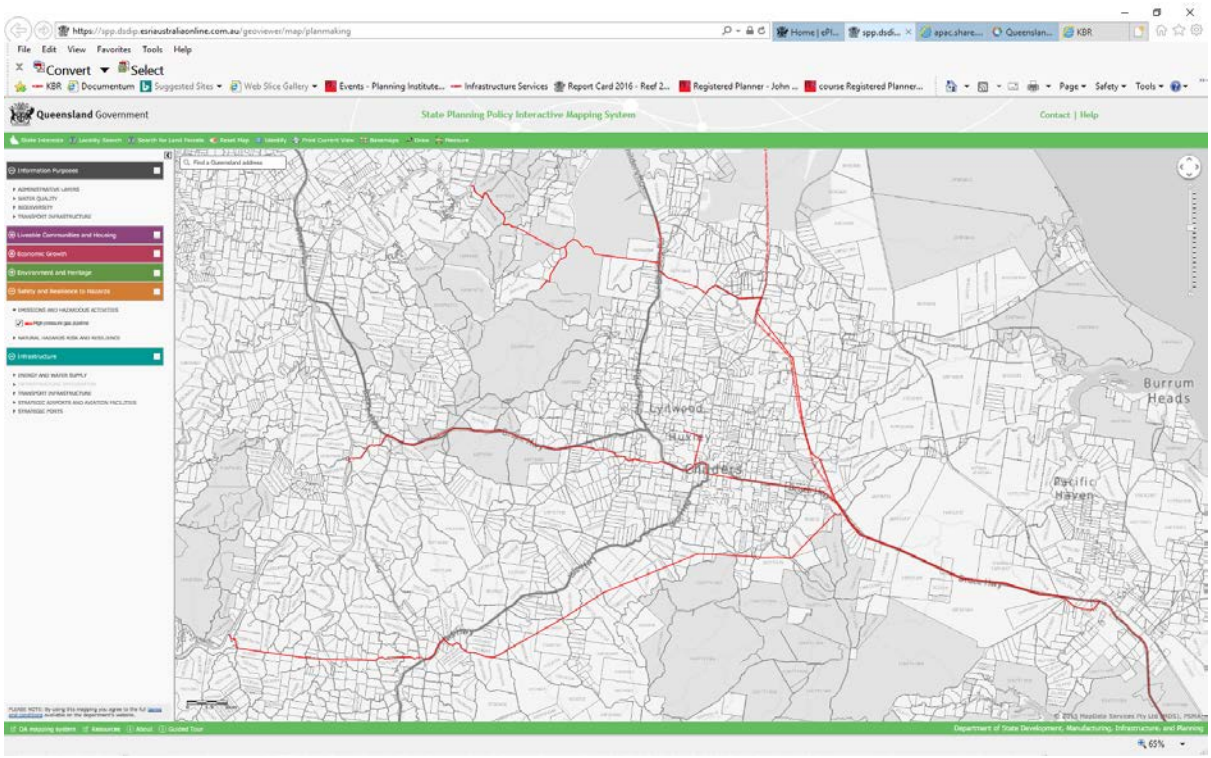
Biodiversity



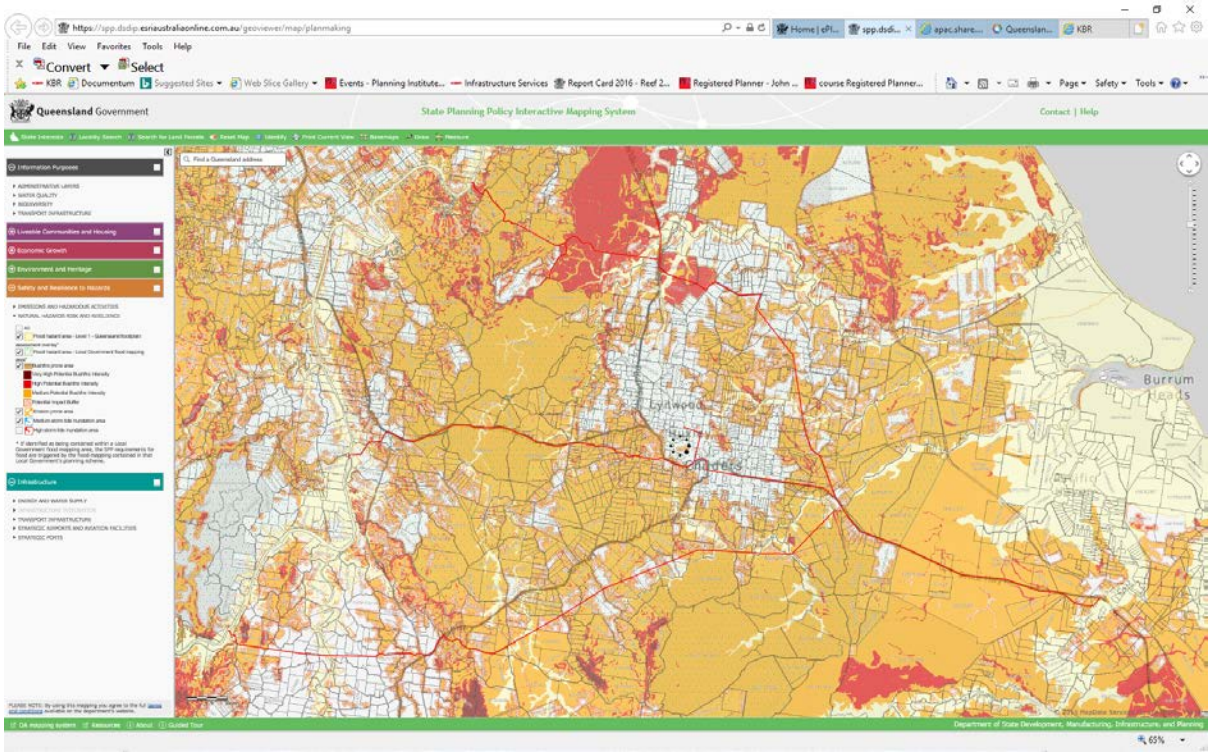
SAFETY AND RESILIENCE TO HAZARDS

Emissions and Hazardous Activities

There is a high pressure gas pipeline running along the Bruce Highway.

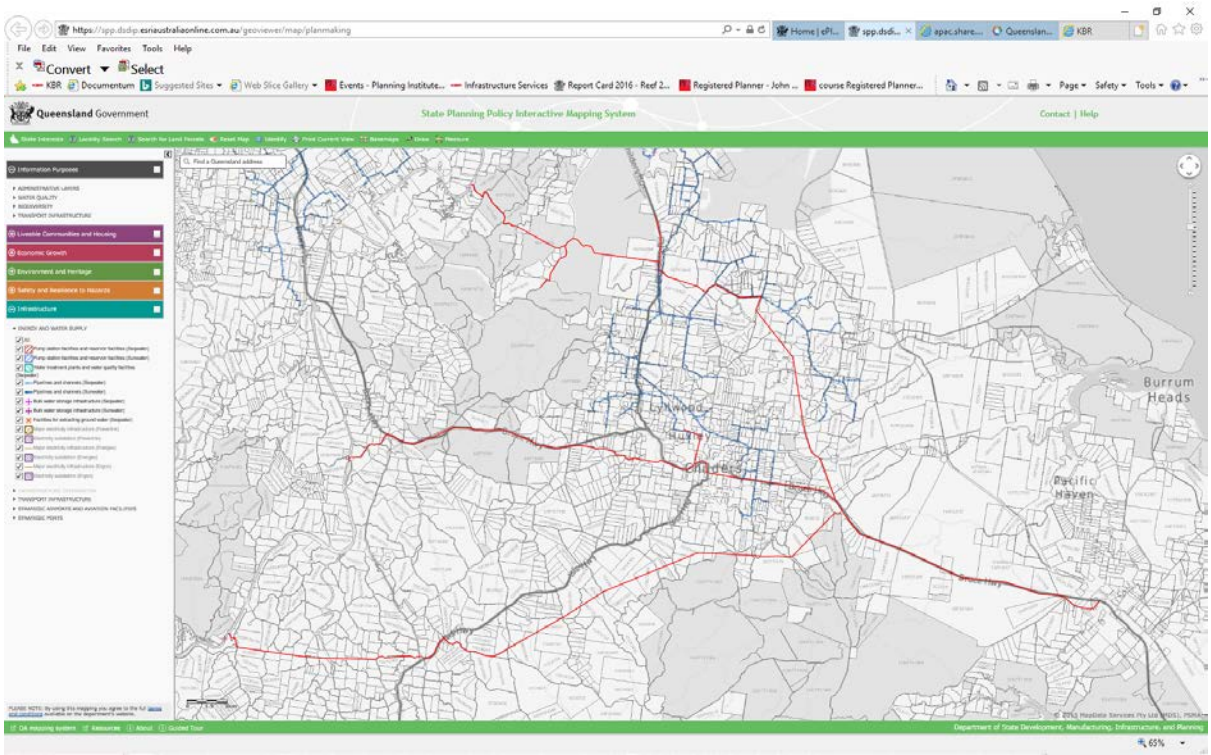


Natural Hazards Risk and Resilience

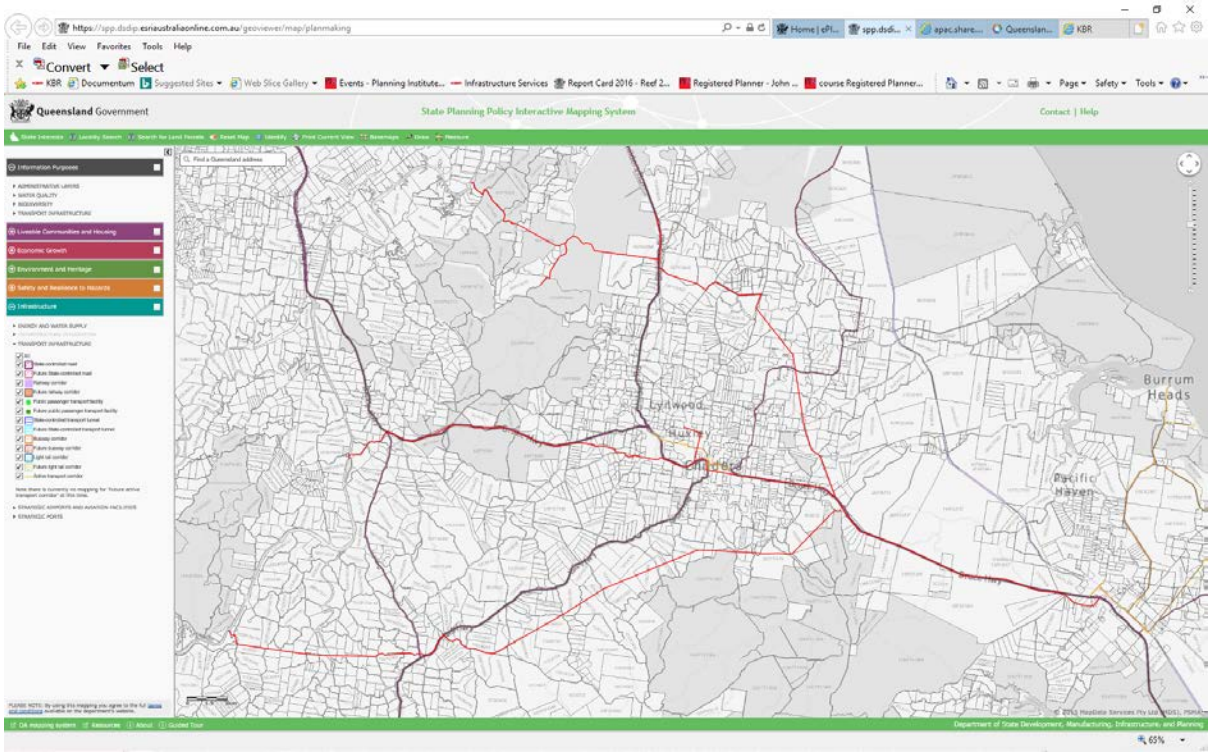


INFRASTRUCTURE

Energy and Water Supply



Transport Infrastructure



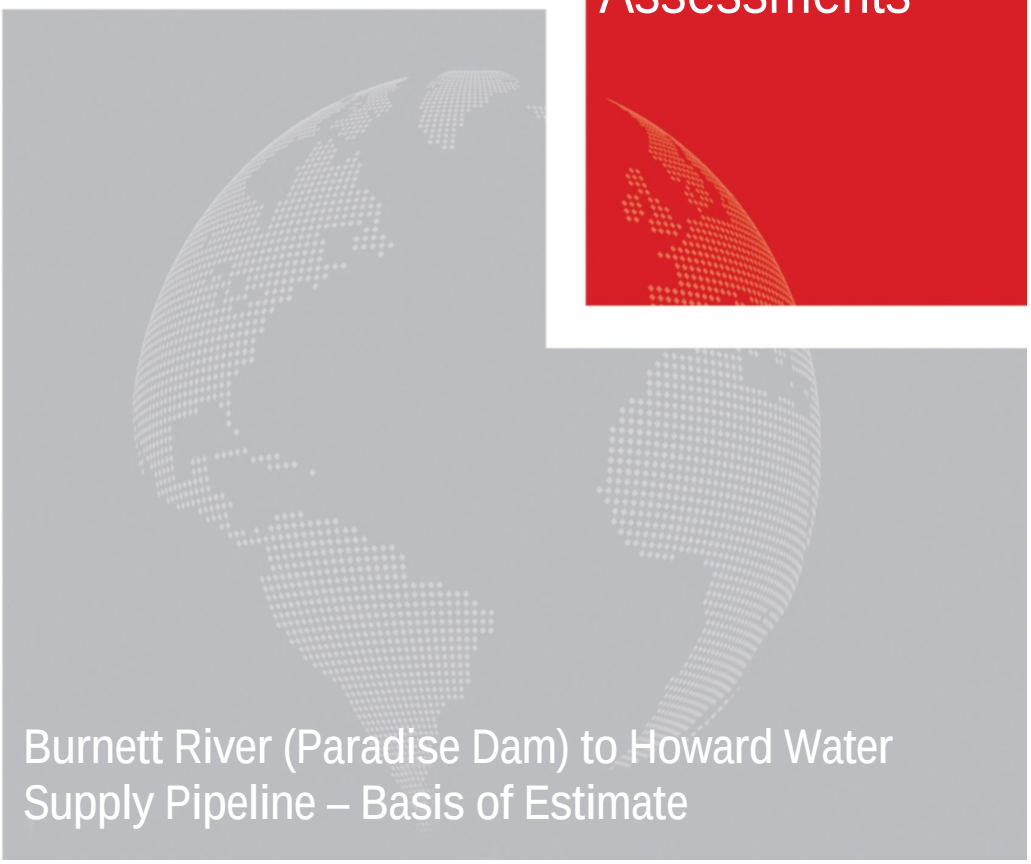
Appendix F

Basis of Estimate

We Deliver

KBR

MIPP Early Stage Assessments

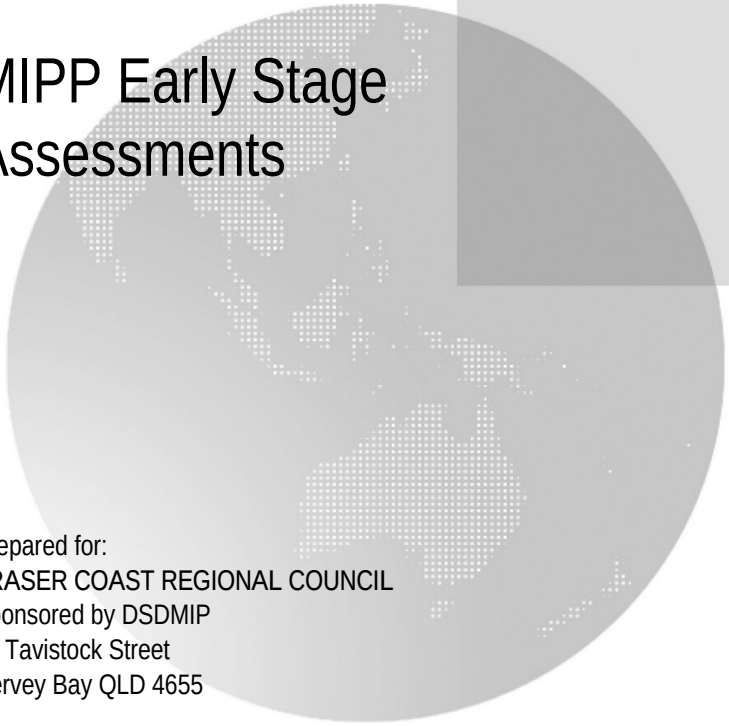


Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Basis of Estimate

We Deliver

Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Basis of Estimate

MIPP Early Stage Assessments



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Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to present the basis of estimate for the Burnett River (Paradise Dam) to Howard Water Supply Pipeline Project in accordance with the scope of services set out in the contract between KBR and Fraser Coast Regional Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from existing infrastructure, existing water capacity, and future demands, in addition to GIS information and past experience on costs associated with similar raw water supply projects. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to Wide Bay Water Corporation's 2015 Fraser Coast Water Supply Strategy, in addition to Client supplied information on existing infrastructure, existing water capacity, and future demands provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning future Hervey Bay water source options. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon Wide Bay Water Corporation's 2015 Fraser Coast Water Supply Strategy, in addition to Client supplied information on existing infrastructure, existing water capacity, and future demands in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
A	14/09/2018	Draft Issue	M. Herring	R. Populin	R. Populin	K. Fung
0	10/10/2018	Final	M. Herring	T. Belgrove	R. Populin	K. Fung

Contents

1 Basis of Estimate

1.1 PURPOSE

This document sets of the Basis of Estimate used for the development of the Level 1 estimate for the Burnett River to Burrum pipeline as part of the Preliminary Evaluation process for the project.

1.2 ESTIMATE CRITERIA

The capital cost estimate has been:

- Prepared to a pre-feasibility study (+50%/-50%) estimate accuracy.
- Expressed in Australian dollars.
- Expressed in cost terms based on August 2018 pricing. The estimate assumes no escalation beyond this base date.
- Developed with the best available information at this time. Additional investigations such as survey and service detection and detailing of staging would be required to improve the estimate accuracy.
- Developed excluding Goods and Services Tax.

1.3 ESTIMATE QUANTIFICATION

1.3.1 Pipeline

Pipeline lengths have been obtained from GIS, based on the alignments identified in the Preliminary Evaluation report.

As limited information on the existing services and ground conditions is known, pipeline alignments have used the most convenient route determined by GIS and aerial imagery. The routes typically lie within road reserves and power line corridors to facilitate construction access and to minimise vegetation clearing.

Service locations and surveying have not been undertaken at this stage of the study.

1.3.2 Pump Stations

Pump stations have been sized with respect to 'total installed kW', in accordance with the criteria discussed in the Preliminary Evaluation report.

1.3.3 Balance Tanks

Balance tanks have been sized based on 2 hours retention time at peak design flows, in accordance with Preliminary Evaluation report.

1.3.4 Power Connections

An allowance for one transformer (11 kW to 415 V) has been included for each option.

Power line lengths have been determined for each option, dependant on the vicinity of the pump stations to the existing power grid.

1.4 ESTIMATE PRICING AND RATE DEVELOPMENT

Estimate rates have been based on experience with similar raw water supply projects, taking into consideration project location and size. Past rates where applicable, include an allowance for escalation to the estimate base date of third quarter 2018 with no escalation past this point.

1.4.1 Supply and Installation of Pipe

Estimate rates for pipe supply and installation have been determined by assessing budget prices, estimating tools and past projects. The pipe supply and install rate is based on a $/m rate and incorporates the following:

- supply of pipe including fittings and delivery
- installation of the pipe including excavation, laying, backfill and reinstatement
- allowance for road/rail/river crossings
- ground constraints (e.g. forested land, open land, roadways)
- testing and commissioning.

An allowance for $100k has been allowed for the connection of the new main to the existing raw water pressure main (DN600 Burrum to Burgowan pipeline). This figure is based on past project experience, and includes allowance for all necessary pipework fittings and instrumentation.

1.4.2 Pump Stations

Estimate rates for pump stations and reservoirs have been determined using estimating tools and past project experience. Pump stations have been sized based on total installed kW, and include all necessary civil works, pumps/pipework, and electrical components.

1.4.3 Balance Tanks

Estimate rates for reservoirs have been determined using estimating tools and past project experience. The adopted rate for reservoirs are based on the total storage required, assuming a ground level concrete structure with allowance for metal work for rails, access etc. The rate includes an allowance for pipework and valving within the site, and includes a small allowance for earthworks and landscaping.

1.4.4 Power Connections

Estimate rates for power connections and power lines have been based on past project experience. The adopted rate for power connections includes a per metre rate for power lines and a fixed cost for transformers and connections.

1.5 ESTIMATE ALLOWANCES AND OVERHEADS

The following allowances have been incorporated into the capital cost estimate:

- Design and Site investigations: A design and site investigations allowance of 10% of the construction cost, based on industry standards, has been included in the estimate.
- Project Management: A project management allowance of 5% of the construction cost, based on industry standards, has been included in the estimate.
- Contract Management: A contract management allowance of 7.5% of the construction cost, based on industry standards, has been included in the estimate.

1.6 RISK CONTINGENCY

A risk contingency allowance of 40% of the construction cost has been included in the estimate. The contingency includes an allowance for Risks of Scope, Estimate, Market ,Technology / Complexity, Localised community impact, Traffic Control, Access and Constructability / Constraints.

1.7 ESTIMATE ASSUMPTIONS

Estimate assumptions include the following:

- Works can be completed in the road reserve and power line corridors to reduce vegetation clearing.
- All work to be completed via trenching, no requirement for tunnelling.
- No allowance for relocation of services has been included. No survey or service location has been undertaken and service relocations are not expected to differ in costs between options.
- All excavation costs assume the ground is moderately constrained good soil with minimum ground improvement works required and do not include allowance for adverse soil conditions. No geotechnical information is available, however will be required to confirm design parameters.
- Minimum cover is assumed for the length of the pipeline.
- Spacing between air valves and scour valves is approximately 500m for the length of the pipeline.
- Cathodic protection cost is incorporated into the pipeline rate.

1.8 EXCLUSIONS

The following items have been excluded from the capital estimate:

- operational and capital spares
- any environmental, cultural or heritage requirement
- relocation of buried services along the pipe route
- impacts from future geotechnical data or surveying
- allowance for removal and or remediation of contaminated materials on site
- escalation past the estimate base date of August 2018
- foreign currency fluctuations
- financing costs
- government duties, taxes, permit fees etc.
- Goods and Services Tax (GST)
- no allowance for service relocations
- no allowance for state or federal government subsidies.

Appendix G

Cost Estimate

We Deliver

CAPITAL COST ESTIMATE

Client: **Fraser Coast Regional Council**
Project: **Burnett River to Howard Pipeline**
Description: **Option 1A - Ned Churchward Weir to Burrum (inc offtakes)**
Prepared: **10/08/18**

Item	Description		Rate ($)	Qty	Unit	Amount	Comments
1	**Construction Works**						
1.1	**PIPELINE**						
	Ground Constraint						
	Cattle Land - Open		$ 806	3,500	m	$ 2,822,625	
	Forrested Land (clearing required)		$ 971	-	m	$ -	
	Power Line (easement) - Open		$ 838	15,000	m	$ 12,571,314	
	Minor Road (verge) - No Reinstatement		$ 865	29,000	m	$ 25,089,705	
	Highway (verge) - No Reinstatement		$ 919	18,500	m	$ 17,007,264	
	Connection to existing raw water pressure main		$ 100,000	1	Item	$ 100,000	
	Subtotal					**$ 57,590,908**	
1.2	**OFFTAKES**						
	Pipe size						
	DN225	Area A - Minor Road (verge) - No Reinstatement	$ 324	4,490	m	$ 1,454,760	
	DN225	Area B - Highway (verge) - No Reinstatement	$ 345	3,490	m	$ 1,203,149	
	DN375	Area C - Minor Road (verge) - No Reinstatement	$ 541	1,240	m	$ 670,501	
	Subtotal					**$ 3,328,410**	
1.3	**INTAKE PUMP STATION**						
	Total installed kW						
	1000 kW		$ 4,467,696	1	Item	$ 4,467,696	2 x 500kW pumps
	50% Allowance for Intake Structure		$ 2,233,848	1	Item	$ 2,233,848	
	Subtotal					**$ 6,701,543**	
1.4	**INTERMEDIATE PUMP STATION**						
	Total installed kW						
	400 kW		$ 2,492,504	1	Item	$ 2,492,504	Booster Pump 1 in Area B. two 160kW pumps. Rounded to 400kW station
	Subtotal					**$ 2,492,504**	
1.5	**BALANCE TANK 1**						
	Tank Size	*Earth Works*					
	2.5 ML	No major earthworks required	$ 808,031	1	Item	$ 808,031	Assumed no major earthworks are required
	Subtotal					**$ 808,031**	
1.6	**POWER CONNECTIONS**						
	Power Lines 11 kV		$ 250	6,000	m	$ 1,500,000	
	Kiosk transformer (11 kV to 415 V)		$ 250,000	1	Item	$ 250,000	
	Subtotal					**$ 1,750,000**	
V	**Sub-total of Construction Works**					**$ 72,671,397**	
	CONSTRUCTION - TOTAL (ex GST)					$ 72,671,397	
	Risk and Contingency		40%	=% Item V	%	$ 29,068,559	
W	**TOTAL**					**$ 101,739,955**	
	Owners Costs, Statutory Approvals & Design						
	Easement and Land Purchase (in km)						
	Land Type						
	Grass Paddock		$ 150	20800	m	**$ 3,120,000**	
	Farm Land (Cane etc)		$ 300	4500	m	**$ 1,350,000**	
	Urban		$ 600	0	m	**$** -	
	DESIGN AND CONSTRUCTION MANAGEMENT						
	Design & Site Investigations		10%	=% Item W	%	$ 10,173,996	
	Project Management		5%	=% Item W	%	$ 5,086,998	
	Contract Management		7.5%	=% Item W	%	$ 7,630,497	
	Subtotal Design And Construction Management					**$ 27,361,490**	
		TOTAL PROJECT COSTS (ex GST)				**$ 129,101,445**	
		Rounded to nearest $0.1m				**$ 129,100,000**	

CAPITAL COST ESTIMATE

Client: **Fraser Coast Regional Council**
Project: **Burnett River to Howard Pipeline**
Description: **Option 1B - Ned Churchward Weir to Burrum (no offtakes)**
Prepared: **10/08/18**

Item	Description		Rate ($)	Qty	Unit		Amount	Comments
1	**Construction Works**							
1.1	**PIPELINE**							
	Ground Constraint							
	Cattle Land - Open		$ 806	3,500	m	$	2,822,625	
	Forrested Land (clearing required)		$ 971	-	m	$	-	
	Power Line (easement) - Open		$ 838	15,000	m	$	12,571,314	
	Minor Road (verge) - No Reinstatement		$ 865	29,000	m	$	25,089,705	
	Highway (verge) - No Reinstatement		$ 919	18,500	m	$	17,007,264	
	Connection to existing raw water pressure main		$ 100,000	1	Item	$	100,000	
	Subtotal					**$**	**57,590,908**	
1.3	**INTAKE PUMP STATION**							
	Total installed kW							
	900 kW		$ 4,232,554	1	Item	$	4,232,554	2 x 425kW pumps. Rounded to 900kW station
	50% Allowance for Intake Structure		$ 2,116,277	1	Item	$	2,116,277	
	Subtotal					**$**	**6,348,831**	
1.4	**INTERMEDIATE PUMP STATION**							
	Total installed kW							
	400 kW		$ 2,492,504	1	Item	$	2,492,504	Booster Pump 1 in Area B. two 160kW pumps. Rounded to 400kW station
	Subtotal					**$**	**2,492,504**	
1.5	**BALANCE TANK 1**							
	Tank Size	*Earth Works*						
	2.5 ML	No major earthworks required	$ 808,031	1	Item	$	808,031	2.2ML reservior required. Rounded to 2.5ML and assumed no major earthworks are required
	Subtotal					**$**	**808,031**	
1.6	**POWER CONNECTIONS**							
	Power Lines 11 kV		$ 250	6,000	m	$	1,500,000	
	Kiosk transformer (11 kV to 415 V)		$ 250,000	1	Item	$	250,000	
	Subtotal					**$**	**1,750,000**	
V	**Sub-total of Construction Works**					**$**	**68,990,274**	
	CONSTRUCTION - TOTAL (ex GST)					$	68,990,274	
	Risk and Contingency		40%	=% Item V	%	$	27,596,110	
W	**TOTAL**					**$**	**96,586,384**	
	Owners Costs, Statutory Approvals & Design							
	Easement and Land Purchase (in km)							
	Land Type							
	Grass Paddock		$ 150	12900	m	**$**	**1,935,000**	
	Farm Land (Cane etc)		$ 300	4500	m	**$**	**1,350,000**	
	Urban		$ 600	0	m	**$**	**-**	
	DESIGN AND CONSTRUCTION MANAGEMENT							
		Design & Site Investigations	10%	=% Item W	%	$	9,658,638	
		Project Management	5%	=% Item W	%	$	4,829,319	
		Contract Management	7.5%	=% Item W	%	$	7,243,979	
	Subtotal Design And Construction Management					**$**	**25,016,936**	
		TOTAL PROJECT COSTS (ex GST)				**$**	**121,603,320**	
		Rounded to nearest $0.1m				**$**	**121,600,000**	

CAPITAL COST ESTIMATE

Client: Fraser Coast Regional Council
Project: Burnett River to Howard Pipeline
Description: Option 2A - Causeway Road to Burrum (inc offtakes)
Prepared: 10/08/18

Item	Description		Rate ($)	Qty	Unit	Amount	Comments
1	**Construction Works**						
1.1	**PIPELINE**						
	Ground Constraint						
	Cattle Land - Open		$ 806	1,500	m	$ 1,209,696.24	
	Forrested Land (clearing required)		$ 971	-	m	$ -	
	Power Line (easement) - Open		$ 838	-	m	$ -	
	Minor Road (verge) - No Reinstatement		$ 865	18,000	m	$ 15,572,920.56	
	Highway (verge) - No Reinstatement		$ 919	42,300	m	$ 38,886,880.12	
	Connection to existing raw water pressure main		$ 100,000	1	Item	$ 100,000	
	Subtotal					**$ 55,769,497**	
1.2	**OFFTAKES**						
	Pipe size						
	DN150	Area C - Minor Road (verge) - No Reinstatement	$ 216	2700	m	$ 583,985	
	DN150	Area C - Cattle Land - Open	$ 202	900	m	$ 181,454	
	Subtotal					**$ 765,439**	
1.3	**INTAKE PUMP STATION**						
	Total installed kW						2 x 590kW pumps. Rounded to 1200kW station
	1200 kW		$ 5,079,064	1	Item	$ 5,079,064	
	50% Allowance for Intake Structure		$ 2,539,532	1	Item	$ 2,539,532	
	Subtotal					**$ 7,618,597**	
1.4	**BALANCE TANK 1**						
	Tank Size	*Earth Works*					2.3ML reservior required. Rounded to 2.5ML and assumed no major earthworks are required
	2.5 ML	No major earthworks required	$ 808,031	1	Item	$ 808,031	
	Subtotal					**$ 808,031**	
1.5	**POWER CONNECTIONS**						
	Power Lines 11 kV		$ 250	14000	m	$ 3,500,000	
	Kiosk transformer (11 kV to 415 V)		$ 250,000	1	Item	$ 250,000	
	Subtotal					**$ 3,750,000**	
V	**Sub-total of Construction Works**					**$ 68,711,564**	
	CONSTRUCTION - TOTAL (ex GST)					$ 68,711,564	
	Risk and Contingency		40%	=% Item V	%	$ 27,484,626	
W	**TOTAL**					**$ 96,196,190**	
	Owners Costs, Statutory Approvals & Design						
	Easement and Land Purchase (in km)						
	Land Type						
	Grass Paddock		$ 150	2100	m	**$ 315,000**	
	Farm Land (Cane etc)		$ 300	0	m	**$ -**	
	Urban		$ 600	0	m	**$ -**	
	DESIGN AND CONSTRUCTION MANAGEMENT						
		Design & Site Investigations	10%	=% Item W	%	$ 9,619,619	
		Project Management	5%	=% Item W	%	$ 4,809,809	
		Contract Management	7.5%	=% Item W	%	$ 7,214,714	
	Subtotal Design And Construction Management					**$ 21,959,143**	
		TOTAL PROJECT COSTS (ex GST)				**$ 118,155,332**	
		Rounded to nearest $0.1m				**$ 118,200,000**	

CAPITAL COST ESTIMATE

Client: **Fraser Coast Regional Council**
Project: **Burnett River to Howard Pipeline**
Description: **Option 2B - Causeway Road to Burrum (no offtakes)**
Prepared: **10/08/18**

Item	Description		Rate ($)	Qty	Unit	Amount	Comments
1	**Construction Works**						
1.1	**PIPELINE**						
	Ground Constraint						
	Cattle Land - Open		$ 806	1,500	m	$ 1,209,696.24	
	Forrested Land (clearing required)		$ 971	-	m	$ -	
	Power Line (easement) - Open		$ 838	-	m	$ -	
	Minor Road (verge) - No Reinstatement		$ 865	18,000	m	$ 15,572,920.56	
	Highway (verge) - No Reinstatement		$ 919	42,300	m	$ 38,886,880.12	
	Connection to existing raw water pressure main		$ 100,000	1	Item	$ 100,000	
	Subtotal					**$ 55,769,497**	
1.2	**INTAKE PUMP STATION**						
	Total installed kW						
	1100 kW		$ 4,785,137	1	Item	$ 4,785,137	2 x 530kW pumps. Rounded to 1100kW station
	10% Allowance for Intake Structure		$ 478,514	1	Item	$ 478,514	
	Subtotal					**$ 5,263,651**	
1.3	**BALANCE TANK 1**						
	Tank Size	*Earth Works*					
	2.5 ML	No major earthworks required	$ 808,031	1	Item	$ 808,031	2.2ML reservior required. Rounded to 2.5ML and assumed no major earthworks are required
	Subtotal					**$ 808,031**	
1.4	**POWER CONNECTIONS**						
	Power Lines 11 kV		$ 250	14000	m	$ 3,500,000	
	Kiosk transformer (11 kV to 415 V)		$ 250,000	1	Item	$ 250,000	
	Subtotal					**$ 3,750,000**	
V	**Sub-total of Construction Works**					**$ 65,591,179**	
	CONSTRUCTION - TOTAL (ex GST)					$ 65,591,179	
	Risk and Contingency		40%	=% Item V	%	$ 26,236,472	
W	**TOTAL**					**$ 91,827,651**	
	Owners Costs, Statutory Approvals & Design						
	Easement and Land Purchase (in km)						
	Land Type						
	Grass Paddock		$ 150	1200	m	**$ 180,000**	
	Farm Land (Cane etc)		$ 300	0	m	**$** -	
	Urban		$ 600	0	m	**$** -	
	DESIGN AND CONSTRUCTION MANAGEMENT						
		Design & Site Investigations	10%	=% Item W	%	$ 9,182,765	
		Project Management	5%	=% Item W	%	$ 4,591,383	
		Contract Management	7.5%	=% Item W	%	$ 6,887,074	
	Subtotal Design And Construction Management					**$ 20,841,221**	
			TOTAL PROJECT COSTS (ex GST)			**$ 112,668,872**	
			Rounded to nearest $0.1m			**$ 112,700,000**	

CAPITAL COST ESTIMATE

Client: **Fraser Coast Regional Council**
Project: **Burnett River to Howard Pipeline**
Description: **Option 3 - Paradise Dam to Burrum**
Prepared: **10/08/18**

Item	Description	Rate ($)	Qty	Unit	Amount	Comments
1	**Construction Works**					
1.1	**PIPELINE**					
	Ground Constraint					
	Cattle Land - Open	$ 806	11,400	m	$ 9,193,691	
	Forrested Land (clearing required)	$ 971	1,600	m	$ 1,553,724	
	Power Line (easement) - Open	$ 838	30,200	m	$ 25,310,245	
	Minor Road (verge) - No Reinstatement	$ 865	8,500	m	$ 7,353,879	
	Highway (verge) - No Reinstatement	$ 919	19,700	m	$ 18,110,438	
	Connection to existing raw water pressure main	$ 100,000	1	Item	$ 100,000	
	Subtotal				**$ 61,621,978**	
1.2	**INTAKE PUMP STATION**					
	Total installed kW					
	1100 kW	$ 4,785,137	1	Item	$ 4,785,137	2 x 530kW pumps. Rounded to 1100kW station
	50% Allowance for Intake Structure	$ 2,392,569	1	Item	$ 2,392,569	
	Subtotal				**$ 7,177,706**	
1.3	**BALANCE TANK 1**					
	Tank Size *Earth Works*					
	2.5 ML No major earthworks required	$ 808,031	1	Item	$ 808,031	2.2ML reservior required. Rounded to 2.5ML and assumed no major earthworks are required
	Subtotal				**$ 808,031**	
1.4	**POWER CONNECTIONS**					
	Power Lines 11 kV	$ 250	8000	m	$ 2,000,000	
	Kiosk transformer (11 kV to 415 V)	$ 250,000	1	Item	$ 250,000	
	Subtotal				**$ 2,250,000**	
V	**Sub-total of Construction Works**				**$ 71,857,715**	
	CONSTRUCTION - TOTAL (ex GST)				$ 71,857,715	
	Risk and Contingency	40%	=% Item V	%	$ 28,743,086	
W	**TOTAL**				**$ 100,600,801**	
	Design And Construction Management					
	Easement and Land Purchase (in km)					
	Land Type					
	Grass Paddock	$ 150	43200	m	**$ 6,480,000**	
	Farm Land (Cane etc)	$ 300	0	m	**$ -**	
	Urban	$ 600	0	m	**$ -**	
	DESIGN AND CONSTRUCTION MANAGEMENT					
	Design & Site Investigations	10%	=% Item W	%	$ 10,060,080	
	Project Management	5%	=% Item W	%	$ 5,030,040	
	Contract Management	7.5%	=% Item W	%	$ 7,545,060	
	Subtotal Design And Construction Management				**$ 29,115,180**	
		TOTAL PROJECT COSTS (ex GST)			**$ 129,715,982**	
		Rounded to nearest $0.1m			**$ 129,700,000**	

Appendix H

Economic Analysis Report

We Deliver

Economic Evaluation of the Burnett River Pipeline Project

Final report to Kellogg Brown & Root

October 2018

Synergies Economic Consulting Pty Ltd
www.synergies.com.au

Disclaimer

Synergies Economic Consulting (Synergies) has prepared this report exclusively for the use of the party or parties specified in the report (the client) for the purposes specified in the report (Purpose). The report must not be used by any person other than the client or a person authorised by the client or for any purpose other than the Purpose for which it was prepared.

The report is supplied in good faith and reflects the knowledge, expertise and experience of the consultants involved at the time of providing the report.

The matters dealt with in this report are limited to those requested by the client and those matters considered by Synergies to be relevant for the Purpose.

The information, data, opinions, evaluations, assessments and analysis referred to in, or relied upon in the preparation of, this report have been obtained from and are based on sources believed by us to be reliable and up to date, but no responsibility will be accepted for any error of fact or opinion.

To the extent permitted by law, the opinions, recommendations, assessments and conclusions contained in this report are expressed without any warranties of any kind, express or implied.

Synergies does not accept liability for any loss or damage including without limitation, compensatory, direct, indirect or consequential damages and claims of third parties, that may be caused directly or indirectly through the use of, reliance upon or interpretation of, the contents of the report.

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Executive Summary

Synergies Economic Consulting (Synergies) has been engaged to undertake the economic analysis of the Burnett River (Paradise Dam) to Howard Water Supply Pipeline project (the Burnett River pipeline project) in accordance with the requirements for a Preliminary Evaluation (PE) as set out in the Queensland Government's Project Assessment Framework (PAF).

The following approach was applied to undertake this economic analysis:

- define and quantify cashflows under the base case, with particular regard to the urban water supply-demand balance for the region and the implications for the timing of a supply augmentation and the frequency and severity of restrictions;
- define the reference project options to be assessed against the base case;
- identify and, where possible, quantify the economic benefits and costs of the reference project options relative to the base case, based on a review of available data and information and consultation with project stakeholders;
- conduct discounted cashflow modelling of the economic benefits and costs to calculate the Net Present Value (NPV) and Benefit Cost Ratio (BCR) for each reference project option; and
- conduct sensitivity and scenario analysis on the results.

The base case against which the reference project options are to be assessed can be summarised as follows:

- in the event that a supply augmentation is required, the Fraser Coast Island option has been identified as the option most likely to be adopted. However, no cost associated with this augmentation has been included in the base case due to the long-term water supply-demand projections indicating that augmentation will not be required within the next 30 years;
- a total cost of $45.16 million (PV terms) to be incurred by urban water users as a result of the implementation of level 3 as well as level 4 water restrictions; and
- no cost has been included in relation to emergency supply measures, based on the long-term urban water supply-demand projections for the Hervey Bay region.

The reference project involves the construction of a new pipeline and associated pump station over a four-year period to 2023 to transport approximately 22 ML of water per day (or around 8,000 ML per annum) from three identified route options to the Burrum Weir Pump Station (see Figure 3).

The following alternative route options have been identified:

- Option 1A – supply from Ned Churchward Weir to Burrum, in addition to offtakes for agricultural production;
  - Option 1B – as above, but excluding offtakes;
- Option 2A – supply from Causeway Road to Burrum, in addition to offtakes for agricultural production;
  - Option 2B – as above, but excluding offtakes; and
- Option 3 – supply from Paradise Dam to Burrum.

Two economic benefits were assessed for these reference project options relative to the base case:

- avoided cost of water restrictions
- economic value derived from water use for agricultural production.

Note that given no costs associated with water supply augmentations or emergency water supply measures have been included in the base case, there are no benefits associated with the avoidance of these costs under the reference project options.

The economic benefits of the avoided cost of water restrictions were the same for each option. Based on estimates provided in relation to the frequency of level 3 and 4 restrictions under the reference project options relative to the base case, the economic benefit was estimated at $18.98 million (in PV terms) for all reference project options.

For the benefits associated with agricultural water use, the following key activities and irrigator demands were identified for two reference project options:

- Ned Churchward Weir to Burrum (Option 1A):
  - 500 ML of high priority water per annum for the production of citrus crops
  - 500 ML of high priority water per annum for the production of avocados
  - 2,600 ML of medium priority water per annum for the production of sugarcane
- Causeway Road to Burrum (Option 2A):
  - 500 ML of high priority water per annum for avocado production.

Based on estimates relating to the irrigation application rates, crop yields, crop prices, crop establishment and production costs and the opportunity cost of land used for crop production, the economic benefits from agricultural water use were estimated at $16.78 million for Option 1A and $1.75 million for Option 2A, both in PV terms.

The economic costs to be incurred under the reference project options are:

- capital costs
- operating and maintenance costs, including electricity costs
- water allocation costs.

The PV estimates for these economic costs for each reference project option are summarised, in addition to the economic benefits, in the table below.

Summary of results from the economic analysis

Metric	Present Value Estimates ($ million)				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Economic benefits					
Avoidance of severe water restriction	$18.98	$18.98	$18.98	$18.98	$18.98
Increased agricultural production	$16.78	n/a	$1.75	n/a	n/a
Total benefits	**$35.76**	**$18.98**	**$20.73**	**$18.98**	**$18.98**
Economic costs					
Capital costs	$104.89	$98.80	$96.04	$91.57	$105.38
Operating and maintenance costs	$12.43	$9.30	$9.15	$7.81	$9.11
Water allocation costs	$34.52	$30.65	$31.54	$29.68	$29.68
Total costs	**$151.84**	**$138.74**	**$136.72**	**$129.06**	**$144.17**
Benefit Cost Ratio	**0.24**	**0.14**	**0.15**	**0.15**	**0.13**
Net Present Value	**($116.08)**	**($119.77)**	**($115.99)**	**($110.08)**	**($125.19)**

The results in the table highlight the following:

- the NPV of all reference project options are significantly negative
- the BCRs are well below 1 under all reference project route options.

Given the absence of a major supply augmentation under the base case and the relatively low volumes of water to be used for agricultural production, the poor performance of the reference project options relative to the base case is not unexpected. It is noted that were the Hervey Bay region to suffer a prolonged drought in the short to medium term to the extent that a supply augmentation was required, the economic benefits of the reference project options would increase significantly (although unlikely to the extent necessary to result in a positive NPV).

Sensitivity analysis was conducted on key assumptions and parameter estimates. The conclusions from this sensitivity analysis were as follows:

- base NPV results are not overly sensitive to changes in the discount rate or the economic cost of water restrictions; and
- base NPV results are somewhat sensitive to changes in capital costs under all five reference project options, i.e. variation of around ±16-18 per cent.

These results are consistent with the significance of the capital cost of the reference project options in relation to the NPV of the four options.

A scenario was also modelled under which the Maryborough to Hervey Bay Interconnector project was constructed under the base case. This project is currently under consideration and would enable up to 1,500 ML of water to be transported between Maryborough and Hervey Bay annually, thereby reducing the incidence of level 3 and 4 water restrictions in Hervey Bay. Whilst the BCRs of the reference project options are improved under this scenario (due to the benefit from avoiding the capital cost of the interconnector project), the NPVs of all reference project options remain negative under all reference project options with BCRs of well below 1 (0.36 being the highest).

In summary, under all sensitivities and scenarios tested, the reference project options result in a significant net economic cost. This is primarily attributable to the significant up-front cost associated with the reference project options, including the capital costs and the cost of purchasing water allocations, and the absence of a major water supply augmentation under the base case (that is, the urban water supply-demand balance does not indicate that a new supply source is necessary over the 30-year study period).

Contents

Figures and Tables

1 Introduction

Synergies Economic Consulting (Synergies) has been engaged to undertake the economic analysis of the Burnett River (Paradise Dam) to Howard Water Supply Pipeline project (the Burnett River pipeline project) in accordance with the requirements for a Preliminary Evaluation (PE) as set out in the Queensland Government's Project Assessment Framework (PAF).

The Burnett River pipeline project is being progressed as part of the State Government's *Maturing the Infrastructure Pipeline Program*. The objective of the project is to provide a suitable long-term water source solution for the Fraser Coast region. The project was identified as the preferred long-term supply augmentation option based on an options analysis conducted by Kellogg Brown and Root (KBR).

This report contains the economic assessment of the Burnett River pipeline project. The economic benefits and costs of the project options have been assessed against the base case using the well-accepted cost-benefit analysis technique, in accordance with the requirements in the PAF.

The report has been structured as follows:

- section 2 outlines the methodology, assumptions and data sources used;
- section 3 defines the base case against which the reference project options are to be assessed;
- section 4 describes the reference project options;
- section 5 assesses and quantifies the economic benefits under the reference project options;
- section 6 assesses and quantifies the economic costs to be incurred under the reference project options;
- section 7 sets out the results of the economic analysis of the reference project options, including the results of the sensitivity and scenario analysis; and
- section 8 details the key findings and conclusions.

2 Approach

This section sets out our approach to undertaking the economic analysis and the key assumptions to be applied.

2.1 Methodology

In accordance with the PE (and Cost-Benefit Analysis) guideline under the PAF, the following approach was applied in undertaking the cost-benefit analysis:

- define the base case, with particular regard to:
  - the urban water supply-demand balance for the region over the study period;
  - the water supply augmentation(s) likely to be pursued under the base case (based on discussions with personnel from the Fraser Coast Regional Council (FCRC) and other relevant stakeholders), including the feasibility and cost of the various augmentation options;
  - the frequency and severity of water restrictions over the study period;
  - the likelihood that emergency water supply measures will be required over the study period;
- quantify cash flows that ensue from the base case over the study period;
- define the reference project options for which economic benefits and costs are to be assessed relative to the base case;
- identify all economic benefits and costs to be assessed under the reference project options, based on an assessment of available data and information and consultation with project stakeholders;
- where possible, quantify economic benefits and costs under the reference project options;
- where impacts are not able to be quantified, undertake a detailed qualitative evaluation of the nature of the impact;
- conduct discounted cashflow modelling of the economic benefits and costs of the reference project options and calculate the Net Present Value (NPV) and Benefit Cost Ratio (BCR) for each option; and
- conduct sensitivity and scenario analysis to assess the impact of changes to key parameters and assumptions on the results.

2.2 Key assumptions

The key assumptions for this economic analysis are:

- a real discount rate of 7 per cent, with sensitivity analysis to be conducted at 4 and 10 per cent;
- a study period of 30 years;[1] and
- 2018 as Year 0 for the analysis.

2.3 Key data and information sources

The key sources of data and information used to inform the analysis were:

- the 2015 Fraser Coast Water Supply Strategy, published by Wide Bay Water Corporation;[2]
- the Regional Water Supply Security Assessment (RWSSA) completed for the Hervey Bay region by the Department of Energy and Water Supply (in conjunction with the FCRC) in 2015;[3]
- an early stage assessment of the Burnett River pipeline project completed by FCRC in 2017;[4]
- the Strategic Assessment of Service Requirements (SASR) completed for the Burnett River pipeline project by KBR;[5]
- SunWater documentation, including 2017/18 fees and charges schedules for the Lower Mary River and Bundaberg (Burnett) Water Supply Schemes; and
- various studies and reports regarding water users' willingness to pay to avoid water restrictions.[6]

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1 A study period of 30 years is considered appropriate for projects involving the development of long-lived infrastructure such as water supply pipelines.

2 Wide Bay Water Corporation (2015). Fraser Coast Water Supply Strategy.

3 Department of Energy and Water Supply (2015). Regional Water Supply Security Assessment – Hervey Bay.

4 Fraser Coast Regional Council (2017). Early Stage Assessment – Project Scope Template – Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Staged Approach. Department of Infrastructure, Local Government and Planning.

5 Kellogg Brown & Root (2018). Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Strategic Assessment of Service Requirements. Prepared for the Fraser Coast Regional Council.

6 For example: Australian National University (2012). Willingness to Pay Research Project – Final Report; Cooper, B., Crase, L. & Burton, M. (2011). Urban Water Restrictions: Attitudes and Avoidance; Allen Consulting Group (2007). Willingness to Pay for Increased Reliability of Water Supply in South East Queensland: A contingent valuation study.

3 Base Case

This section sets out the base case against which the reference project options are to be assessed. The relevant considerations in defining the base case are:

- future urban water demand for the Hervey Bay region;
- the future water supply-demand balance in the region;
- planned water supply augmentations and the timing and cost of these augmentations; and
- the frequency and severity of water restrictions over the study period.

3.1 Future urban water supply-demand balance

3.1.1 Urban water demand

Estimates of future urban water demand for the Hervey Bay region were supplied by FCRC. The demand estimates were based on the projections from the 2015 Wide Bay Water Fraser Coast Water Supply Strategy, updated using latest population projections from the Queensland Government Statistician's Office (QGSO).[7] Table 1 presents projected growth in equivalent dwelling (ED) and water requirements in Hervey Bay's water reticulation network over the study period .

Table 1 Hervey Bay Water Supply – equivalent dwelling and water demand projections

Year	Total equivalent dwelling (ED)	Average daily water demand (ML/D)	Annual water demand (ML/Annum)
2016	36,630	23.1	8,432
…	…	…	…
2019	**37,675**	**23.7**	**8,667**
…	…	…	…
2021	38,371	24.2	8,823
2026	41,084	25.9	9,447
2031	44,135	27.8	10,149
2036	46,846	29.5	10,772
2041	49,257	31.0	11,327
2046	51,792	32.5	11,877
…	…	…	…
2048	**52,858**	**33.1**	**12,097**

Note: Due to the unavailability of data, demand prerejection prior to 2021 were interpolated based on five-yearly estimates.

[7] Queensland Government Statistician's Office (2018). Queensland Government population projections. 18 May, Queensland Treasury, Queensland.

Source: Wide Bay Water Corporation (2015). Fraser Coast Water Supply Strategy. Estimates have been updated to reflect the Queensland Governments Statistician's Office latest population growth forecasts.

The above table shows that total ED in the Hervey Bay region is expected to increase from 37,675 in 2019 to 52,858 in 2048, representing an annual average growth rate of 1.2 per cent. On this basis, annual water demand is expected to increase from 8,667 ML in 2019 to 12,097 ML in 2048.

3.1.2 Urban water supply

Hervey Bay urban water users are supplied by the following three storages in the Wide Bay WSS:

- Lake Lenthall, the primary source, which has a capacity of 28,400 ML and a safe annual yield of just over 14,000 ML;
- Burrum Weir No.1, which has a capacity of 1,715 ML; and
- Burrum Weir No.2, which has a capacity of 2,242 ML.[8]

Water is pumped from storages to the Burgowan WTP (and Howard WTP if demand exceeds the capacity of the Burgowan WTP). It is then pumped into water reservoirs and supplied to urban water users.[9]

3.1.3 Supply-demand balance

Figure 1 shows that based on current information in relation to future urban water demand and the safe yield of Lake Lenthall, urban water demand for the Hervey Bay region is not expected to exceed the safe reliable yield out to 2050.

In the occurrence of no recharge events, Lake Lenthall is projected to have approximately two years of storage available (subject to the commencement of the drought management plan). As the water level reaches minimum operating level, also referred to as the dead storage level, level 4 (i.e. the most severe) restrictions would be implemented, with urban water users to be supplied solely from the weirs, which would provide approximately 10 months of supply.[10]

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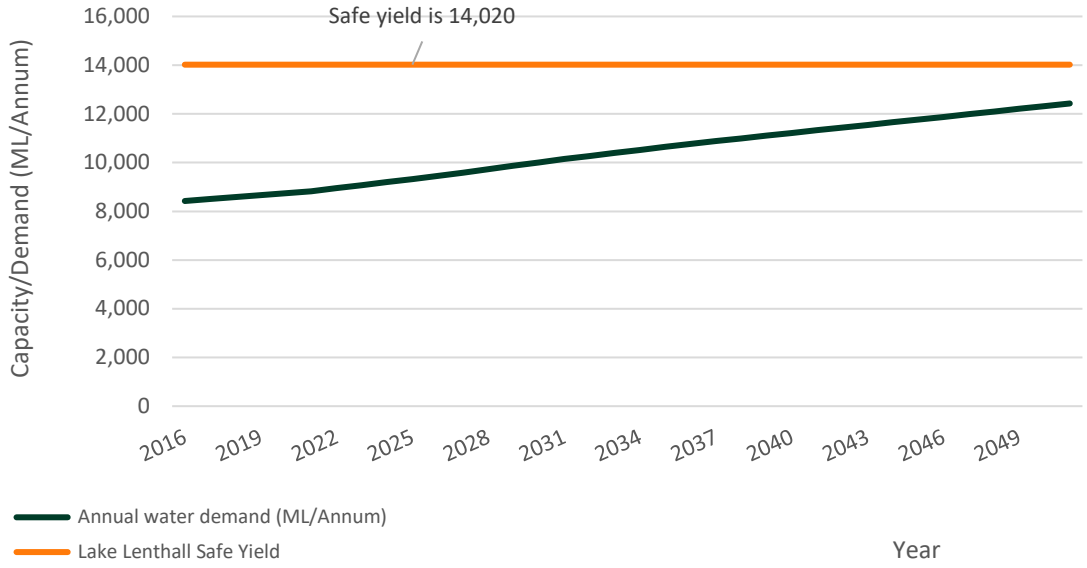
[8] Water is released from Lake Lenthall into Burrum Weir Nos 1 and 2.

[9] It should be noted that 90 per cent of Hervey Bay's wastewater is treated and then piped into farms (cane and turf farms) and tree plantations.

[10] Wide Bay Water Corporation (2015). Fraser Coast Water Supply Strategy. August.

Department of Energy and Water Supply (2015). Regional Water Supply Security Assessment – Hervey Bay. State of Queensland, Queensland

Figure 1 Hervey Bay reticulation network – Safe yield and forecast water demands



Data source: WBWC (2015).

Whilst the figure shows that based on current projections, existing water supplies are expected to be sufficient to satisfy urban water demand in the Hervey Bay region over the next 30 years, the potential for the supply-demand balance to tighten to the extent that water restrictions and/or supply augmentation are required increases towards the end of the period.[11]

3.2 Water supply augmentations

The SASR for the Burnett River pipeline project identified a shortlist of options with the potential to address future water demands in the Hervey Bay region. Five options (in addition to the Burnett River Pipeline) were assessed:[12]

- Interconnector pipeline between Hervey Bay and Maryborough
- Indirect Potable Reuse (IPR)
- Mary River
- Fraser Island
- Desalination.

[11] Noting that this is based on an assumed safe reliable yield of 14,020 ML per annum.

[12] Kellogg Brown & Root (KBR) (2018). Burnett River (Paradise Dam) to Howard Water Supply Pipeline – Strategic Assessment of Service Requirements. Prepared for the Fraser Coast Regional Council, Queensland.

A summary of each augmentation option, including a number of key elements of the option being considered, is detailed in Table 2.

Table 2 Overview of water supply augmentation options

Augmentation option	Project details	Parameter inputs	Impact on supply-demand balance	Consideration under the base case
Hervey Bay-Maryborough Interconnector	This option requires the development of a new pipeline from Burgowan WTP (Hervey Bay) to the Boys Avenue Reservoir (Maryborough) and associated pumping stations.	CAPEX estimated at $31 million[a] Estimated energy (operating) cost is approximately $20/ML[d]	Does not make additional water supplies available for the Fraser Coast region. Rather, it would enable the more efficient management of available water supplies.	Project is currently under consideration by FCRC as part of a separate assessment process. Not considered further as a viable water supply augmentation as it does not make additional volumes of supply available.
Indirect Potable Reuse	This option involves augmenting the Nikenbah WWTP to enable it to perform advanced treatment (reverse osmosis and advanced oxidation) to produce Purified Recycled Water (PRW). Water would then be piped to Cassava Dam and, subsequently, used as a raw water source for the Burgowan WTP.	CAPEX estimated at $47 million[a]	Capacity increase of 4.8 ML of water per day[a] Increased supply capacity, however, is unable to meet the total volume required in the region.	Not considered further, because it: • does not provide sufficient water source into the supply system; and • public/political resistance, in addition to potentially high OPEX.
Mary River	This option involves the installation of a pipeline from the Mary River Barrage to the Burgowan WTP site and the construction of a pump station. The option also involves the purchase of 8,000 ML of high-priority water allocations.	CAPEX estimated at $59.5 million[a] Up-front water allocation cost estimated at $10.1 million[13, c] OPEX includes: • a fixed annual cost of $115,000 and an additional variable charge of $1.89/ML;[c] and • energy costs estimated at $44/ML.[d]	Capacity increase of 22 ML of water per day.[a] Provides sufficient capacity to address the identified water supply need, though, concerns exist such as: • the availability of high priority water; and • ongoing reliability of the source.	Identified as potentially feasible supply augmentation under the base case as: • it meets the long-term water security needs in the Hervey Bay region; • is technically feasible; and • FCRC identified it as a relatively inexpensive future water source option.
Fraser Island	This option involves sourcing water from the Bogimbah Creek area (either via a borefield or directly from the creek flow itself) and then transferring it to mainland Hervey Bay by means of a submarine pipeline.	CAPEX estimated at $56 million[b] Estimated energy (operating) cost is approximately $45/ML[d]	Capacity increase of 56 ML of water per day[a] Provides sufficient capacity to meet the project need, though, the following risks have been identified: • close proximity to an environmentally	Identified as potentially feasible supply augmentation under the base case as: • it meets the long-term water security needs in the Hervey Bay region; • is technically feasible; and

[13] Note that the charges are for the Lower Mary channel and not the Mary Barrage. This would indicate that additional water is not available from the Mary River and therefore this would be subject to further modelling and investigation with DNRME.

Augmentation option	Project details	Parameter inputs	Impact on supply-demand balance	Consideration under the base case
			sensitive (heritage-listed) area; and • potentially high-water colouring issues, in turn, requiring further treatment and expenditure.	• has relatively low CAPEX and OPEX. However, it is important to note the issues in relation to environmental impacts.
Desalination	This option involves the construction of two small desalination plants in suitable sites, e.g. River Heads, Booral, Dundowran and Burrum Heads.	Capex estimated at $81.2 million[a]	Capacity increase of 20 ML of water per day[a] Provides sufficient capacity to meet the project need of providing long-term water security.	While the option is not suitable to address long-term water demands, due to its high CAPEX and OPEX outlays (including possible environmental issues relating to disposal of waste brine), it could be considered as an emergency measure to safeguard against unforeseen drought events.

a WBWC (2015) - Fraser Coast Water Supply Security Strategy. **b** KBR (2018) - SASR. **c** SunWater (2017) - Fees and Charges Schedule.[14] **d** FCRC (2018) – inputs emailed on 5 July 2018.

Note: CAPEX, OPEX, WTP and WWTP denote capital expenditure, operating expenditure, water treatment plant and wastewater treatment plant, respectively.

The key findings from the assessment of the identified water supply augmentation options presented in the above table are:

- the Mary River and Fraser Island augmentation options are most likely to be pursued to provide long-term water supply security to the Hervey Bay region, noting the environmental issues associated with the Fraser Island option;
- the Interconnector project would not increase the volume of water supply available to the Fraser Coast region and has therefore not been included in the base case, however it is important to note that this project is currently under consideration as part of a separate assessment process;[15] and
- the IPR and desalination options do not represent viable augmentations under the base case, noting the latter could form part of an emergency supply response.

Based on consultation with FCRC, the assumption has been adopted that, in the event that the water supply-demand balance in the Hervey Bay region results in a supply augmentation being required, either the Fraser Coast Island or Mary River supply options are likely to be pursued. For the purpose of this cost-benefit analysis, it has been assumed that the Fraser Island option would be pursued.

[14] SunWater (2017). Fees & Charges Schedule 2017/18 – Lower Mary River Water Supply Scheme. July

[15] Scenario modelling has been conducted to account for the scenario in which the Interconnector project is developed (see section 7.2.2).

Given that a 30-year evaluation period has been adopted for this analysis (i.e. from 2019 to 2048), and augmentation is not required within this timeframe (based on current demand projections and the current estimate of safe reliable yield), capital and operating expenditure for the Fraser Island source augmentation option were excluded from this analysis.

3.3 Water restrictions

Water restrictions are another measure that can be applied to manage the urban water supply-demand balance. As the supply-demand balance tightens, it is expected that the frequency and severity of water restrictions imposed on Hervey Bay water users will increase. This imposes a cost on the community under the base case. To quantify this cost, it is necessary to derive estimates for:

- the frequency of water restrictions
- the economic cost incurred when restrictions are implemented.

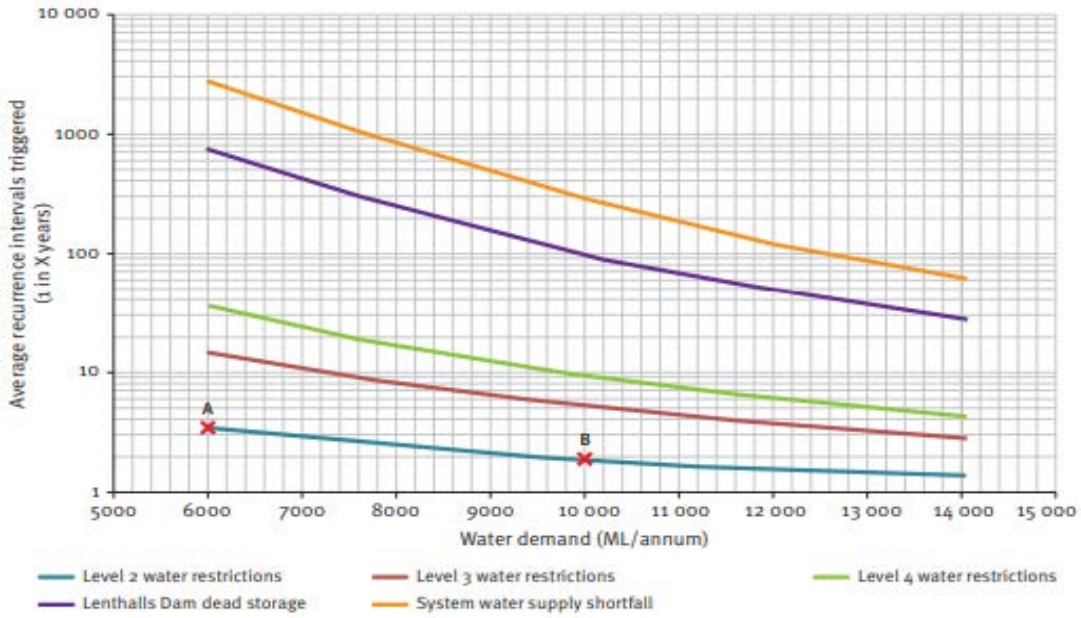
3.3.1 Frequency of water restrictions

The frequency of different levels of water restrictions in the Hervey Bay region over the study period was assessed based on the modelling undertaken by DEWS (in conjunction with FCRC). The results of this modelling are presented in Figure 2, which shows the likelihood that various water restriction triggers are expected to be reached for a range of water demands in Hervey Bay's water supply system. It is important to note that the modelling underpinning this chart excludes any consideration of supply augmentations or other demand management or water use efficiency measures.

In assessing the economic cost of water restrictions under the base case, it is necessary to focus on level 3 and level 4 restrictions (i.e. moderate to severe restrictions). This is appropriate as the light-handed nature of level 1 and level 2 restrictions mean that the implementation of these restrictions impose minimal cost on the community.[16]

[16] Level 1 and Level 2 water restrictions have water reduction targets of 0 and 5 per cent respectively. Studies have indicated that restrictions of this nature do not impose an economic cost on the community.

Figure 2 Hervey Bay – frequency of water restrictions against total annual demand



Source: Department of Energy and Water Supply (2015). Regional Water Supply Security Assessment – Hervey Bay.

Table 3 presents a snapshot of the results of the DEWS modelling for level 3 restrictions (20 per cent target reduction in demand) and level 4 restrictions (40 per cent target reduction in demand) at current demand and projected demand for 2048.

Table 3 Forecast frequency of water restrictions for given levels of demand

Triggered restrictions	Year 2019 demand	Year 2048 demand
Level 3	~1 in every 7 years (annual incidence of ~14.3 per cent)	~1 in every 4 years (annual incidence of ~25 per cent)
Level 4	~1 in every 15 years (annual incidence of ~6.7 per cent)	~1 in every 6 years (annual incidence of ~16.7 per cent)

Table 4 sets out the expected incidence of level 3 and level 4 water restrictions under the base case up until 2048.

Table 4 Incidence of level 3 and 4 water restrictions under the base case

Year	2020	2024	2028	2032	2036	2040	2044	2048
Level 3	14.6%	15.8%	17.5%	19.4%	21.0%	22.8%	24.8%	27.0%
Level 4	6.9%	8.5%	9.8%	11.2%	12.3%	13.5%	14.9%	16.5%

Source: Synergies calculation using estimates from DEWS 2015 RWSSA – Hervey Bay.[17]

[17] Department of Energy and Water Supply (2015). Regional Water Supply Security Assessment (RWSSA) – Hervey Bay. State of Queensland, Queensland.

3.3.2 Economic cost of water restrictions

Based on a number of studies that have estimated the cost of water restrictions in Australia (see below), households were found to place a material value on the ability to avoid the implementation of severe water restrictions. While households were willing to pay to reduce the likelihood of the implementation of severe water restrictions, for less severe restrictions, they were found to be willing to pay only a small amount (or none).[18]

Table 5 provides a summary of several studies from the relevant literature that have investigated the economic cost of water restrictions in Australia.

Table 5 Summary of studies on water triggers and restriction levels

Study	Location (user group)	Method	Result(s)
Allen Consulting Group (2007)[a]	Southeast Queensland (residential users)	Contingent valuation	WTP to reduce the frequency of Level 4 restrictions (from 50% to 20%) estimated at $132 p.a.
Australian National University (2012)[b]	Canberra, ACT (residential users)	Choice modelling	WTP to reduce the frequency of Stage 4 restrictions (by 5%) estimated at $200 p.a., whilst the corresponding estimate for Stage 3 restrictions was $70 p.a.
DBM Consultants (2007)[c]	South East Queensland (residential users)	Choice modelling	For the highest set of water security outcomes (level 4 restrictions 1 in 100 years), the average WTP was $174 p.a.
Hensher, D., Shore, N. and Train, K. (2006)[d]	Canberra, ACT (residential and business users)	Choice modelling	WTP to avoid level 3 water restrictions was estimated at $239 p.a.
Marsden Jacob Associates (2006)[e]	South East Queensland (commercial, industrial and residential users)	An average WTP using methods such as contingent valuation/choice modelling	Households were willing to pay $233 and $291 to avoid level 3 and 4 restrictions, respectively.

a Allen Consulting Group (2007). Willingness to Pay for Increased Reliability of Water Supply in South East Queensland - A Contingent Valuation Study.

b Australian National University (2012). Willingness to Pay Research Project – Final Report.

c DBM Consultants (2007). Economic Valuation of Water Reliability in South-East Queensland Using Choice Modelling.

d Hensher, D., Shore, N. and Train, K. (2006). Water Supply Security and Willingness to Pay to Avoid Drought Restrictions. Economic Record, 82, pp 56-66.

e Marsden Jacob Associates (2006). Economic Cost of Water Restrictions in South East Queensland.

Adjusting (or escalating) the cost estimates in Table 5 for inflation[19] results in an average willingness to pay to avoid water restrictions of approximately $236 per ED per annum (in $2018). This estimate, which has been applied for the economic cost of level 3 restrictions, was derived by averaging the escalated/inflated estimates from relevant studies/reports relating to the cost of implementing moderate to severe restrictions.[20]

[18] This is the rationale for not attributing an economic cost to the occurrence of Level 1 or Level 2 restrictions.

[19] Inflation rates based on 6401.0 Consumer Price Index, Australia, Mar 2018. Available from: http://www.abs.gov.au/ausstats/abs@.nsf/mf/6401.0 [Accessed 27 June 2018]

[20] The $236 per ED per annum cost estimate was derived by escalating and then averaging estimates from the 2012 Australian National University report ($78.90 per ED in $2018), the 2006 Hensher et al. study ($318.48 per ED in $2018) and the 2006 Marsden Jacob Associates report ($310.48 per ED in $2018).

For level 4 (severe) restrictions, it has been assumed that the economic cost incurred by households will be two and a half times this estimate (i.e. $354 per ED per annum). That is, the cost of level 4 restrictions is $354 per household, plus the $236 per household incurred as a result of level 3 restrictions being imposed. This is based on the assessment that level 4 restrictions require the same level of reduction in terms of the volume of water use (i.e. 20 per cent reduction), however the cost incurred by households in reducing consumption increases as water consumption falls.

Due to the inherent uncertainty associated with non-market parameter estimates, nonetheless, these estimates have been subject to sensitivity analysis (see section 7.2.1).

3.3.3 Estimated cost of water restrictions under the base case

The economic cost of water restrictions under the base case is estimated by applying the estimate for the cost of water restrictions per household (or dwelling) to the number of EDs in the Hervey Bay region. This produces an estimate for the economic cost imposed on the community in a year in which level 3 or level 4 water restrictions are implemented. The expected incidences of water restrictions are then applied to these estimates to derive an estimate for the economic cost of water restrictions in each year of the study period.

For example, in 2020 it is estimated that 38,023 EDs will be supplied via the Hervey Bay water supply system. At a cost of $236 per ED for level 3 and $354 per ED for level 4, the economic cost associated with the imposition of severe water restrictions is estimated at approximately $22.4 million (in $2018). Based on an expected incidence of moderate to severe water restrictions, i.e. 14.6 per cent for level 3 and 6.9 per cent for level 4, this equates to an economic cost of water restrictions of $2.23 million $((0.146 * 8.97) + (0.069 * 13.46))$ in $2018.

Table 6 sets out the calculation of the economic cost of water restrictions under the base case over the evaluation period.

Table 6 Estimating the cost of water restrictions under the base case ($ million as of 2018)

Metric	2020	2024	2028	2032	2036	2040	2044	2048
Level 3	14.6%	15.8%	17.5%	19.4%	21.0%	22.8%	24.8%	27.0%
Community cost[a]	$8.97	$9.44	$9.98	$10.54	$11.05	$11.51	$11.98	$12.47
Level 4	6.9%	8.5%	9.8%	11.2%	12.3%	13.5%	14.9%	16.5%
Community cost[a]	$13.46	$14.16	$14.97	$15.81	$16.58	$17.26	$17.97	$18.71
Cost of restrictions[b]	**$2.23**	**$2.69**	**$3.22**	**$3.81**	**$4.37**	**$4.95**	**$5.66**	**$6.46**

a This is computed by multiplying total ED to the estimated cost of water restriction in each year of the evaluation period. **b** This represents the total cost of level 3 and 4 water restrictions.

Source: Synergies modelling.

Based on the inputs set out above, the total economic cost of water restrictions to be imposed on water users supplied by the Hervey Bay reticulation network under the base case is estimated to be $45.16 million (in PV terms) over the study period.

3.4 Emergency supply measures

Emergency supply measures are implemented when it is not possible for conventional water supply augmentations to be pursued to alleviate a water supply-demand imbalance. This may be due to timing issues or augmentation options not being viable due to climate or other factors. Where there is a likelihood that emergency supply measures will be required under the base case, it is appropriate to assess the potential cost and likelihood of these measures to quantify this cost under the base case.

Using stochastic modelling techniques with over 100 years of historical data, DEWS (2015)[21] revealed the likelihood of the Lenthall Dam falling below the minimum operating level (dead storage) at around 1 in every 200 years at the 2019 demand. At total demand of 12,097 ML per annum (year 2048 demand), this probability increases to around 1 in every 50 years.

Based on consultation with FCRC, it is anticipated that desalination represents the most likely supply option to be pursued in an emergency supply scenario, primarily due to the fact that this option is not climate-dependent, and the relatively short lead-time associated with the implementation of this option. However, given that, based on current urban water demand projections for the Hervey Bay region, it is not anticipated that a supply augmentation will be required over the next 30 years, no costs associated with the need to implement emergency supply measures have been included in the base case.

3.5 Summary of the base case

In summary, the key features of the base case against which the reference project options are to be assessed are:

- in the event that a supply augmentation is required, the Fraser Coast Island option has been identified as the option most likely to be adopted. However, no cost associated with this augmentation has been included in the base case due to the long-term water supply-demand projections indicating that augmentation will not be required within the next 30 years;

[21] Department of Energy and Water Supply (2015). Regional Water Supply Security Assessment – Hervey Bay. State of Queensland, Queensland.

- a total cost of $45.16 million (PV terms) to be incurred by urban water users as a result of the implementation of level 3 as well as level 4 water restrictions; and
- no cost has been included in relation to emergency supply measures, based on the long-term urban water supply-demand projections for the Hervey Bay region.

4 Reference project options

The reference project involves the construction of a new pipeline and associated pump station over a four-year period to 2023 to transport approximately 22 ML of water per day (or around 8,000 ML per annum) from three identified route options to the Burrum Weir Pump Station (see Figure 3).

The following alternative route options have been identified:

- Option 1A – supply from Ned Churchward Weir to Burrum, in addition to offtakes for agricultural production;
  - Option 1B – as above, but excluding offtakes;
- Option 2A – supply from Causeway Road to Burrum, in addition to offtakes for agricultural production;
  - Option 2B – as above, but excluding offtakes; and
- Option 3 – supply from Paradise Dam to Burrum.

The project would provide long-term water supply security to the Hervey Bay region, in addition to potentially making water available for agricultural production in the region (Option 1 and 2 include private agricultural demands by priority).

Figure 3 Burnett River to Hervey Bay – route options

Source: KBR (2018). Burnett River Pipeline – Consultation Feedback on Other Demands. Technical Memorandum, 11 July.

The economic benefits and costs associated with these reference project options relative to the base case are set out in the following sections.

5 Economic benefits

This section sets out the economic benefits attributable to the reference project options relative to the base case. The following benefits have been identified:

- avoided cost of water restrictions
- economic value derived from water use for agricultural production.

Note that given no costs associated with water supply augmentations or emergency water supply measures have been included in the base case, there are no benefits associated with the avoidance of these costs under the reference project options.

5.1 Avoided cost of water restrictions

The construction of the Burnett River pipeline will result in a significant increase in the volume of water available to meet urban water demand in the Hervey Bay region over the study period. This will result in a reduction in the frequency of implementation of level 3 and level 4 restrictions and hence the economic cost associated with the implementation of these restrictions.

Section 3.3.3 sets out the estimated cost of level 3 and level 4 water restrictions under the base case. The magnitude of this benefit under the reference project options will depend on the extent to which the frequency of level 3 and level 4 restrictions will be reduced as a result of the reference project options. Using statistical information provided by KBR, the economic cost of water restrictions under the reference project options is estimated at $26.18 million in PV terms. As such, of the costs incurred under the base case, $18.98 million (in PV terms) is avoided under the reference project options.

Table 7 sets out annual estimates of the economic cost of water restrictions under the base case and reference project options for selected years of the study period.

Table 7 Estimating the cost of water restrictions under the project options ($ million as of 2018)

Scenario	2020	2024	2028	2032	2036	2040	2044	2048
Base case costs	$2.23	$2.69	$3.22	$3.81	$4.37	$4.95	$5.66	$6.46
Reference project options	$2.23	$1.60	$1.69	$1.78	$1.87	$1.95	$2.03	$2.11
Avoided cost[a]	**$0.00**	**$1.10**	**$1.53**	**$2.03**	**$2.50**	**$3.01**	**$3.63**	**$4.35**

a The resulting difference is the cost saving (or benefit) obtained from reduced risk of water restrictions.

Source: Synergies modelling.

5.2 Economic value of agricultural production

As noted in section 4, several of the reference project options will also make water available for agricultural production.

The following key activities and irrigator demands have been identified in the Burnett Wide Bay Region, with the potential to be served by the reference project:

- Ned Churchward Weir to Burrum (Option 1A):
  - 500 ML of high priority water per annum for the production of citrus crops
  - 500 ML of high priority water per annum for the production of avocados
  - 2,600 ML of medium priority water per annum for the production of sugarcane
- Causeway Road to Burrum (Option 2A):
  - 500 ML of high priority water per annum for avocado production.[22]

Determining the economic value derived from the use of water for agricultural production requires the following to be established:

- for each crop, the volume of water to be used and the irrigation application rate (i.e. ML per hectare);
- the revenue to be derived from the production of each crop on a per hectare or per unit basis, having regard to crop yields and crop prices received by producers; and
- the total cost of production, including pre-harvest, irrigation, harvest and post-harvest costs, annual administration costs, annualised cost of capital equipment, annualised crop establishment costs and an allowance for the opportunity cost of land.

This results in an estimate for the net economic return per hectare from crop production. Dividing this estimate by the irrigation application rate for that crop results in an estimate for the net economic return per ML of water used. This represents the economic benefit attributable to the use of water for the production of this crop.

As stated above, the demand assessment identified three crops to be produced using water supplied from the pipeline – sugarcane; citrus; and avocadoes. The following sections assess the economic benefits of water use for each of these crops.

[22] Demand profile provided by KBR.

5.2.1 Sugarcane

Table 8 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for sugarcane production.

Table 8 Key information for sugarcane production

Metric	Parameter estimate	Source
Application rate	3 ML per hectare	4618.0 - Water Use on Australian Farms (Various editions)
Gross margin	$1,500 per hectare	Adjusted DAF Farm Economic Assessment Tool (FEAT).
Opportunity cost of land	$2,500 per hectare	Synergies estimate of dryland sugarcane production based on the DAF Farm Economic Assessment Tool (FEAT).

5.2.2 Citrus crops

Table 9 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for citrus production.

Table 9 Key information for citrus production

Metric	Parameter estimate	Source
Application rate	9 ML per hectare	Based on https://www.daf.qld.gov.au/business-priorities/plants/fruit-and-vegetables/fruit-and-nuts/citrus/harvesting,-yields-and-prices
Gross margin	$25,000 per hectare	Based on a gross margin published by the Qld Government in 1997 under the Agrilink series
Production costs	Includes the following costs: • annual admin cost of $4,000; • annual capital cost (excluding land) of $9,000 per hectare; and • an establishment cost of $20,000 per hectare.	Based on a gross margin published by the Qld Government in 1997 under the Agrilink series
Net annual return	$12,000 per hectare	Synergies calculation, i.e. gross margin less production costs (excluding establishment cost)
Opportunity cost of land	$3,000 per hectare	Synergies estimate.

5.2.3 Avocados

Table 10 sets out the key parameter estimates applied to estimate the economic benefit derived from the use of water for avocado production.

Table 10 Key information for avocado production

Metric	Parameter estimate	Source
Application rate	8 ML per hectare	Queensland Government. Agrilink Avocado Information Kit ,2001.
Gross margin	$18,000 per hectare	Queensland Government. Agrilink Avocado Information Kit ,2001.
Production costs	Includes the following costs: • annual admin cost of $4,000; • annual capital cost (excluding land) of $9,000 per hectare; and • an establishment cost of $20,000 per hectare.	Queensland Government. Agrilink Avocado Information Kit ,2001.
Net annual return	$5,000 per hectare	Synergies calculation, i.e. gross margin less production costs (excluding establishment cost)
Opportunity cost	$3,000 per hectare	Synergies Estimate

5.2.4 Summary of agricultural benefits

Table 11 sets out the estimated economic benefits, based on the demand profile and parameter estimates detailed above, to be derived from the use of water for agricultural production under reference project options 1A and 2A.

Table 11 Economic benefits from increased agricultural production

Project option	Description	Present Value estimate
Option 1A	Economic value derived from the use of 2,600 ML of medium priority water per annum for sugarcane production and 1,000 ML of high priority water per annum for increased production of citrus crops as well as avocados.	**$16.78 million**
Option 2A	Economic value derived from the use of 500 ML of high priority water per annum for avocado production	**$1.75 million**

5.3 Summary of economic benefits

Table 12 presents a summary of the economic benefits quantified under each reference project option. The table shows that Option 1A has a significantly higher total economic benefit compared to the other four options, due to this option involving the highest use of water for agricultural production (and the fact that all options result in the same benefit in terms of the avoided economic cost of water restrictions).

Table 12 Summary of economic benefits (in PV terms)

Option	Benefits ($ million, in PV terms)		
	Avoidance of severe water restrictions	Increased agricultural production	Total
Option 1A	$18.98	$16.78	**$35.76**
Option 1B	$18.98	-	**$11.39**
Option 2A	$18.98	$1.75	**$20.73**
Option 2B	$18.98	-	**$11.39**
Option 3	$18.98	-	**$11.39**

6 Economic costs

The economic costs to be incurred under the reference project options include:

- capital costs
- operating and maintenance costs, including electricity costs
- water allocation costs.

6.1 Capital costs

Significant capital expenditure is required under all reference project options. Based on information provided by KBR, the capital costs for each option are set out in Table 13, including the total PV estimates.

Table 13 Capital costs by reference project option ($million)

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
2020	$12.91	$12.16	$11.82	$11.27	$12.97
2021	$12.91	$12.16	$11.82	$11.27	$12.97
2022	$51.64	$48.64	$47.28	$45.08	$51.88
2023	$51.64	$48.64	$47.28	$45.08	$51.88
Total Present Value estimate	**$104.89**	**$98.80**	**$96.04**	**$91.57**	**$105.38**

Source: Cost estimates provided by KBR.

6.2 Operating and maintenance costs

Table 14 sets out the PV totals for the annual operating and maintenance costs, fixed and variable, to be incurred under each reference project option. These costs relate to the operation and maintenance of the pipeline and associated infrastructure and the power costs to be incurred in supplying water via the pipeline.

Table 14 Total operating and maintenance costs by reference project option ($million, PV terms)

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Fixed O&M [a]	$6.43	$6.11	$5.69	$4.99	$5.84
Variable O&M [b]	$6.01	$3.19	$3.46	$2.83	$3.28
Total O&M cost	**$12.43**	**$9.30**	**$9.15**	**$7.81**	**$9.11**

a The fixed operating and maintenance (O&M) cost stream includes costs for pipeline, pump stations and balance tanks. **b** The variable O&M cost stream includes cost for intake PS power and transfer PS power.

Source: Cost estimates provided by KBR.

6.3 Water allocation costs

The reference project options require the up-front purchase of water allocations from the Burnett River WSS. In addition to the up-front purchase of the allocations, costs are also to be incurred in relation to the ongoing fixed and variable charges[23] associated with these allocations. Based on data provided by KBR, the costs associated with the acquisition of water allocations under the reference project options are illustrated in Table 15 below.

Table 15 Total water allocation costs by reference project option ($million)

Option	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Purchase of water allocations (one-off cost)	$25.85	$22.97	$24.41	$22.97	$22.97
Total fixed costs	$30.60	$27.20	$26.24	$24.70	$24.70
Total variable costs	$0.22	$0.11	$0.12	$0.11	$0.11
Total Present Value estimate	**$34.52**	**$30.65**	**$31.54**	**$29.68**	**$29.68**

Source: Cost estimates provided by KBR.

6.4 Summary of economic costs

Table 16 summarises the economic costs of the reference project options relative to the base case in PV terms.

Table 16 Summary of economic costs (in PV terms)

Option	Costs ($ million, PV terms)			
	Capital costs	O&M costs	Water allocation costs	Total
Option 1A	$104.89	$12.43	$34.52	**$151.84**
Option 1B	$98.80	$9.30	$30.65	**$138.74**
Option 2A	$96.04	$9.15	$31.54	**$136.72**
Option 2B	$91.57	$7.81	$29.68	**$129.06**
Option 3	$105.38	$9.11	$29.68	**$144.17**

Source: Synergies modelling.

The above table shows that Option 1A has the highest total cost, driven by the higher capital cost and variable operating and maintenance costs of this option relative to the other options. This is likely attributable to the requirements for this option to supply higher volumes of water for agricultural use compared to the other options.

[23] Typically levied on an annual basis.

7 Results

This section summarises the results of the economic analysis relating to the reference project options against the base case.

7.1 Results of economic analysis

The PV estimates for the economic costs and benefits of the reference project options relative to the base case are summarised in Table 17 below.

Table 17 Summary of results from the economic analysis ($millions, PV terms)

Metric	Present Value Estimates ($million)				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Economic benefits					
Avoidance of severe water restriction	$18.98	$18.98	$18.98	$18.98	$18.98
Increased agricultural production	$16.78	n/a	$1.75	n/a	n/a
Total benefits	**$35.76**	**$18.98**	**$20.73**	**$18.98**	**$18.98**
Economic costs					
Capital costs	$104.89	$98.80	$96.04	$91.57	$105.38
Operating and maintenance costs	$12.43	$9.30	$9.15	$7.81	$9.11
Water allocation costs	$34.52	$30.65	$31.54	$29.68	$29.68
Total costs	**$151.84**	**$138.74**	**$136.72**	**$129.06**	**$144.17**
Benefit Cost Ratio	**0.24**	**0.14**	**0.15**	**0.15**	**0.13**
Net Present Value	**($116.08)**	**($119.77)**	**($115.99)**	**($110.08)**	**($125.19)**

Source: Synergies modelling.

The results in the table highlight the following:

- the NPV of all reference project options are significantly negative
- the BCRs are well below 1 under all reference project route options.

Despite having a significantly higher total economic benefit estimate than the other reference project options, the NPV for Option 1A is comparable to the other project options, with the exception of Option 3. This is attributable to the higher economic costs to be incurred under this option.

Given the absence of a major supply augmentation under the base case and the relatively low volumes of water to be used for agricultural production, the poor performance of the reference project options relative to the base case is not unexpected. It is noted that were the Hervey Bay region to suffer a prolonged drought in the short to medium term to the extent that a supply augmentation was required, the economic benefits of the

reference project options would increase significantly (although unlikely to the extent necessary to result in a positive NPV).

7.2 Sensitivity and scenario analysis

7.2.1 Sensitivity analysis

Sensitivity analysis shows how the results of the analysis are affected by changes to key parameters and assumptions. This provides policy makers with an indication of the level of certainty associated with the modelled results in addition to identifying critical parameters and assumptions in terms of the impact on the net economic impact of the reference project options.

The following parameters have been subject to sensitivity analysis:

- discount rate (4 and 10 per cent)
- capital costs (±20 per cent)
- the economic cost of water restrictions (±50 per cent).

Table 18 presents the results from key parameter changes.

Table 18 Results of sensitivity analysis

Parameter estimate	Present Value Estimates ($million) *(% change)*				
	Option 1A	Option 1B	Option 2A	Option 2B	Option 3
Base result	**($116.08)**	**($119.77)**	**($115.99)**	**($110.08)**	**($125.19)**
Discount rate					
Low (4%)	($117.14) *(-0.9%)*	($127.66) *(-6.6%)*	($122.20) *(-5.4%)*	($116.11) *(-5.5%)*	($133.16) *(-9.6%)*
High (10%)	($111.73) *(+3.8%)*	($111.65) *(+6.8%)*	($108.88) *(+6.1%)*	($103.27) *(+6.2%)*	($116.86) *(+8.3%)*
Capital costs					
Low (-20%)	($95.11) *(+18.1%)*	($100.01) *(+16.5%)*	($96.78) *(+16.6%)*	($91.77) *(+16.6%)*	($104.12) *(+16.8%)*
High (+20%)	($137.06) *(-18.1%)*	($139.53) *(-16.5%)*	($135.20) *(-16.6%)*	($128.40) *(-16.6%)*	($146.27) *(-16.8%)*
Economic cost of water restrictions					
Low (-50%)	($125.57) *(-8.2%)*	($129.26) *(-7.9%)*	($125.48) *(-8.2%)*	($119.57) *(-8.6%)*	($134.68) *(-7.6%)*
High (+50%)	($106.60) *(+8.2%)*	($110.28) *(+7.9%)*	($106.50) *(+8.2%)*	($100.59) *(+8.6%)*	($115.71) *(+7.6%)*

Source: Synergies modelling.

The outcomes from this sensitivity analysis are as follows:

- base NPV results are not overly sensitive to changes in the discount rate or the economic cost of water restrictions; and
- base NPV results are somewhat sensitive to changes in capital costs under all five reference project options, i.e. variation of around ±16-18 per cent.

These results are consistent with the significance of the capital cost of the reference project options in relation to the NPV of the five options.

7.2.2 Scenario analysis

The key scenario to be assessed is the net economic impact of the reference project options under the scenario in which the Maryborough to Hervey Bay Interconnector is constructed. As noted in section 3.2, this project is currently under consideration and would enable up to 1,500 ML of water to be transported between Maryborough and Hervey Bay annually. This would increase the volumes of water available in the Hervey Bay region, hence reducing the incidence of level 3 and level 4 water restrictions in Hervey Bay.

The following assumptions have been applied to estimate the net economic impact of the reference project options under the scenario in which the interconnector is constructed under the base case:

- the interconnector is to be constructed by 2021 (over a two-year period), with a capital cost of $31 million (or $28.02 million in PV terms) and an annual energy pumping cost of $30,000 (or $0.31 million in PV terms); and
- based on data provided by KBR, the total economic cost of level 3 and level 4 water restrictions over the study period under the scenario in which the interconnector is constructed is estimated at $33.11 million (in PV terms).

The results of the scenario analysis are presented in Table 19. Although the NPV outcomes are still found to be negative, they are positively impacted by the inclusion of the interconnector project under the base case. This is attributable to the benefit of avoiding the capital cost associated with this augmentation. It is important to highlight that the economic feasibility of the interconnector project has not been assessed in this analysis. This project would need to be subject to a separate economic evaluation that considered all relevant economic benefits and costs associated with the project.

Table 19 Results of the scenario analysis

Reference project option	Net Present Value		% Change
	Base results	Scenario results	
Option 1A			
Net Present Value	($116.08)	($97.63)	15.9%
Benefit Cost Ratio	0.24	0.36	
Option 1B			
Net Present Value	($119.77)	($101.31)	15.4%
Benefit Cost Ratio	0.14	0.27	
Option 2A			
Net Present Value	($115.99)	($97.53)	15.9%
Benefit Cost Ratio	0.15	0.29	
Option 2B			
Net Present Value	($110.08)	($91.63)	16.8%
Benefit Cost Ratio	0.15	0.29	
Option 3			
Net Present Value	($125.19)	($106.74)	14.7%
Benefit Cost Ratio	0.13	0.26	

Source: Cost estimates provided by KBR.

8 Key findings and conclusions

The analysis presented in the preceding sections shows that all reference project options for the construction of a pipeline from the Burnett River to the Burrum Weir Pump Station result in significantly negative NPVs (ranging from ($110.08 million) to ($125.19 million)) with BCRs of well below 1 (ranging from 0.13 to 0.24). These results are driven by the following:

- the absence of a water supply augmentation under the base case over the study period. This is due to urban water demand in the Hervey Bay region not exceeding the safe reliable yield of the Burrum Weir out to 2048;
- the significant up-front cost associated with the reference project options, including the capital cost of construction of the pipeline and the purchase of the water allocations. The reference project options also involve significant ongoing costs in relation to operating and maintenance expenditure and the costs associated with water allocation charges; and
- the relatively low level of agricultural water use under the reference project options.

Whilst the reference project options perform better against the base case which includes the Maryborough to Hervey Bay Interconnector project, the NPVs for all reference project options remain significantly negative with BCRs of well below 1.

In conclusion, the urban water supply-demand balance in the Hervey Bay region over the next 30 years means that a major water supply augmentation in the short-to-medium term is unlikely to be feasible, particularly one with the significant up-front and ongoing costs as the development of a pipeline from the Burnett River to the Burrum Weir Pump Station.