Australian Government
Department of Agriculture and Water Resources

# Expression of Interest – Feasibility Component

# National Water Infrastructure Development Fund

## Section A: General information

| | |
|---|---|
| **Purpose of this form** | To apply for funding under the Feasibility Component of the National Water Infrastructure Development Fund ('the fund'). |
| **Before applying** | Read the Feasibility Component Guidelines<br>Ensure you meet the eligibility requirements at section C of this form. |
| **To complete this form** | **Electronically**<br>You can complete this form electronically, using Microsoft Word. Please remember to print it out and sign before submitting.<br>**Manually**<br>Use black or blue pen<br>Print in BLOCK LETTERS<br>Mark boxes with a tick or a cross |
| **Your application must include** | ☐ a completed and signed application form<br>☐ all attachments listed at question 9 |
| **Email your application** | waterinfrastructure@agriculture.gov.au |
| | **Please note altered forms will not be accepted** |

## Section B: Applicant and feasibility study details

**1 Jurisdiction and administering department details** Charters Towers Regional Council

Postal Address PO Box 189 CHARTERS TOWERS QLD 4820

Australian Business Number (ABN) 67 731 313 583

**2 Contact for correspondence**

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**3 Second contact for correspondence**

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Please note information provided here may be publically released.

| | |
|---|---|
| Project title | Big Rocks Weir |

| | |
|---|---|
| Short proposal description (one page max) | Charters Towers Regional Council (CTRC) is responsible for the provision of water supply to the Charters Towers community. Supplies are currently extracted from the Charters Towers Weir, situated on the Burdekin River. The existing weir has limited storage capacity and provides an insufficient level of reliability to the community and is unable to satisfactorily cater for any significant increase in demand. This presents a key limitation in attracting new industries to region and a major inhibitor to ensuring the long-term economic development to the region. (Refer to DEWS Report attached).<br>CTRC proposes to augment the storage capacity of the existing Charters Towers Weir with the construction of an additional weir at "Big Rocks", some 23 km upstream of the existing weir.<br>Configuration & Cost<br>• The Big Rocks Weir Concept is shown in Figure 2, Appendix A |

| | |
|---|---|
| | of the attached report.<br>• The Big Rocks Weir (10,000 ML) will enable CTRC to provide a sufficiently reliable water supply, in conjunction with the existing Charters Towers Weir, to supply up to approximately 11,000 to 12,000 ML/annum.<br>• The estimated capital cost of the project is $19.8 million.<br>*Impacts of River Hydrology* - Big Rocks Weir will have negligible impact on the hydrology of the Upper Burdekin River System. The weir's proposed storage capacity of 10,000 represents less than 0.25% of the total mean annual flows of the Burdekin River in its upper region. Furthermore, the current Burdekin Basin Water Resource Plan and Resource Operations Plan identify water allocations (10,000 ML Strategic Reserve and 10,000 General Reserve) that are currently available within the Upper Burdekin subcatchment.<br>**Key Opportunities**<br>In addition to the weir providing greatly enhanced security of water supply for the Charters Towers region, the following additional opportunities have been identified that warrant further consideration:<br>• *Recreation Development* – The Big Rocks Weir storage area has the potential to greatly enhance the current amenity of the Big Bend recreational area.<br>• *Agricultural Development* – Potential will exist for properties located in close proximity to the Big Rocks Weir storage to extract additional supplies from the river (during periods of natural river flow) for the purposes of irrigation. Similar irrigated agricultural developments have successfully established adjacent to the existing Charters Towers Weir. Furthermore, the Big Rocks Weir has the potential to efficiently integrate into any larger scale water resource development in the Upper Burdekin system (eg Dalrymple Scheme [7]). Refer to Agriculture map attached.<br>**Delivery**<br>The project is envisaged to be able to be undertaken in a period of approximately three years. The next key stages include CTRC securing funding, refining project delivery planning and commencing design. |

| | |
|---|---|
| Funding required through this EOI (exclusive of GST) | $3,000,000.00 |

## Section C: Eligibility Criteria

If you answer NO to any of the following questions, you are not eligible to apply for funding through this Expression of Interest process

**4 Are you a state or territory government?**

No ☑ You are not eligible to apply for funding through this Expression of Interest process

Yes ☐

**5 Does this funding request relate to a feasibility study for a proposed water infrastructure project?**

No ☐ You are not eligible to apply for funding through this Expression of Interest process

Yes ☑

## Section D: Applicant Response to Assessment Criteria

**6 Applicant response to assessment criteria**

Please refer to the Feasibility Component Guidelines for the Fund to respond to the criteria. If you refer to any attachments, please label them alphabetically (i.e. Attachment A, Attachment B etc).

| Assessment criterial no. | Applicant response |
|---|---|
| 1 Strategic approach | • Does applicant describe a clear and credible plan for undertaking the study?<br>o GHD's Concept Plan builds on previous studies/information and clearly defines the proposed scope of future work required. For the sake of clarity, the works identified in the section 7.2 of the Concept Plan (ie site investigations, preliminary design, approvals and detailed project delivery planning) are proposed to be included in the Feasibility Study.<br>• Can the study be delivered in the proposed time frame (ie by June 2019)?<br>o Section 7 and Appendix C of the Concept Plan outline the proposed delivery program. The schedule satisfies the timeline obligations of the funding agreement. |
| 2 Alignment with fund objectives | • Does the study align with the objectives of the fund?<br>o This project is directly focussed on facilitating the long-term economic development of the Charters Towers region by (a) providing a long-term secure water supply (b) creating additional opportunities for agricultural development in the region. The study will provide the detailed planning to enable informed water infrastructure investment and to expedite construction of the project.<br>• Will the study consider the principles of the National Water Initiative?<br>o Yes. The proposed project fully complies with current water resource plans (refer to page 21 of the Concept Plan) and is considered to fully align with COAG's NWI objectives.<br>• How does the proposal relate to Queensland's long-term strategic plan?<br>o The proposal is considered to fully align with the State's long-term strategic plan. Refer to page 21 of the Concept Plan. |

| Assessment criterial no. | Applicant response |
|---|---|
| 3 Proposed funding contributions | Council has a limited capacity to contribute to the feasibility and planning stage and has committed $50,000 over two year period. |
| 4 Cost effectiveness | • Are the costs appropriate for the study and are they justified?<br>o Council has obtained specialist advice on the proposed scope of work and costs from GHD, a highly reputable engineering organisation with substantial experience in this field of work and in this region of Queensland.<br>o Project cost estimates are clearly itemised and described in Section 6 and Appendix B of the Concept Plan.<br>• Is this a value-for-money proposal?<br>o This project presents clear benefits and limited barriers to implementation. The potential for this project to proceed and to realise the investment is very real.<br>o The scope of work and proposed study costs have been developed with careful consideration of the work undertaken to date and the current levels of uncertainty that warrant additional investigation.<br>o All key components of the study will be procured in strict accordance with Queensland Local Government procurement guidelines, which include a clear obligation to ensure value-for-money. |
| 5 Risk management | • Has the applicant described a clear and credible risk management strategy?<br>o Section 5 of the Concept Plan comprehensively identifies a broad range of project risks and opportunities.<br>o In addition to the above, Council recognises is in-house resource limitations and proposes to engage the services of suitably experienced consultants to assist with managing and undertaking the work. |
| 6 Performance history | • Council has a proud record of successfully delivering numerous State and Federally funded projects.<br>• The Concept Plan outlines a careful considered and well defined delivery program to undertake the work.<br>• Council will engage the services of suitably experienced consultants to assist with managing and undertaking the work. |

## 7 Attachments listed in responses to assessment criteria

Add in the title of the attachment in the space provided. Attachments must be referred to in your response to the assessment criteria. If they are not, the department reserves the right to not consider them as part of your application. (Add additional rows if required).

Attachment A Charters Towers Regional Council – Big Rocks Weir Concept Plan – GHD 9/15_____

Attachment B Charters Towers Regional Council Water Supply Security Assessment_____

Attachment C _____

Attachment D _____

## 8 Proposed funding contributions

Please note all figures must be exclusive of GST.

| Contributors | 2015-16 | 2016-17 | 2017-18 | 2018-19 | Total |
|---|---|---|---|---|---|
| Australian government | [Table text] | 983,000.00 | 983,000.00 | 984,000.00 | 2,950,000.00 |
| State or territory government | [Table text] | [Table text] | [Table text] | [Table text] | |
| CTRC | [Table text] | 25,000.00 | 25,000.00 | [Table text] | 50,000.00 |
| [name of investor add lines as required] | [Table text] | [Table text] | [Table text] | [Table text] | |
| Total financial contributions for project | | | | | 3,000,000.00 |

## Section E: Applicant declaration

To be completed by the person listed in section B of this application.

I declare that the information I have provided is true and correct. I understand that it is a criminal offence under the *Criminal Code Act 1995* to knowingly give false or misleading information to a Commonwealth officer exercising powers under Commonwealth law. This offence carries a maximum penalty of 12 months imprisonment.

**Please note altered forms will not be accepted**

Signat [redacted] s47F

Date (dd/mm/yyyy) 14/12/2015

Full name RAMON JAYO

## Section F: Privacy notice

'Personal information' means any information or opinion about an identified individual or an individual who is reasonably identifiable.

'Sensitive personal information' is a subset of personal information and includes any information or opinion about an individual's racial or ethnic origin, political opinion or association, religious beliefs or affiliations, philosophical beliefs, sexual preferences or practices, trade or professional associations and memberships, union membership, criminal record, health or genetic information and biometric information or templates.

The Department of Agriculture and Water Resources collects your personal information, as defined in the Privacy Act 1988 (Cwlth), to assess your application and for related purposes. If you fail to

provide some or all of the personal information requested in this form, the Department of Agriculture and Water Resources will not be able to process your application.
The Department of Agriculture and Water Resources may disclose your personal information to relevant authorities and other Australian government agencies, persons or organisations where necessary for these purposes, provided the disclosure is consistent with the Privacy Act 1988 and other relevant laws. Your personal information will be used and stored in accordance with the Australian Privacy Principles.

See the department's Privacy Policy to learn more about accessing or correcting personal information or making a complaint. Alternatively, telephone the department on +61 2 6272 3933.

**OFFICE USE ONLY**

Jurisdiction _____

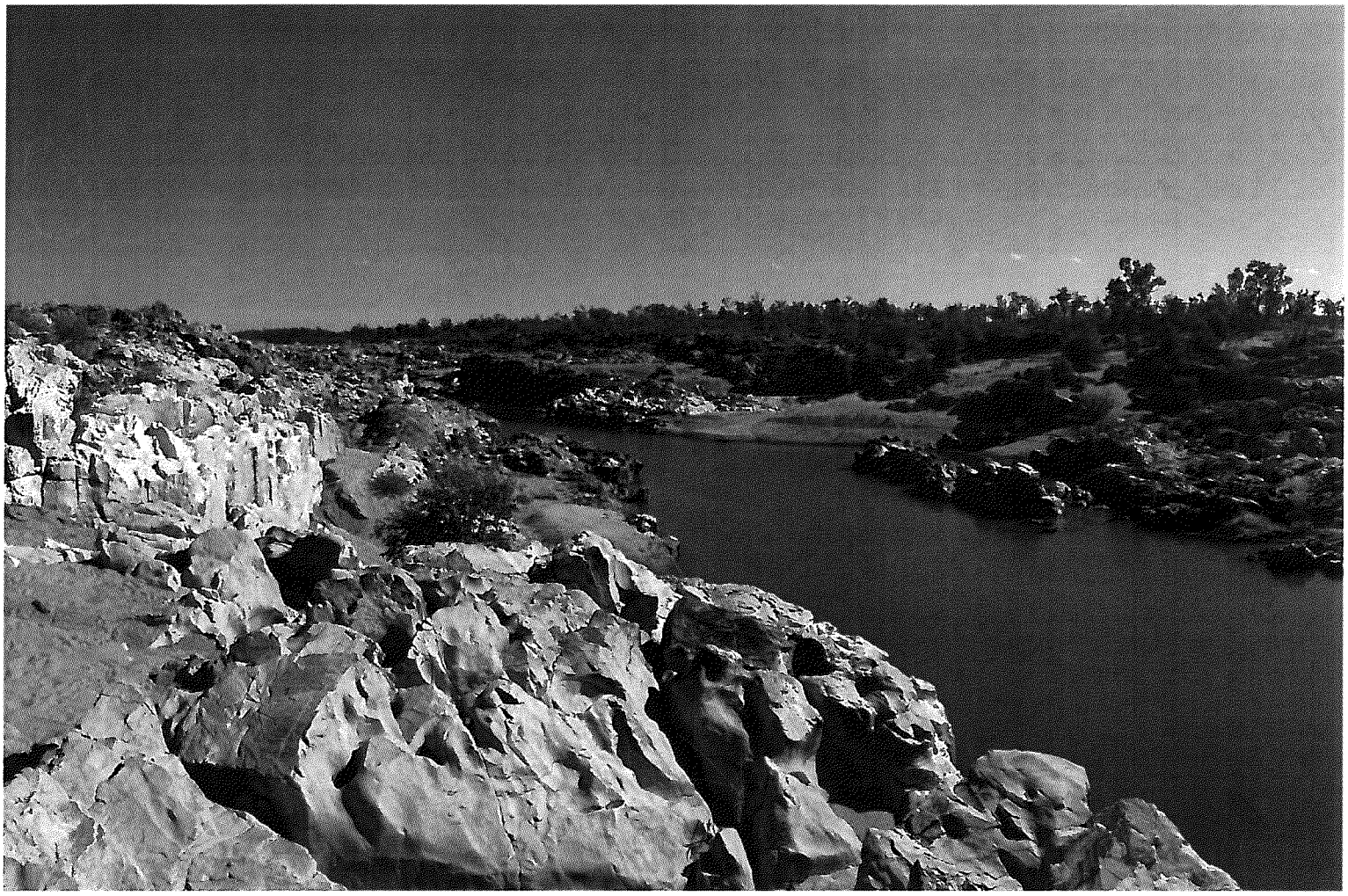
Application number _____

Eligibility of application

No ☐

Yes ☐

Department officer processing form _____



# Charters Towers Regional Council

## Big Rocks Weir
## Concept Plan

September 2015

# Table of Contents



# Table Index

# Figure Index



# Appendices

# 1. Executive Summary

Charters Towers Regional Council is responsible for the provision of water supply to the Charters Towers community. Supplies are currently extracted from the Charters Towers Weir, situated on the Burdekin River. The existing weir has limited storage capacity and relies heavily on regular flows within the Burdekin River in order to maintain a reliable supply to the community.

CTRC considers that the existing infrastructure provides an insufficient level of reliability to the community and is unable to satisfactorily cater for any significant increase in demand. This presents a key limitation in attracting new industries to region and a major inhibitor to ensuring the long-term economic development to the region.

In order to address the long-term water needs of Charters Towers, CTRC proposes to augment the storage capacity of the existing Charters Towers Weir with the construction of an additional weir at "Big Rocks", some 23 km upstream of the existing weir.

The purpose of this report is to develop a concept plan for the proposed Big Rocks Weir that assists CTRC in promoting the project, and securing funding and regulatory support for the project. The report is of a conceptual desktop nature and additional work will be required during subsequent phases of the project to refine and optimise the project.

Key findings of this report include:

**Configuration & Cost**

- The Big Rocks Weir Concept is shown in Figure 2, Appendix A.
- The Big Rocks Weir (10,000 ML) will enable CTRC to provide a sufficiently reliable water supply, in conjunction with the existing Charters Towers Weir, to supply up to approximately 11,000 to 12,000 ML/annum.
- The estimated capital cost of the project is $19.8 million.

**Key Risks**

A project of this nature inevitably involves a range of risks. However based on a preliminary assessment undertaken as part of this study, **no issues have been identified at this stage that are considered likely to present a major impediment to the project proceeding**. Key issues that have been identified (and for which it is considered acceptable management strategies can be implemented) include:

- *Impacts of River Hydrology* - Big Rocks Weir will have negligible impact on the hydrology of the Upper Burdekin River System. The weir's proposed storage capacity of 10,000 represents less than 0.25% of the total mean annual flows of the Burdekin River in its upper region. Furthermore, the current Burdekin Basin Water Resource Plan and Resource Operations Plan identify water allocations (10,000 ML Strategic Reserve and 10,000 General Reserve) that are currently available within the Upper Burdekin subcatchment. Based on preliminary discussions with DNRM, the Big Rocks Weir has the potential to be deemed as meeting the conditions required to qualify for access to the 10,000 ML Strategic Reserve for the Upper Burdekin. It is understood that none of the Strategic Reserve has been allocated and is therefore fully available to CTRC. It is understood that this allocation would be compliant with the current WRP and ROP and no additional hydrologic or environmental impacts assessments would be specifically in required in relation to this matter. It is also noted that the general reserve would be unaffected by the Big Rocks Weir project and remain available to other potential users in the Upper Burdekin

- *Waterway Barrier* – The weir is likely to be required to make suitable provision for the passage of fish upstream and downstream of the weir structure. Provision has been made in the concept for such a facility.
- *Inundation Impacts* – A range of impacts associated with physical construction of the weir and formation of the weir storage have been identified that are likely require regulatory assessment and approval. However none of the issues are currently considered to present major impacts that could adversely impact on the viability of the project.

**Key Opportunities**

In addition to the weir providing greatly enhanced security of water supply for the Charters Towers region, the following additional opportunities have been identified that warrant further consideration:

- *Recreation Development* – The Big Rocks Weir storage area has the potential to greatly enhance the current amenity of the Big Bend recreational area.
- *Agricultural Development* – Potential will exist for properties located in close proximity to the Big Rocks Weir storage to extract additional supplies from the river (during periods of natural river flow) for the purposes of irrigation. Similar irrigated agricultural developments have successfully established adjacent to the existing Charters Towers Weir. Furthermore, the Big Rocks Weir has the potential to efficiently integrate into any larger scale water resource development in the Upper Burdekin system (eg Dalrymple Scheme [7])

**Delivery**

The project is envisaged to be able to be undertaken in a period of approximately three years. The next key stages include CTRC securing funding, refining project delivery planning and commencing design.

# 2. Introduction

## 2.1 Background

Charters Towers Regional Council is responsible for the provision of water supply to the Charters Towers community. Supplies are extracted from the Charters Towers Weir situated on the Burdekin River.

The existing infrastructure ostensibly relies on the continued flow of the Burdekin River in order to maintain a reliable supply to the community. The weir only provides limited additional storage to meet demands during periods of no flow in the river. The infrastructure underwent upgrades in the early 1990's that were based on being able to supply the projected annual water demands for a seven month period of no flow in the river (based on historical records).

However since the upgrades, demand has grown has increased and river flows appear to be becoming less reliable. This has placed both short and long-term reliability of the town's water supply under significant pressure. CTRC considers that the current level of reliability offered to the community requires improvement.

Furthermore, CTRC is experiencing significant interest from a range industries to establish operations within CTRC's area. However these projects all require a highly reliable water supply. CTRC is currently unable to provide the surety of supply to potential new developments. Consequently CTRC's current water infrastructure is seen as a major limitation in attracting new industries and a major inhibitor to ensuring the long-term economic development to the region.

CTRC has identified the need to augment the storage capacity of the existing Charters Towers Weir as a key strategy in improving long-term water supply reliability to the region. (CTRC is also considering implementing a range of operational water demand management initiatives but these will not negate the need for additional raw water storage capacity.) CTRC wishes to create the additional raw water storage capacity required by construction of a weir on the Burdekin River at "Big Rocks", some 23 km upstream of the existing weir.

## 2.2 Purpose of this Report

The purpose of this report is to develop a concept plan (addressing infrastructure configuration, key project risks & opportunities, preliminary costs and project delivery) of the proposed Big Rocks Weir that assists CTRC in promoting the project, securing funding and regulatory support for the project's next phases.

The report is of a conceptual desktop nature and additional work will be required during subsequent phases of the project to refine and optimise the project.

## 2.3 Scope and Limitations

*This report: has been prepared by GHD for Charters Towers Regional Council* and *may only be used and relied on by Charters Towers Regional Council for the purpose agreed between GHD and the Charters Towers Regional Council as set out in Section 2.2 of this report.*

*GHD otherwise disclaims responsibility to any person other than Charters Towers Regional Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared this report on the basis of information provided by Charters Towers Regional Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

*GHD has prepared the preliminary cost estimate set out in Section 6 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.*

*The Cost Estimate has been prepared for the purpose of providing a preliminary indication of potential project costs and must not be used for any other purpose. The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the project can or will be undertaken at a cost which is the same or less than the Cost Estimate.*

*Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.*

# 3. Existing Water Supply System

## 3.1 Charters Towers Water Demands

### 3.1.1 Current Demand

Charters Towers currently has an estimated population of approximately 10,300 [1]. Typical annual water demand is currently approximately 4000 ML/year although this varies considerably due to annual climatic variations. During extended periods of below average rainfall, monthly demands are considerably higher than long term averages.

### 3.1.2 Future Demand

CTRC has identified a range of potential increases in water demand in the short-medium term as detailed in Table 3-1. These projections are based on actual approaches from potential project proponents and are not arbitrary estimates. This table includes an allowance to sustain possible agricultural development water demand of 4,700 ML/yr (ie approx. 500 to 1000 ha depending on specific cropping requirements).

**Table 3-1 – Potential Additional Water Demands**

| Demand Source | Daily Demand | Annual Demand (ML/yr) |
|---|---|---|
| Proposed Abattoir | 1 - 2 ML/day | 365 – 730 ML/yr |
| Proposed Pet Food Factory | 1 ML/day | 365 ML/yr |
| Residential Growth (especially related to regional mining developments) | 2 – 3 ML/day | 730 – 1095 ML/yr |
| Mining | 2 – 3 ML/day | 730 – 1095 ML/yr |
| Agriculture | 13 ML/day (approx.) | 4,700 ML/yr* |
| **Total** | **19 – 22 ML/day** | **6,890 – 7,985 ML/yr** |

Based on the above potential future demands, the forecast average annual demand may increase to approximately 10,890 – 11,985 ML in the medium term.

## 3.2 Water Supply Infrastructure

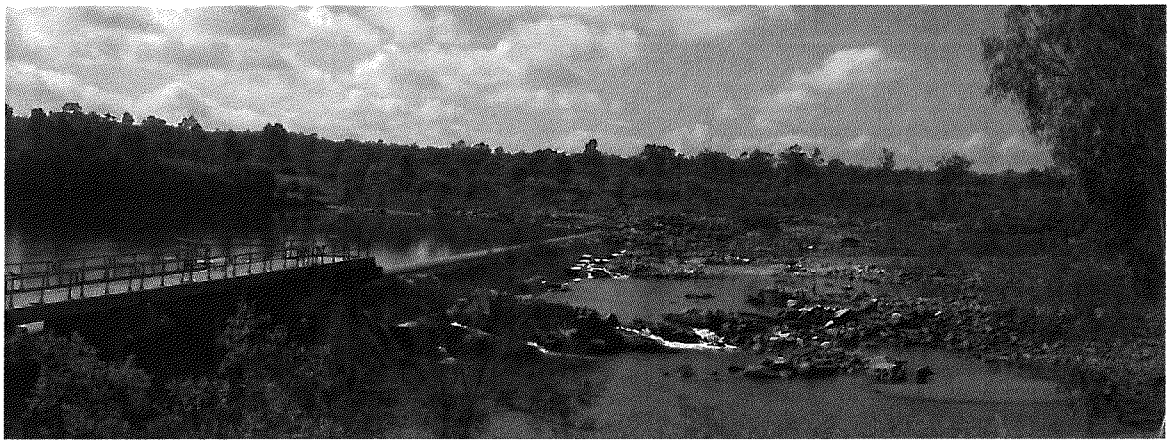
### 3.2.1 Water Source/Storage

At present, all water supplies for Charters Towers are drawn for the Charters Towers Weir on the Burdekin River, some 12 km north-east of the city. The weir was originally constructed in approximately 1900 following repeated drought periods when flows in the river ceased. The weir provided an efficient pumping pool whilst river flows occurred and then additional storage capacity to extract from once the river stopped flowing.

In more recent history, as the city's water demands grew, the ability to of the original weir to maintain supply during periods of no river flow became increasing untenable even with the imposition of severe water restrictions. In 1995, CTRC elected to raise the weir by approximately 2.1 m to a full supply level of RL 231 m which provided a total storage capacity of approximately 5227 ML and a usable storage capacity of approximately 4945 ML when accounting for "dead storage".

* Note: The annual agriculture demand is based on possible usage during the 7 month dry period. Refer Section 4.2 for details.

**Photo 3-1 Existing Charters Towers Weir**



Additional miscellaneous issues to note regarding the existing weir include the following:

- CTRC is required to maintain an environmental flow downstream of the weir at all times.
- A number of landholders adjoin the weir storage hold their own water allocations that entitle them to extract flows from the river/storage whilst inflows to the weir storage are occurring. The water is used primarily for irrigated agriculture.
- The weir has become a popular fishing and recreational facility.
- A significant zone of riparian vegetation has established alongside the weir storage area and is valued by local bird watching and environmental groups.
- The existing intake facility at the weir experiences significantly operation and maintenance problems with sediment build up. CTRC officers believe that the extent of problems has increased following raising of the weir.

### 3.2.2 Water Delivery & Treatment

Water is extracted from the existing weir via the Phil Matthews Pump Station and delivered to the FEJ Butcher Water Filtration Plant and then distributed to the city. Both the water delivery system and the treatment plant are facing significant capacity and reliability limitations. CTRC is addressing these challenges via a separate project.

## 3.3 Current System Reliability

### 3.3.1 Reliability Requirements

CTRC's water system supplies potable water to a significant sized community along with a number of regionally significant industries. Furthermore, there are a number of new industries seriously considering establishing operations in the area as described in Section 3.1.2. CTRC wishes to ensure that their water supply infrastructure can confidently supply high reliability water to the existing community and potential new consumers. To this end, CTRC's system yield/reliability requirements is classed as "High Priority" as defined by the *Water Resources (Burdekin) Plan 2007* [2] and *Burdekin Basin Resources Operations Plan 2009* [3].

### 3.3.2 Reliability Assessment

A detailed hydrologic assessment is beyond the scope of this concept plan. However the following general commentary can be provided.

- It is important to understand that CTRC's existing water supply scheme is primarily a "run of the river" scheme whereby river flows are extracted at the existing Charters Towers Weir

site. That is, most of the time, the weir simply acts as a pumping pool. It is only during periods of little or no runoff that the water stored within the weir is drawn down.

- Given the relatively limited storage capacity of the existing weir, the system is heavily reliant on regular flows within the river to "top up": the weir storage.
- A historical assessment of period of no flow in the Burdekin River has been previously reported [4]. Records indicate that the Burdekin River has stopped flowing for at least 50% of years on record for the period 1924-1993. During this time, the Burdekin River stopped flowing for periods of three months on four occasions, and up to seven months on one occasion.
- Even at current levels of demand (3000 to 4000 ML), Council has experienced sustained periods no flow in the river that have resulted in weir water levels have dropped to perilously low levels.
- Various investigations have shown that, in order to provide sufficient a level of reliability of supply, additional storage capacity will be required for any increase in current demand levels.

# 4. Big Rocks Weir

## 4.1 Overall Concept

"Big Rocks" is located on the Burdekin River approximately 26 km north of Charters Towers and 23 km upstream of the existing Charters Towers Weir. Refer Figure 1 and Figure 2, Appendix A. The construction of a weir at Big Rocks is not a new concept and was most recently considered by CTRC in 1994 [4].

CTRC's general concept for the Big Rocks Weir is as follows:

- Big Rocks Weir to have a storage capacity of 10,000 ML.
- The existing Charters Towers Weir would continue to act in the role of primary water supply and delivery source for the city.
- City demands would be extracted exclusively from the existing Charters Towers Weir whilst flows in the Burdekin River occurred.
- Once flows in the river ceased, and the storage within the existing weir started to get depleted, water would be released downstream from Big Rocks to the existing weir storage pool so as to extend the supply time available whilst there are no natural river flows.

## 4.2 Hydrology

### 4.2.1 General

The Upper Burdekin River captures a large catchment area and is a major watercourse. A Department of Natural Resources and Mines (DNRM) stream gauging station ("Gainsford" – Station No. 120122A) is located in close proximity to Big Rocks site (refer Figure 1, Appendix A). The following summary of information was obtained from the Bureau of Meteorology's Water Data Online website [5]:

- Catchment area 26,316 $km^2$
- Period of record 2004 to current
- Minimum annual discharge 1,195,723 ML
- Maximum annual discharge 14,135,670 ML
- Mean annual discharge 4,413,598 ML

Whilst the period of record is relatively limited it can be seen that, on an annual basis, the proposed storage capacity of Big Rocks Weir (10,000 ML) represents a very small portion of the total river flow (i.e. 0.2% of the mean annual discharge).

It is also noted that the current Water Resources (Burdekin) Plan 2007 [2] and Burdekin Basin Resource Operations Plan 2009 [3], which are based on exhaustive hydrologic modelling of the entire Burdekin system, incorporate an allowance for a total 20,000 ML of high priority water that is yet to be allocated.

It is clear from the above that:

- The proposed Big Rocks Weir storage will have negligible impact on the overall hydrology of the Upper Burdekin.
- Current water resource planning provisions make due allowance for a scheme of this magnitude.

### 4.2.2 Preliminary Yield Assessment

Historical monthly flow records have shown that the Burdekin River has had several no flow periods for three months and did not flow for seven months on one occasion since 1915 [4]. A preliminary yield assessment has been undertaken based on the current and predicted demand projections for Charters Towers as described in Section 3, including possible agriculture and irrigation demands.

The assessment is based on the existing Charters Towers Weir operating in conjunction with a new weir at Big Rocks with a storage capacity of 10,000 ML. The yield assessment has examined the proposed weir's ability to improve the reliability of supply for projected water demands (refer Section 3.1.2) during the worst extended period of no river flow on record (seven months – refer Section 3.3.2).

A summary of the inputs, assumptions and results of the yield assessment are outlined below.

*Storage Characteristics*

Storage characteristics for Big Rocks Weir are based on data from survey undertaken for previous investigations [4]. Storage characteristics for Big Rocks Weir are shown in Figure 4-1 and Figure 4-2.

Storage characteristics for Charters Towers Weir were provided by CTRC and are shown in Figure 4-3. The minimum operating level (and resultant dead storage) has been assumed in this yield assessment for each weir are as per existing information.

**Figure 4-1 Big Rocks Weir Storage Volume vs Height**

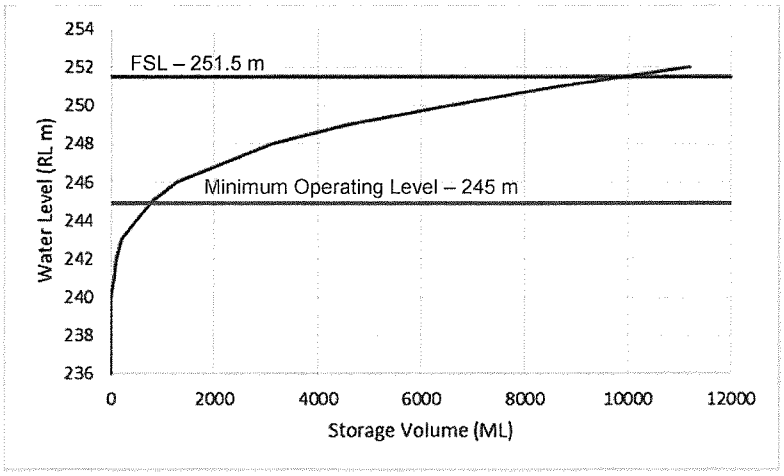


**Figure 4-2 Big Rocks Weir Storage Area vs Height**

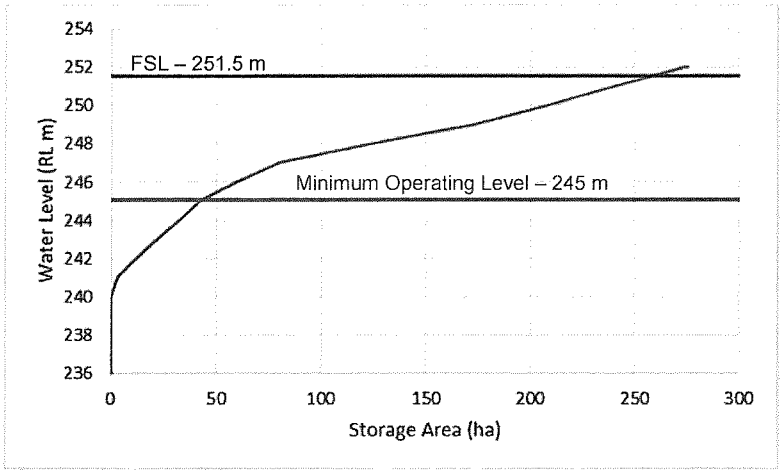
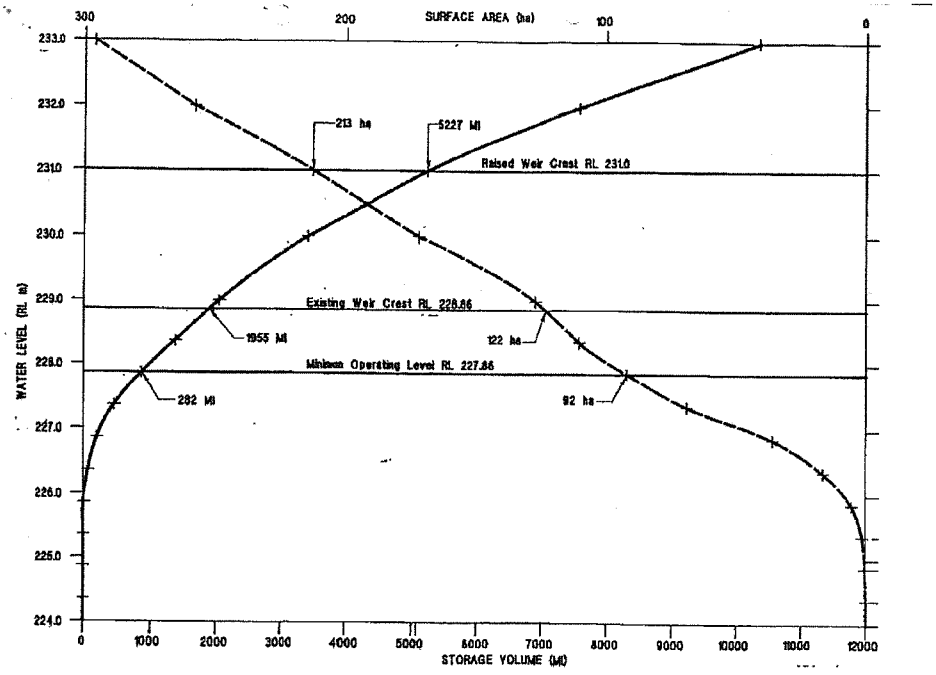



**Figure 4-3 Charters Towers Weir Storage Characteristics**

(Note – "raised weir" depicts current weir configuration)




### *Evaporation*

The pan evaporation and pan to lake evaporation factors used in this yield assessment are consistent with previous assessments [4, 6].

Transmission evaporation losses from Big Rocks Weir to Charters Towers Weir have been updated from previous assessments to take into account increased releases/demands for the proposed Big Rocks Weir storage capacity.

### *Seepage*

Seepage losses from Big Rocks Weir are estimated based on previous geotechnical investigations and assessment. Seepage from the weir is assumed to be captured downstream and contribute to storage in the Charters Towers Weir.

Seepage losses from Charters Towers Weir have been assumed to be a constant 30 ML/month. In practice, these seepage losses are likely to reduce as the reservoir level drops.

### *Environmental Flows*

A nominal environmental flow allowance of 300 ML/month has been assumed for this analysis.

### *Water Demands & Operational Rules*

Water released from the Big Rocks Weir has been determined based on consideration of the Charters Towers water demands (refer Section 3), evaporation losses from Charters Towers Weir storage, environmental flow requirements and transmission evaporation losses. The yield analysis assumes that water will be released from Big Rocks Weir once natural river flows cease with the aim of maintaining the existing weir at full supply level for as long as possible. Once Big Rocks Weir is depleted, water reserves held within the Charters Towers Weir will be accessed and the reservoir level at Charters Towers Weir will begin to decline until natural river flows occur.

### *Yield Assessment Results*

The preliminary yield analysis shows that the Big Rocks Weir (storage capacity of 10,000 ML) will satisfactorily meet projected water demands (refer Section 3.1.2) when operating to supplement the existing Charters Towers Weir. Figure 4-4 and Figure 4-5 illustrates the simulated storage levels within Big Rocks Weir and Charters Towers Weir for a seven month "no flow" period (worst on record) in the Burdekin River.

**Figure 4-4 Projected Big Rock's Weir Storage Volumes**

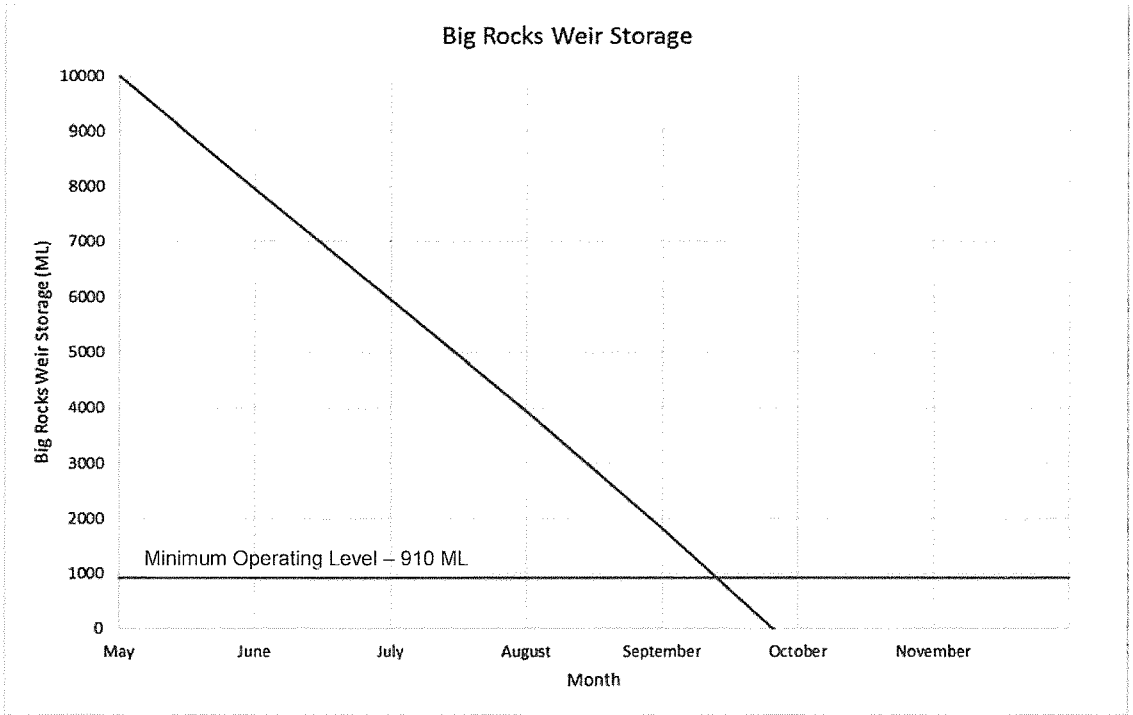
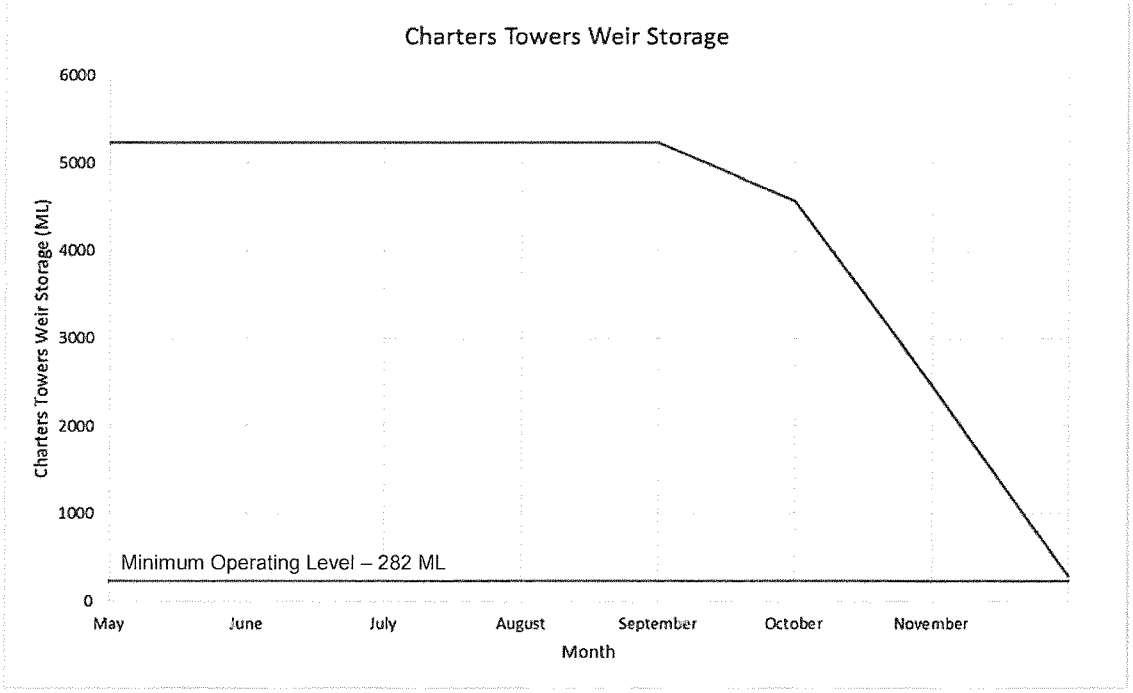


**Figure 4-5 Projected Existing Charters Towers Weir Storage Volumes**




***Impacts on Existing River Hydrology***

There are two gauging stations on the Burdekin River located in broad proximity to the Big Rocks site:

- Gainsford (GS120122A)
  - Location: approx.. 18 km upstream of Big Rocks
  - Period of Record: 2004 to 2015
  - Mean Annual Flow: 4,413,599 ML
  - Minimum Annual Flow: 1,195,724 ML
  - Maximum Annual Flow: 14,135,671 ML
- Sellheim (GS120002C)
  - Location: approx.. 40 km downstream of Big Rocks
  - Period of Record: 1968 to 2015
  - Mean Annual Flow: 4,908,769 ML
  - Minimum Annual Flow: 195,543 ML
  - Maximum Annual Flow: 24,248,488 ML

The proposed storage capacity of Big Rocks Weir is 10,000 ML and only represents approximately 0.25% of the total annual mean flow of the Upper Burdekin River.

## 4.3 Site Description

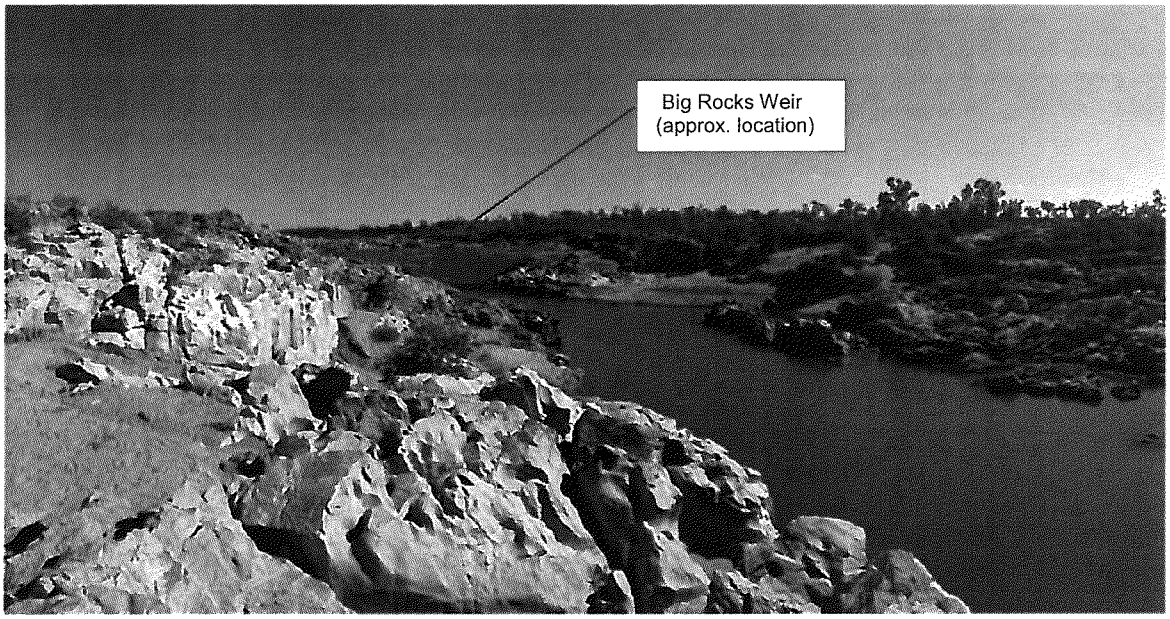
The Big Rocks weir site is located on the Burdekin River approximately 26 km north of Charters Towers and 23 km upstream of the existing Charters Towers Weir. Access to the site is proposed via the Gregory Developmental Road and an existing track to the south of the Burdekin River. The existing access track will be required to be upgraded nearer to the weir site due to a crossing at Lolworth Creek and rocky outcrops and high flow channels to the south of the main weir site.

The principal geological units of the site comprise [4]:

- Bedrock comprising granitoid rocks with dyke intrusions
- Devoninan limestones and associated sedimentary rocks
- Rhyolite intrusions
- Tertiary laterites and associated rocks
- Tertiary basaltic lava flows of the Nulla province
- Toomba basalt flow

The main flow channel and site of the proposed weir is situated on the Rhyolite gorge known as Big Rocks. This area is understood to consist of high strength rock. As such, installation of grouted anchors are likely to be sufficient for stability of the weir, without the need for foundation grouting. Saddle dams required to impound the required storage volume are proposed to be located in high flow channels to the north and south of the main channel. The site is located several kilometres downstream of 'Big Bend' and the Dalrymple National Park.

**Photo 4-1 Proposed Big Rocks Weir Site Looking Upstream**




## 4.4 Weir Configuration

### 4.4.1 General

The weir configuration contained in this concept report is based on the previous details developed during studies undertaken in the early 1990s by CTRC in considering water storage upgrades at that time [4].

The most notable change in the weir configuration is the revised storage capacity of 10,000 ML. Figure 4-1 provides a summary of the storage capacity estimates for the Big Rocks Weir site previously determined.

A concept site plan and configuration for the weir is shown in Figure 2, Appendix A. All details shown and described in the following sub-sections should be viewed as being of a conceptual nature only and subject to further investigation and refinement during subsequent phases of the project.

A range of key weir design concepts are summarised in the following sub-sections.

### 4.4.2 Full Supply Level

In order to achieve CTRC's proposed storage capacity of 10,000 ML, a weir crest level (ie FSL) of RL 251.5 m is required. This equates to a maximum structure height of approximately 10 m.

### 4.4.3 Upstream Hydraulics

Insufficient survey is currently available to accurately determine the upstream extent of the weir storage or the estimated increase in upstream flood levels as a result of the weir. However it is noted that the high banks of the river appear to be approximately 10 m higher that the proposed weir crest level. On that basis it is expected the increase in flood levels at "bank full" flow conditions due to the afflux created by the weir is likely within tolerable limits. The impounded storage area may impact on current access and activities at Big Bend.

### 4.4.4 Weir Structure

The current concept is based on construction of the weir using conventional mass concrete. Potential cost savings may be achievable with the use of roller compacted concrete and should be investigated during subsequent project phases. The weir concept shown consists of a homogeneous ogee shaped cross section. Alternative weir dimensions could be considered at in the design phase of the project following more detailed hydraulic assessment and comparison of construction techniques. The weir is likely to be anchored to the rock foundations using grouted anchor bars.

### 4.4.5 Intake/Outlet Facilities

Concept planning is based on sizing the intake/outlet system to enable peak city demands to be able to be met, with due consideration of:

- Seepage occurring through permeable basalt feature on the right (south) abutment, (previously estimated at approximately 1.25 ML/day for a water level at RL 250.0 [4]), noting that the majority of this seepage is likely to return to the Burdekin River downstream of the proposed weir.
- Evapotranspiration transmission losses between Big Rocks Weir and Charters Towers Weir.

The concept arrangement consists of an inlet tower with inlet screens and a single DN900 concrete encase outlet pipe. The outlet will be fitted with a control valve to control releases from the storage. Due to the relatively infrequent use, this valve has been assumed to be manually operated, however automation may be considered at a subsequent design stage. The intake tower should be fitted with guides to isolation with a bulkhead gate if required. Energy dissipation downstream of the weir is assumed to be via a concrete impact structure, as per previous studies.

The configuration and control philosophy of the intake and outlet will require refinement to take in account:

- Access (eg physical access to the weir is difficult and exacerbated during floods)
- Operations (eg the extent of remote operations required)
- Maintenance (eg management of sediment build up) issues.

### 4.4.6 Fish Passage

It is likely that the weir will be required to make suitable provision for the passage of fish. Due to the proposed height of the weir, the concept design is based on the use of a vertical fish lift

facility. Further investigations are required during subsequent phases of the project to determine the need, performance requirements and arrangement of the fish passage.

### 4.4.7 Saddle Dams

Based on currently available survey, two minor saddle dams are required to contain storage at RL 251.5 m. The northern and southern saddle dams are likely to be in the order of up to 3.7 m and 1.5 m height respectively. The southern (right bank) saddle dam could be configured to facilitate vehicle access to the weir during low/no river flow conditions.

### 4.4.8 Site Access

Direct permanent access to the actual weir structure will be difficult due to the terrain and river flood conditions at the site.

Concept planning has assumed that access to the weir structure will only be required for operations and maintenance purposes. That is, no public access to the weir structure has been allowed for.

Figure 2, Appendix A outlines the proposed site access concept.

Concept planning assumes that the existing access tracks in Fletcherview Station will be utilised based on accessing the general site from the Gregory Developmental Road. Upgrades to the existing causeway crossing of Lolworth Creek would be required.

In order to gain access to the actual weir site, it is proposed that a causeway crossing of the main overflow channel be constructed in the general location shown in Figure 2 , Appendix A. This alignment would be remain functional except during major floods.

Further assessment of site access requirements and configurations is required.

### 4.4.9 Recreation

The existing Charters Towers Weir is a popular recreational site for day visitors. It is also noted that the Big Bend/Dalrymple National Park, located approximately 8 km upstream of the Big Rocks weir site is also a popular recreational site for camping, four wheel driving and fishing. On that basis it is likely that the Big Rocks Weir site has the potential to greatly enhance the current recreational benefits at Big Bend and potentially expand to areas downstream near the Big Rocks Weir site. However it is also noted that construction of the Big Rocks Weir may increase the extent of flooding at Big Bend, particularly in relation to access via the flood overflow branch.

The current concept for Big Rocks Weir make no provision for any such development but the potential opportunities and risks should be given further consideration in subsequent stages of the project.

## 4.5 Big Rocks Weir vs Raising Charters Towers Weir

The Big Rocks weir site has previously been considered in similar studies. At the time, the costs and benefits of raising the existing Charters Towers Weir versus the Big Rocks Weir site were similar for a smaller storage upgrade (in the order of 3,500 ML). However, for a larger storage of 10,000 ML as proposed, the Big Rocks Weir site has many advantages compared to another raising of the Charters Towers Weir including:

- The river is much narrower at the proposed Big Rocks weir site and likely to be more efficiently constructed in terms of concrete volumes required. Furthermore, due to the narrow width, flow velocities will be much higher when the weir overtops which will reduce the likelihood of issues due to sedimentation, as experienced at the Charters Towers Weir.

- The weir site is located a relatively short distance upstream which offers opportunities for development of agricultural and industrial development adjacent to the river, north of Charters Towers, via in-stream offtakes.
- Based on an assessment of aerial photographs, publically available topographic maps and visual observation, there are likely to be lesser impacts on adjacent landuse and flooding that would result from raising Charters Towers Weir.
- The Big Bend and Dalrymple National Park are a popular area for recreational activity. Construction of Big Rocks Weir could encourage use of the storage for recreational benefits such as camping, fishing, hiking etc.
- Two separate storages offer an additional water security measure in the event of one storage becoming redundant, for example, due to blue green algae contamination, chemical spills etc.
- The existing reservoir rim at Charters Towers Weir has established a significant zone of riparian vegetation and is valued by local bird watching and environmental groups.
- Potential to efficiently integrate with any future major water resource development project that may occur in the Upper Burdekin.

# 5. Project Risks & Opportunities

## 5.1 General

This section briefly outlines a range of key risks and opportunities associated with construction of the proposed 10,000 ML storage capacity Big Rocks Weir. Note that the assessment has been of a conceptual nature only and additional detailed consideration of these and other matters will be required in subsequent stages of project planning.

## 5.2 Approvals

Table 5-1 summarises a preliminary listing of the key approvals considered likely to be of key relevance to the project at this concept stage. Previous studies have been relied upon where relevant [7] & [8].

**Table 5-1 – Summary of Approvals**

| Legislation | Background of Legislation | Potential Risks to Project | Comment |
|---|---|---|---|
| Environment Protection and Biodiversity Conservation Act 1999 | Relates to projects that have or are likely to have a significant impact on a matter of "national environmental significance" | Low | Previous studies in area have identified the following environmental values of national significance:<br>•13 listed threatened species<br>o 6 birds<br>o 4 mammals<br>o 2 reptiles<br>o 1 plant<br>•10 listed migratory species<br>o 1 migratory marine bird<br>o 5 migratory terrestrial birds<br>o 4 migratory wetland birds.<br>However this project is of a relatively small scale impact with the infrastructure located mostly within the frequent flood zone of Burdekin River. A minimum requirement will possibly be the preparation and lodgement of referral documentation for the project. |
| Native Title Act 1993 | Projects that impact on lands subject to a Native Title claim will require the proponent to enter into an Indigenous land use agreement. Areas not affected by claims will require assessment to determine if Native Title is extinguished. | Medium | No assessment has been undertaken at this conceptual stage. Considered unlikely to be a significant impediment to the project. |
| Aboriginal and Torres Strait Islander Heritage Protection Act 1984 | Protects areas and objects of particular significance to living Aboriginal people in accordance with tradition. | Medium | No assessment has been undertaken at this conceptual stage. Considered unlikely to be a significant impediment to the project |

| Legislation | Background of Legislation | Potential Risks to Project | Comment |
|---|---|---|---|
| Aboriginal Cultural Heritage Act 2003 | A person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage. | Medium | No assessment has been undertaken at this conceptual stage. Considered unlikely to be a significant impediment to the project |
| Environmental Protection Act 1994 | Aims to "protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development)". | Medium | The project is likely to involve "environmentally relevant activities" and hence will be subject to a range of approval conditions under the EP Act. However no key issues have been identified to date. |
| Fisheries Act 1994 | Provides for the use, conservation and enhancement of the community fisheries resources and fish habitats. | High | Construction of a weir has the potential to inhibit the upstream and downstream movement of fish species. Potential also exists for the proposed access causeway across Fletcher Creek to also impact on fish movement. The project would require approval to undertake waterway barrier works as part of the development permit. Provision of fish passage is an integral part of the waterway barrier works approval. |
| Land Act 1994 | Deals with obtaining new tenure over, or reconfiguring, parcels of land required for establishment of a project. | Medium | Land tenure arrangements will need to be addressed for the weir structures, the weir storage area and the access road. |
| Nature Conservation Act 1992 | Aims to conserve the biological diversity of wildlife and its values. | Medium | The project area is known to contain a number of regionally significant species of fauna and flora that are of regional significance. It is also noted that:<br>•The geology of the site, including the basalt formation, may be considered of regional significance.<br>•Fossil formations are known to occur in the general |

| Legislation | Background of Legislation | Potential Risks to Project | Comment |
|---|---|---|---|
| | | | region.<br>• The Dalrymple National Park will about the Big Rocks Weir storage.<br>Each of the above matters will require further assessment during subsequent phases of the project. It is possible that Big Rocks Weir will be subject to a range of approval conditions under this Act. However the extent of inundation resulting from the project is unlikely to significantly alter the current inundation impacts of the river during flooding. |
| Queensland Heritage Act 1992 | Provides for the conservation of Queensland's cultural heritage for the benefit of the community and future generations. | Low | No assessment has been undertaken at this conceptual stage. Considered unlikely to be a significant impediment to the project, although it is noted that the historic settlement of Dalrymple is located upstream of the weir site (at Dalrymple National Park) and will be located adjacent to the weir storage area. |
| Sustainable Planning Act 2009 | Aims to achieve sustainable planning outcomes through an integrated development assessment process. Makes provision for designation of certain facilities as community infrastructure and enables a streamlined approach to development assessment. | Low | Big Rocks Weir is likely to be defined as community infrastructure and will enable a coordinated approach to the planning approval process. |
| Vegetation Management Act 1999 | Regulates the clearing of native vegetation. Approval exemptions apply to community infrastructure as defined under Sustainable Planning Act 2009 | Low | Big Rocks Weir is likely to be defined as community infrastructure and would therefore be exempt. |
| Water Act 2000 | Provides for the sustainable management of water and other resources in Queensland. It is | Medium | The Burdekin Basin WRP and Resource Operations Plan currently identify the following allocations that are available |

| Legislation | Background of Legislation | Potential Risks to Project | Comment |
|---|---|---|---|
| | the overarching legislation which sets out how surface and ground water resources are to be preserved and shared among users.<br>Water Resource Plans (WRP) are subordinate legislation to the Water Act, and they set out the strategic framework for how water is allocated to users and the environment. The WRP for the Burdekin Basin (Water Resource (Burdekin Basin) Plan 2011) was first issued in 1999, and revised in 2011. The purpose of the plan (among other things) is to:<br>•Define the availability of water in the plan area<br>•Provide a framework for sustainably managing water and the taking of water<br>•Identify priorities and mechanisms for dealing with future water requirements<br>•Provide a framework for establishing water allocations<br>•Provide a framework for reversing, where practicable, degradation in natural ecosystems. | | within the Upper Burdekin subcatchment:<br>•10,000 ML Strategic Reserve for State Purposes<br>•10,000 ML General Reserve<br>Based on preliminary discussions with DNRM, the Big Rocks Weir has the potential to be deemed as meeting the conditions required to qualify for access to the 10,000 ML Strategic Reserve for the Upper Burdekin as its intended purpose is for the provision of community water supply.<br>It is understood that none of the Strategic Reserve has been allocated and is therefore fully available to CTRC. It is understood that this allocation would be compliant with the current WRP and ROP and no additional hydrologic or environmental impacts assessments would be specifically in required in relation to this matter.<br>It is also noted that the general reserve would be unaffected by the Big Rocks Weir project and remain available to other potential users in the Upper Burdekin.<br>In addition to the water allocations (addressed via an development permit and water license), a number of other matters relating to the Water Act may need to be addressed for this project including:<br>•Construction of waterway barrier<br>•Environmental flow objectives<br>•Riverine protection permit (to excavate, place fill or destroy vegetation in a watercourse)<br>•Quarry material allocation notice (for extraction of sand, rock or gravel from within the river bed for construction |

| Legislation | Background of Legislation | Potential Risks to Project | Comment |
|---|---|---|---|
| | | | activities) |
| Water Supply (Safety and Reliability) Act 2008 | Aims to strengthen the safety and reliability of Queensland's water supply and contains regulatory provisions relating to (among other things):<br>•Infrastructure management and service provision by water and sewerage service providers<br>•Supply of drinking water by water service providers<br>•Dam safety | Low | A referable dam is one that would put a population at risk in the event of failure. A dam is considered referable if the safety of two or more people would be at risk should the dam fail. Most weirs are found to not be categorised as being referable. However a failure impact assessment will need to be undertaken to confirm the failure impact rating of Big Rocks Weir. |

## 5.3 Engineering Risks & Opportunities

As previously stated, work undertaken to date is of a conceptual nature and a range of engineering risks and opportunities warrant further consideration during subsequent phases of project implementation including (but not necessarily limited to) the following:

- Weir Location
  - The site offers numerous locations for construction of the weir.
  - Additional work is required to optimise the location of the weir structure (and saddle dams) in order to minimise costs, impacts to adjacent landuse, recreational facilities and to optimise accessibility.
- Survey – The following additional survey is required in order to optimise the project design:
  - Topographic survey of the weir site area generally (to optimise design)
  - Topographic survey of the storage area (to accurately determine the extent of inundation and upstream flooding impacts)
  - Cadastral survey to assist with land tenure matters
- Geotechnical – Only limited geotechnical work has been undertaken previously. Additional investigations are required to address a range of issues including, but not limited to, the following:
  - Foundation conditions generally
  - Extent of weathered/exposed rock requiring removal
  - Refinement of seepage estimates through lava flow on right bank
- Hydrology/Hydraulics – Additional work is required in order to confirm the following risks are adequately mitigated:
  - Extent of upstream flooding – Not expected to present any significant change in regional flooding but may have impacts on Big Bend and sections of Dalrymple National Park located within the Burdekin watercourse).
  - Risk of sedimentation – Need to ensure storage does not face long-term sedimentation risks and that intake/outlet works are sufficiently reliable.
- Downstream Releases & Operating Rules – Whilst the Big Rocks Weir is located only some 23 km upstream of the weir storage, further consideration should be given to confirm that transmission losses between Big Rocks Weir and Charters Towers Weir are not excessive. Further consideration should also be given of the operating rules for both weirs to ensure that supply security is maximised.
- Weir Configuration
  - Concept planning is based on a weir design using mass concrete. Opportunity exists to consider the use of roller compacted concrete to minimise construction costs.
  - Consideration could be given to make allowance for future raisings of the weir
  - Intake/Outlet works – flooding/sediment/monitoring
- Access – A range of issues relating to access will require further consideration during subsequent phases of the project:
  - Nature of access requirements (e.g. restricted access vs public, weir structure vs weir storage area etc).
  - Trafficability requirements (e.g. sealed vs unsealed, flood immunity etc).
  - Potential access options to left abutment (noting that CTRC currently controls parcels of land on the left bank that are land locked).

  - Opportunity for some of the access works to be constructed by CTRC day labour.
  - None of these issues are expected to present any major impediment to the project other than potential cost implications. Concept planning has assumed a minimalist approach to access requirements.
- Flooding/Constructability – At this concept stage, the most significant construction risk is considered to be associated with the management of floods during construction. Flooding also has the potential to adversely impact on some of the site investigation and approvals work. The potential duration and severity of flooding at the site is readily quantifiable and it is anticipated that suitable design and construction methodologies, and programming initiatives, will be able to be developed.

## 5.4 Miscellaneous Risks & Opportunities

This section describes a range of miscellaneous risks and opportunities that are not currently included in the Big Rocks Weir concept:

***Future Recreation Development***

As discussed above, the Big Rocks Weir will create another significant surface water storage in the region and may present an opportunity to expand the current recreational facilities at Fletcher Creek and the low level recreational activities undertaken at Big Bend.

***Future Irrigation Development***

The Big Rocks Weir concept is currently focussed primarily on the supplementation of existing town water supplies to increase capacity and the overall level of reliability of supply to the city.

Nevertheless it is also recognised that, like similar arrangements adjacent to the existing Charters Towers Weir, significant interest may arise from landowners in close proximity to the Big Rocks Weir storage for the creation of irrigated agriculture projects. It is envisaged that such projects:

- Would acquire separate water extraction entitlements that do not detract from CTRC's proposed water entitlements.
- Would construct their own water extraction and delivery infrastructure upstream of the weir structure.
- Would operate opportunistically whilst flows are occurring with the river.

It is also acknowledged that the Big Rocks Weir could play a key role (i.e. downstream control structure and pumping pool) in any further large scale development of the Upper Burdekin (e.g. Dalrymple Scheme [7]). The potential future local irrigated agriculture projects could also perform as pilot programs for any large scale development being considered for the region.

# 6. Preliminary Project Costs

## 6.1 General

This section outlines estimated costs for the project. It is noted project costs are of a very preliminary nature and have been based on extremely limited information. Consequently the costs may be subject to significant refinement during to further phases of the project.

## 6.2 Capital Costs

**Table 6-1 – Summary of Preliminary Capital Costs**

| Item | | | Amount [1] (excl. GST) |
|---|---|---|---|
| | **Construction Costs** | | |
| A | • Direct Costs [2] | | $ 10,750,000 |
| B | • Indirect Costs (15%)[3] | | $ 1,650,000 |
| C | | Subtotal (A+B) | $ 12,400,000 |
| | **Other Project Costs** | | |
| D | • Engineering (incl. survey, geotechnical. Design, procurement, construction management) | allow 15% of C | $ 1,850,000 |
| E | • Approvals | allow 5% of C | $ 650,000 |
| F | • Land Tenure | allow | $ 200,000 |
| G | • CTRC Direct Costs | allow 1% of C | $ 125,000 |
| H | | Subtotal (D+E+F+G) | $ 2,800,000 |
| I | Contingency | Allow 30% of C+H | $ 4,560,000 |
| | **Total Project Cost** | **C+H+I** | **$ 19,760,000** |

Notes

1. Costs exclude GST and are shown in 2015 dollars. No allowance for escalation of projects costs has been made.
2. Detailed construction cost breakdown is provided in Appendix B.
3. Includes Contractors' corporate costs, off-site overheads and margin.

# 7. Delivery Program

## 7.1 General

A preliminary project delivery timetable is contained in Appendix C. It is noted that the program is of a very preliminary nature and have been based on extremely limited information. Consequently the tasks and durations identified may be subject to significant refinement during to further phases of the project.

Notwithstanding the preliminary nature of the program, the following key issues are noted:

- Once project funding is secured, the project is expected to take approximately 3 years to complete:
  - Year 1: Commence project planning and procure consultants
    Undertake site investigations & preliminary design
    Commence detailed design, approvals and land tenure
  - Year 2: Complete engineering, approvals & land tenure
    Procure construction contract
    Undertake construction work
  - Year 3: Complete construction work
- Construction work and some site-based design phase work will be heavily impacted by river flooding. At this stage, a nominal allowance of two months construction float has been included to make provision for potential delays due to flooding. The potential range of flooding at Big Rocks is quite considerable and this matter will need careful consideration during the next phase of the project.
- The program is based on the concept level risk assessment detailed in Section 5 and other similar projects. Opportunities exist to reduce the overall timeline but there also a range of factors that have the potential to extend the program.

## 7.2 Next Steps

Key tasks to be undertaken during the next stage of project include:

- Secure project funding, or at least sufficient funding to enable project planning, site investigations, preliminary design and approvals to be undertaken.
- Develop detailed project delivery planning that more thoroughly considers and addresses the various risks and opportunities associated with the project.
- Undertake site investigations (survey, geotechnical, environmental assessments etc) and preliminary design (including updated project costings).

# 8. References


[1] GHD, *Charters Towers Regional Council, Charters Towers Water Supply Planning Report*, Rev 0, 17 April 2014.

[2] McIntyre & Associates Pty Ltd, *Charters Towers City Council, Big Rocks Weir, Preliminary Design Report*, 25 February 1994.

[3] The State of Queensland, *Water Resource (Burdekin Basin) Plan 2007*, current as at 27 June 2014.

[4] Department of Environment and Resource Management (DERM), *Burdekin Basin Resource Operations Plan*, December 2009, amended October 2010, Revision 2.

[5] Australian Government Bureau of Meteorology (BoM), *Water Data Online, 30 June 2015.* [Online]. Available: http://www.bom.gov.au/waterdata/

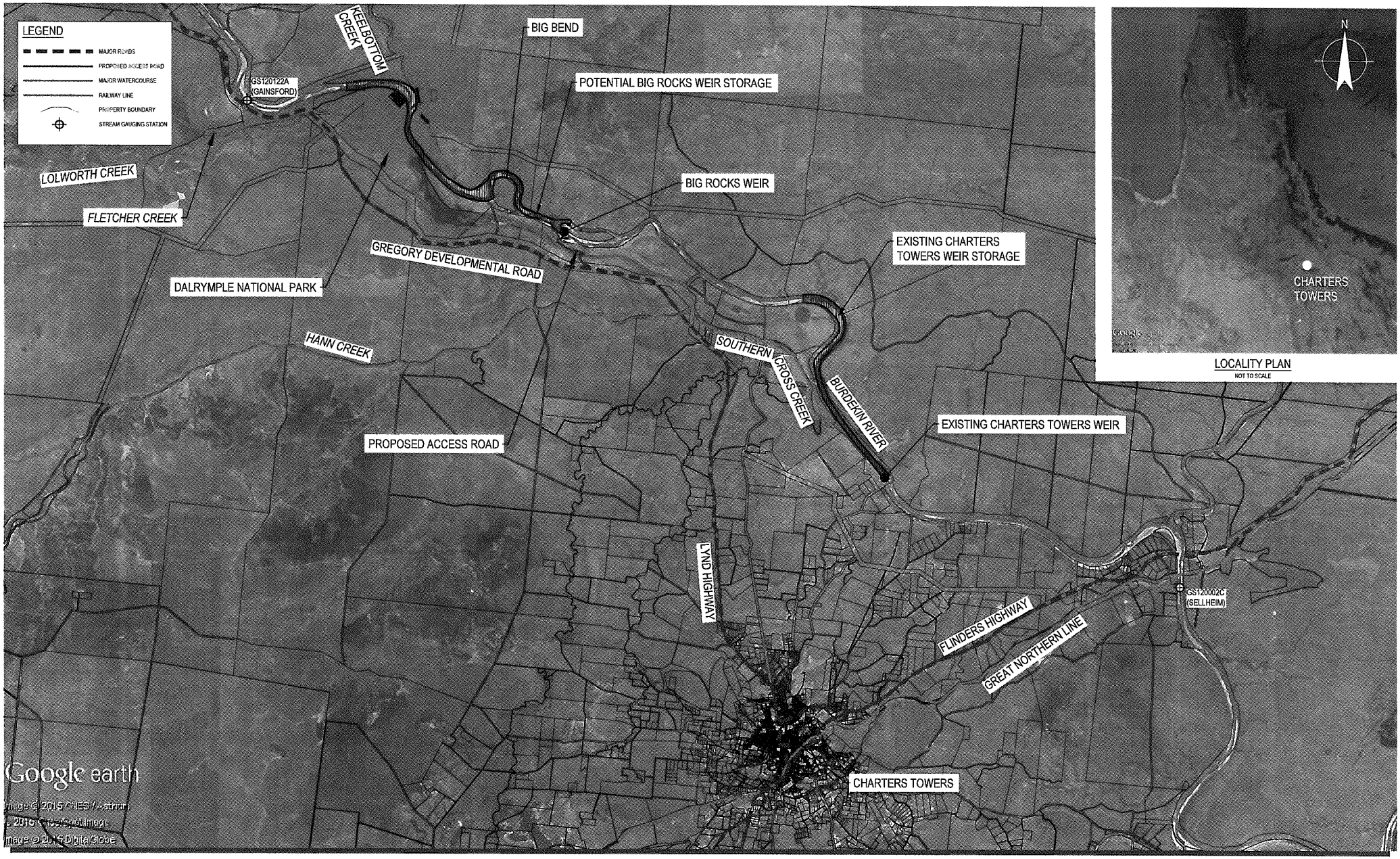
[6] McIntyre & Associates Pty Ltd, *Water Supply Investigation, Big Rocks Weir,* December 1988.

[7] GHD, *North & Northwest Queensland Sustainable Resources Feasibility Studies, The Dalrymple Scheme,* 4 April 2014.

[8] Burrows, DW, *An Initial Assessment of Water Infrastructure Options in the Burdekin* Catchment, Final Report, Report No. 99/29, December 1999.

# Appendices

# **Appendix A** – Concept Figures

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SCALE 1 : 80,000 AT ORIGINAL SIZE

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GHD

CHARTERS TOWERS REGIONAL COUNCIL
BIG ROCKS WEIR CONCEPT PLAN

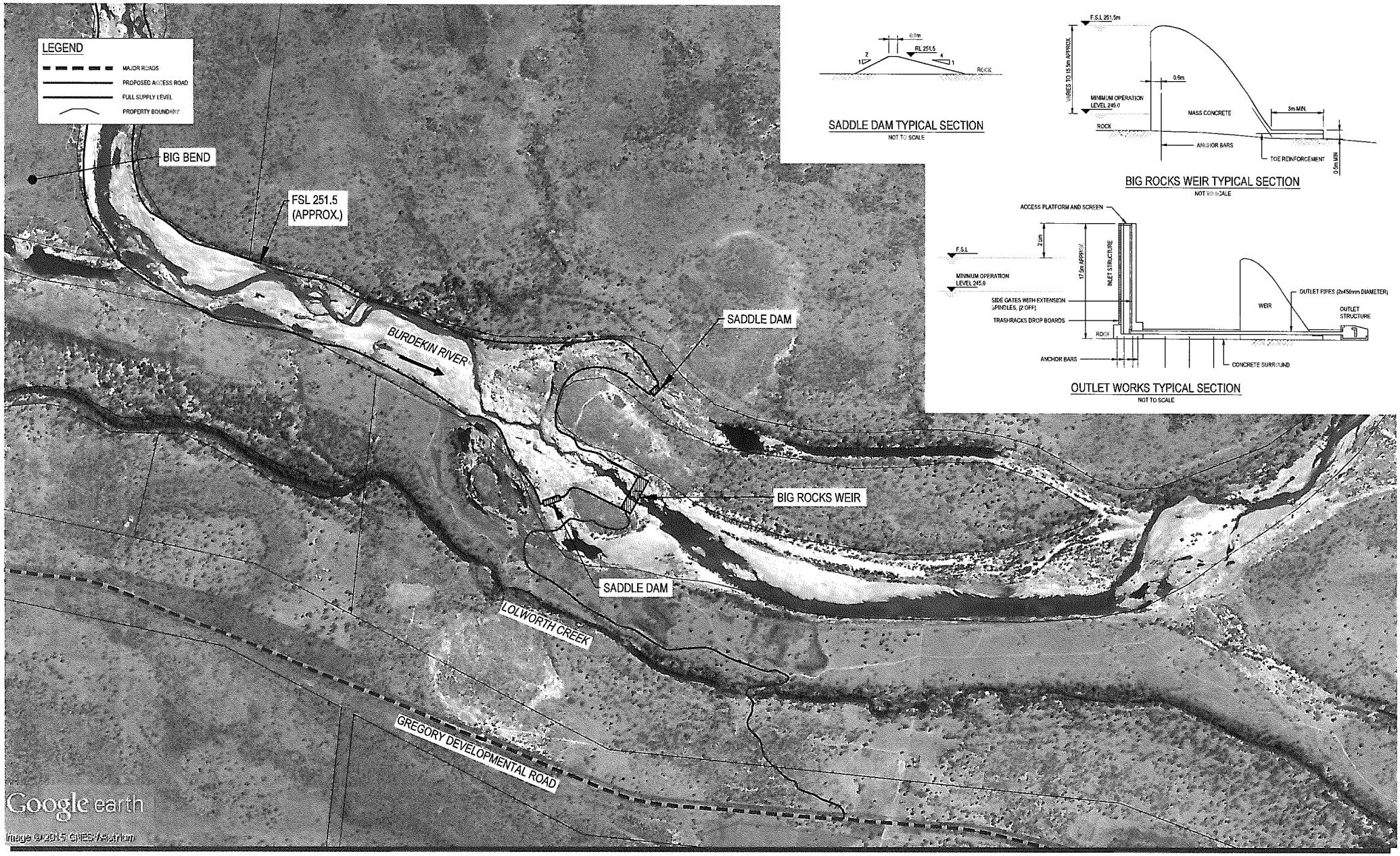
LOCALITY PLAN

Job Number 42-19018
Revision 0
Date SEP 2015

Figure 01

Level 1, 42 Sturt Street Townsville QLD 4810 Australia T 61 7 4720 0400 F 61 7 4772 6514 E tsvmail@ghd.com W www.ghd.com

Plot Date: 8 September 2015 - 2:21 PM Plotted by: Cliff Adams Cad File No: G:\42\19018\CAD\Drawings\42-19018-FIG01.dwg







SADDLE DAM TYPICAL SECTION
NOT TO SCALE




BIG ROCKS WEIR TYPICAL SECTION
NOT TO SCALE




OUTLET WORKS TYPICAL SECTION
NOT TO SCALE

0 100 200 300 400 500m
SCALE 1:8000 AT ORIGINAL SIZE

N

CHARTERS TOWERS REGIONAL COUNCIL
BIG ROCKS WEIR CONCEPT PLAN

Job Number 42-19018
Revision 0
Date SEP 2015

SITE PLAN

Figure 02

Level 1, 42 Sturt Street Townsville QLD 4810 Australia T 61 7 4720 0400 F 61 7 4772 6514 E tsvmail@ghd.com W www.ghd.com

Plot Date 8 September 2015 - 3:18 PM Plotted by Cliff Adams Cad File No G:\42\19018\CADD\Drawings\42-19018-FIG02.dwg

# **Appendix B** – Preliminary Construction Cost Estimate

# BIG ROCKS WEIR CONCEPT PLAN - PRELIMINARY COST ESTIMATE

| | COST ESTIMATE SUMMARY | | |
|---|---|---|---|
| | **CONSTRUCTION COSTS** | | **Amount ($)** |
| A | Direct Costs (refer adjacent) | | $ 10,750,000 |
| B | Indirect Costs (15%) | | $ 1,650,000 |
| C | | Subtotal (A+B) | $ 12,400,000 |
| | **OTHER PROJECT COSTS** | | |
| D | Engineering (incl. survey, geotechnical, design procurement, construction management) | allow 15% of C | $ 1,850,000 |
| E | Approvals | allow 5% of C | $ 650,000 |
| F | Land Tenure | allow | $ 200,000 |
| G | CTRC Direct Costs | allow 1% of C | $ 125,000 |
| H | | Subtotal (D+E+F+G) | $ 2,800,000 |
| I | Contingency | Allow 30% of C + H | $ 4,560,000 |
| | **TOTAL PROJECT COST** | **C + H + I** | $ 19,760,000 |

| DIRECT COSTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item No. | Description | Quantity | Unit | Rate | Amount ($) | | Final Amount ($) | |
| 1 | **GENERAL ITEMS** | | | | | | | |
| 1.01 | Site Establishment | 1 | | 5.0% | $ 378,900 | | | |
| 1.02 | Maintenance of site facilities | 1 | | 2.0% | $ 151,560 | | | |
| 1.03 | Insurances | 1 | | 2.0% | $ 151,560 | | | |
| 1.04 | Environmental plans, sediment control | 1 | | 2.0% | $ 151,560 | | | |
| 1.05 | Site rehabilitation | 1 | | 2.0% | $ 151,560 | | | |
| 1.06 | Survey and setting out of the works | 1 | | 1.0% | $ 75,780 | | | |
| 1.07 | Preparation of as-constructed drawings and information | 1 | | 0.5% | $ 37,890 | | | |
| 1.08 | SMP and compliance with Principal's and regulatory HSE requirements | 1 | | 2.0% | $ 151,560 | | | |
| 1.09 | Site Factor | 1 | | 15.0% | $ 1,136,700 | | | |
| 1.10 | Unmeasured Minor Items Allowance | 1 | | 10.0% | $ 757,800 | | | |
| | **SUB TOTAL** | | | | **$ 3,144,870** | say | **$ 3,150,000** | |
| 2 | **ACCESS ROAD** | | | | | | | |
| 2.01 | Construction access road (modify and extend existing) | 2500 | m | $ 20.00 | $ 50,000 | | | |
| 2.02 | Miscellaneous minor drainage structures | 1 | LS | $ 20,000.00 | $ 20,000 | | | |
| 2.03 | Lolworth creek crossing (concrete floodway) | 20 | m | $ 1,600.00 | $ 32,000 | | | |
| 2.04 | Highflow causeway crossing (concrete floodway & bridge) | 1 | LS | $ 200,000.00 | $ 200,000 | | | |
| | **SUB TOTAL** | | | | **$ 302,000** | say | **$ 300,000** | |
| 3 | **CARE OF WATER - RIVER DIVERSION** | | | | | | | |
| 3.01 | Cofferdam construction and removal | 9000 | $m^3$ | $ 20.00 | $ 180,000 | | | |
| 3.02 | Dewatering and river diversion during construction | 1 | LS | $ 400,000.00 | $ 400,000 | | | |
| | **SUB TOTAL** | | | | **$ 580,000** | say | **$ 600,000** | |
| 4 | **FOUNDATION PREPARATION** | | | | | | | |
| 4.01 | Foundation excavation in rock | 50 | $m^3$ | $ 400.00 | $ 20,000 | | | |
| 4.02 | Foundation preparation and cleanup | 13500 | $m^2$ | $ 60.00 | $ 810,000 | | | |
| 4.03 | Supply and place dental concrete for weir | 100 | $m^3$ | $ 200.00 | $ 20,000 | | | |
| | **SUB TOTAL** | | | | **$ 850,000** | say | **$ 850,000** | |
| 5 | **WEIR STRUCTURE** | | | | | | | |
| 5.01 | Supply and grout foundation anchor bars | 750 | m | $ 150.00 | $ 112,500 | | | |
| 5.02 | Supply and place mass concrete for weir | 10250 | $m^3$ | $ 250.00 | $ 2,562,500 | | | |
| 5.03 | Supply and place reinforced conrete for apron | 900 | $m^3$ | $ 300.00 | $ 270,000 | | | |
| | **SUB TOTAL** | | | | **$ 2,945,000** | say | **$ 2,950,000** | |
| 6 | **OUTLET WORKS** | | | | | | | |
| 6.01 | Construct reinforced concrete intake tower | 1 | LS | $ 200,000.00 | $ 200,000 | | | |
| 6.02 | Outlet pipes and valves | 1 | LS | $ 150,000.00 | $ 150,000 | | | |
| 6.03 | Outlet structure | 1 | LS | $ 40,000.00 | $ 40,000 | | | |
| 6.04 | Fish lift facility | 1 | LS | $ 2,000,000.00 | $ 2,000,000 | | | |
| | **SUB TOTAL** | | | | **$ 2,390,000** | say | **$ 2,400,000** | |
| 7 | **SADDLE DAMS** | | | | | | | |
| 7.01 | Stabalisation of southern bank | 1 | LS | $ 275,000.00 | $ 275,000 | | | |
| 7.02 | Southern saddle dam | 1 | LS | $ 176,000 | $ 176,000 | | | |
| 7.03 | Northern saddle dam | 1 | LS | $ 60,000 | $ 60,000 | | | |
| | **SUB TOTAL** | | | | **$ 511,000** | say | **$ 500,000** | |
| | **TOTAL** | | | | $ 10,722,870 | | $ 10,750,000 | |

*GHD has prepared the preliminary cost estimate set out in Section 6 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.*

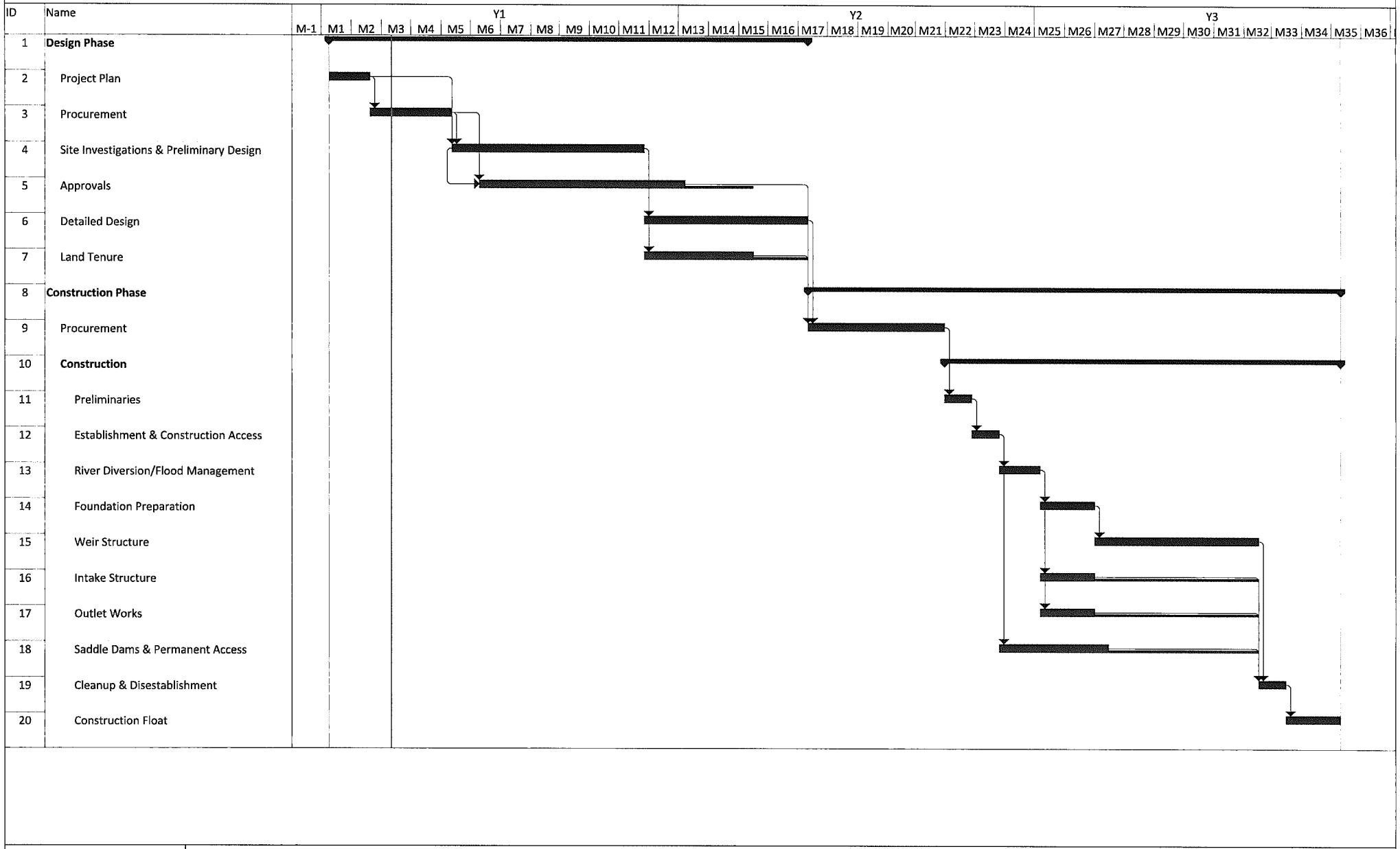
*The Cost Estimate has been prepared for the purpose of providing a preliminary indication of potential project costs and must not be used for any other purpose. The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the project can or will be undertaken at a cost which is the same or less than the Cost Estimate.*

*Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.*

# **Appendix C** – Preliminary Project Timetable

Content

# CHARTERS TOWERS REGIONAL COUNCIL
# BIG ROCKS WEIR CONCEPT PLAN - PRELIMINARY PROJECT TIMETABLE



GHD

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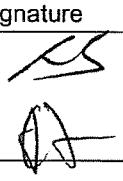
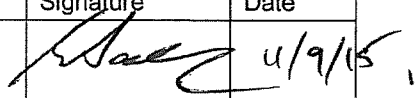
https://projects.ghd.com/oc/nqoc/UpperBurdekinIrrigationProjectConceptPlan/Delivery/Documents/Big Rocks Weir - Concept Plan Report.docx

Document Status

| Rev No. | Author | Reviewer | | Approved for Issue | | |
|---|---|---|---|---|---|---|
| | | Name | Signature | Name | Signature | Date |
| 0 | N. Thomas-Kinsella<br><br>R Saunders | R. Saunders<br><br>J. Foruria |  | R. Saunders |  | 4/9/15 |
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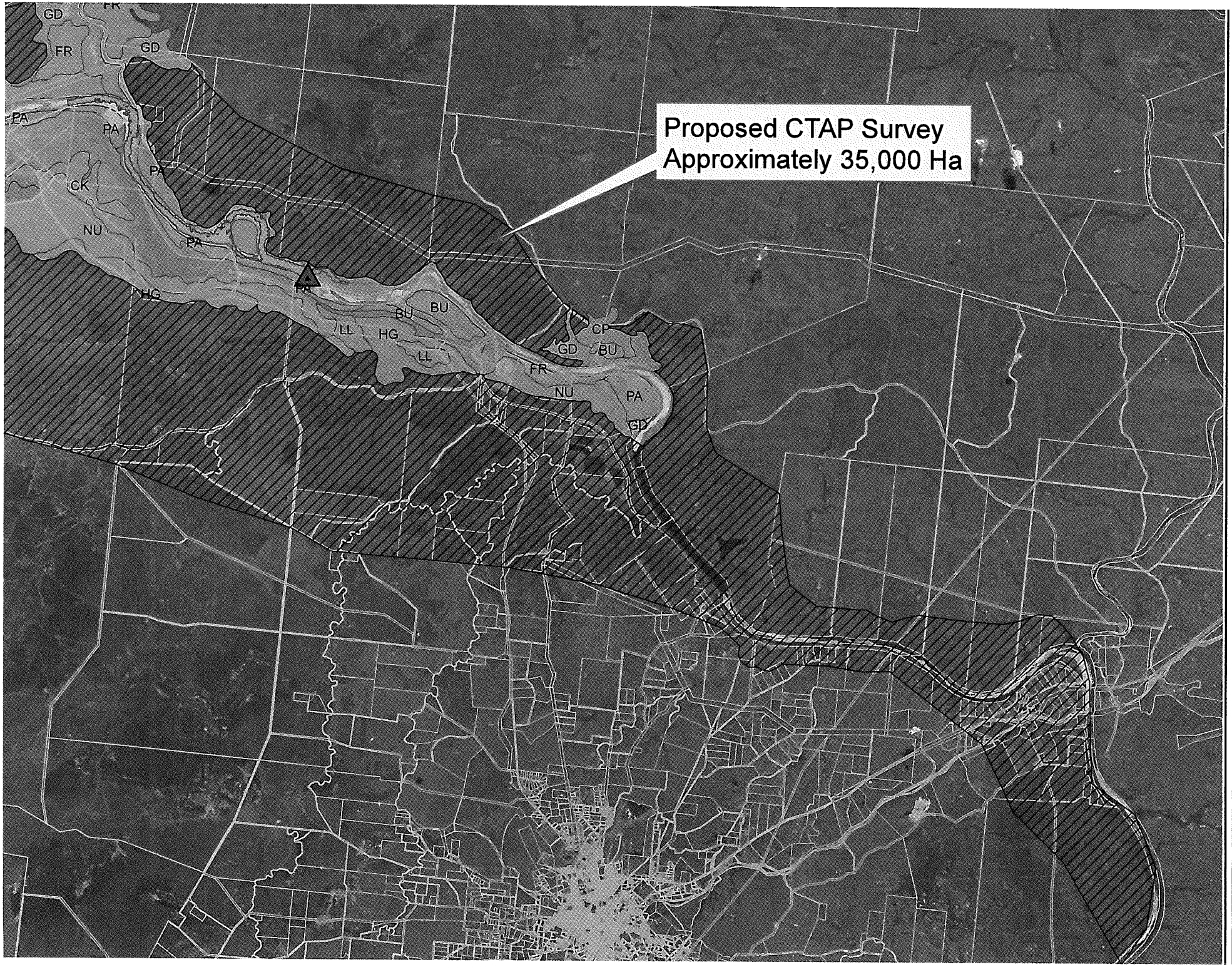
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PROJECTION: Transverse
HORIZONTAL DATUM: GI
ACCURACY STATEMEN
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Resources and Mines mak
reliability, completeness or
responsibility and all liabilit
expenses, losses, damage

PROPOSED
UPPER DAM
FSL 590

MOUNT FOX ROAD

HEADRACE TUNNEL
AND
POWER STATION
150-1200MW
PUMPED HYDRO

DOUGLAS CREEK

HELLS GATES DAM
10-15MW
HYDRO

GREENVALE
RAILWAY
(DECOMISSIONED)

PROPOSED
132/66/33/11kV
SUBSTATION

20MW SOLAR
FARM

CLARKE RIVER

GREGORY DEVELOPMENT ROAD

BURDEKIN RIVER

PLYNNING RIVER

HELLS GATES TO
ROSS RIVER PIPELINE

HERVEY RANGE ROAD

TOWNSVILLE

NORTHERN
IRRIGATION ZONE

CENTRAL
IRRIGATION ZONE

SOUTHERN
IRRIGATION ZONE

BIG ROCKS WEIR

CHARTERS TOWERS

N

LEGEND

- HELLS GATES DAM EXTENTS
- PROPOSED MAIN DAM
- STATE ROUTE
- LOCAL ROADS
- 132kV ELECTRICAL LINES
- 11kV ELECTRICAL LINES
- 66kV ELECTRICAL LINES
- PROPOSED TUNNEL
- PROPOSED IRRIGATION PIPELINE
- PROPOSED IRRIGATION CHANNEL
- PROPOSED WEIR LOCATIONS
- QR RAILWAY NETWORK
- DAM WALL
- EXISTING BRIDGE
- PROPOSED BRIDGE
- PROPOSED ROADS
- HELLS GATES TO ROSS RIVER PIPE LINE
- RIVERS
- POWER STATION
- SUBSTATION (66/11kV OR 33/11kV)

0 2 4 6 8 10km

# HELLS GATES DAM FEASIBILITY STUDY

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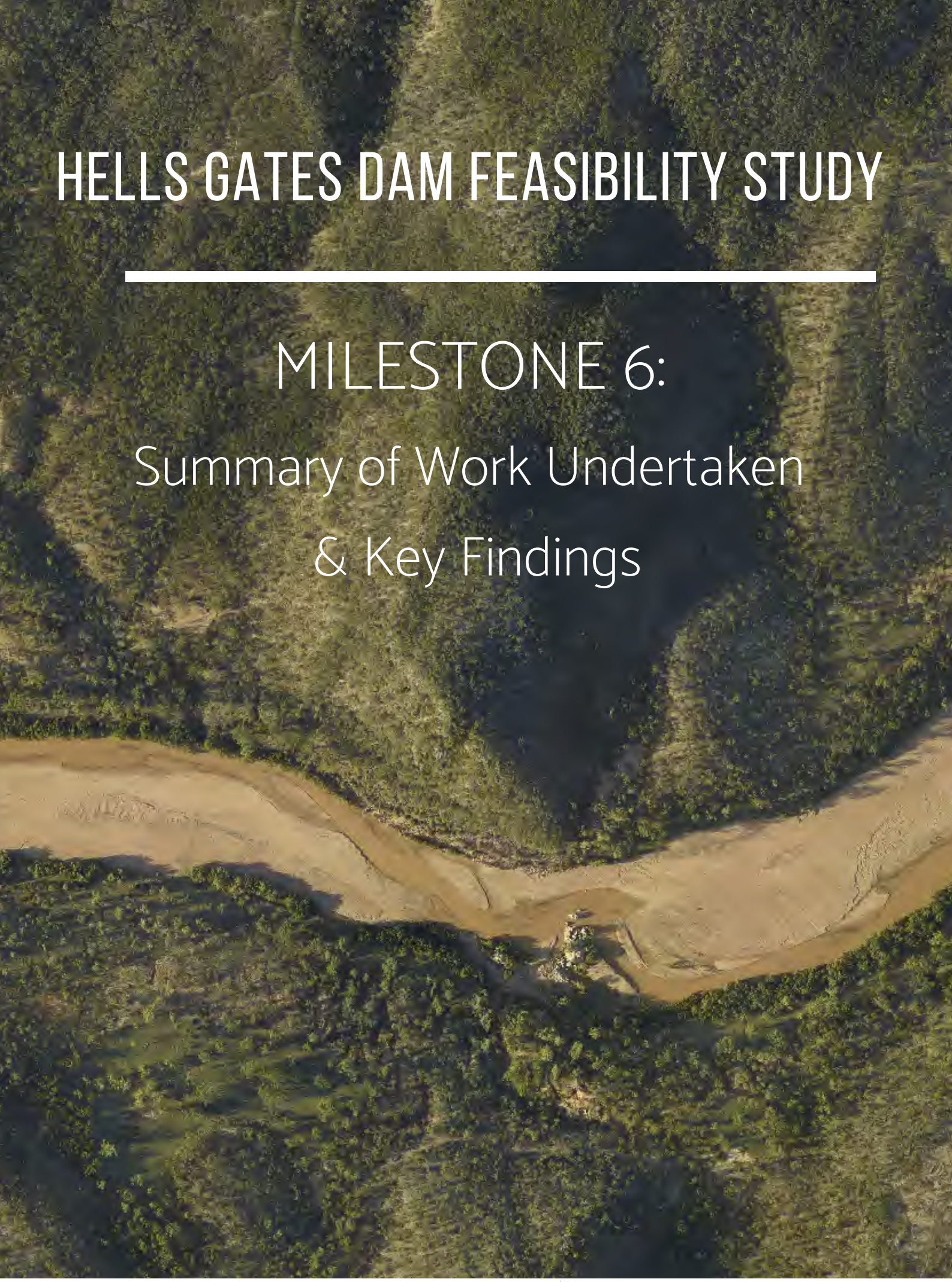

# HELLS GATES DAM FEASIBILITY STUDY

## MILESTONE 6:

## Summary of Work Undertaken & Key Findings

SMEC
Member of the Surbana Jurong Group

townsville enterprise

# Contents

# Document Control

| | |
|---|---|
| Document: | Milestone 6 – Technical Feasibility Report: Summary of Work Undertaken and Key Findings |
| File Location: | I:\Projects\30031890 - Hells Gate\001_Mgmt\1. Financial\1. Invoicing\Invoice 6 |
| Project Name: | Hells Gates Dam Feasibility Study |
| Project Number: | 30031890 |
| Revision Number: | 30031890-LTR-003 Rev01 |

## Revision History

| Revision # | Date | Prepared by | Reviewed by | Approved for Issue by |
|---|---|---|---|---|
| Draft 1 | 1/8/2018 | M Kelly/ G Pollock | G Pollock, H Hausfeld | G Pollock |

## Issue Register

| Distribution List | Date Issued | Number of Copies |
|---|---|---|
| Townsville Enterprise Limited (TEL) | 1/8/2018 | 1 |

## SMEC Company Details


| | | | |
|---|---|---|---|
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# 1. Delivery Process

This Milestone 6 statement covers both Milestone 5 and 6 as per the delivery schedule. Milestone 5 included the extensive economic assessment of the technical elements documented in the reporting for milestone 4, along with updates to the individual elements following comments and questions from various stakeholders received after the submission of the preliminary report to DNRME.

Milestone 6 then incorporated the specific comments and queries from the State of Queensland, refining some economic modelling and including additional data and more detail in some elements of the overall report.

The major technical elements assessed in Milestone 4, updated in Milestone 5 and then the subject of economic assessment in Milestone 5 included the following major components:

- Agricultural development
- Irrigation pipeline and channel infrastructures
- Dam and associated infrastructures
- Electrical and Power Infrastructure
- Hydropower Potential and Concept Infrastructures
- Transportation Infrastructure
- Geological Assessment
- Environmental and Cultural Heritage Assessment
- Land Tenure Assessment
- Water Supply and delivery infrastructure.

Specific additions to the Milestone 4 report following feedback from DNRME included the addition of new elements and significantly more information for other elements, including:

- Options analysis
- Staging of the project
- Next phases of development work
- Social impact evaluation.

The final report was then developed and split into three chapters:

- Executive summary
- Technical feasibility
- Economic & financial analysis.

This was then submitted to DNRME as the final report, concurrent with extensive stakeholder engagement.

# 2. Stakeholder Engagement

Milestone 6 included strong stakeholder engagement. Numerous stakeholder meetings were undertaken throughout Milestone 6 by the project leadership team including:

- TEL's Joe Carey, Michael McMillan, Patricia O'Callaghan and David Lynch
- SMEC's Graeme Pollock, Kris Narayan and Pat Brady (Premise).

The content delivered to stakeholders was generally quite broad, with informing specifics that weren't required of the broader audience, with briefings to the Queensland and Commonwealth Government being far more detailed.

***Detailed briefings delivered:***

- Queensland DNRME
- Commonwealth DAWS
- Senator Canavan, Minister for Northern Australia, and staff
- Senator McVeigh, Minister for Regional Development, and staff

***High level briefings delivered:***

- Charters Towers community 'Town Hall' meeting
- Regional Councils at Townsville, Charters Towers, Burdekin
- Townsville Water
- Katter's Australia Party
- Senator MacDonald & staff
- George Christensen, MP
- The staff of various Commonwealth ministers (in Canberra), including the PM, Deputy PM and Opposition MPs holding shadow portfolios with interests in Water and Regional Development
- Clean Energy Finance Corporation

# 3. Economic and Financial Assessment

AEC were the consortium member responsible for economic and financial assessment, and they performed the majority of works delivered in Milestone 5, which were then refined in Milestone 6. The technical inputs of Milestone 4 formed the majority of the economic analysis baseline data, along with a range of widely accepted market valuation techniques using widely accepted data sources.

AEC delivered the following:

- A high-level market assessment of each identified crop option, with consideration given to key factors including production value and volatility, export potential and existing growing regions within Australia and internationally
- Development of two potential cropping scenarios:
    - Mixed Cropping Scenario: Approximately 50,000 ha with a mix of crops across the identified soil types (annual horticulture, broadacre cropping, perennial crops)
    - Perennial Cropping Scenario: Approximately 30,000 ha of perennial crops irrigated using high security water.
- Financial analysis, including:
    - Cost recovery of infrastructure and identification of required water prices under QTC pricing practices
    - Consideration of agricultural producer's capacity to pay the required water prices using and on-farm Net Present Value/Internal Rate of Return. Net Present Values were sensitivity tested at +-30% for key model inputs
    - Calculation of a whole of scheme NPV and IRR for the mixed and perennial cropping scenarios. NPV's were sensitivity tested using Monte Carlo simulation of key model inputs.
- Economic Impact Assessment: Input-Output modelling was applied to estimate the direct and flow-on economic impacts (output, gross product, wages and salaries, Full Time Equivalent (FTE) jobs) associated with the project during construction and once operational
- Cost Benefit Assessment (CBA) of the mixed and perennial cropping scenarios considering the net socioeconomic benefits of the scenarios over a 30-year period to the State of Queensland. CBA results were sensitivity tested using Monte Carlo simulation of key model inputs
- Consideration of an urban water pipeline connection to Townsville: While the urban water connection was not included in the base scenarios, high level estimates of water costs and economic impacts during construction associated with the development were provided
- Consideration of the key risks, opportunities and next steps required to facilitate the development of the Hells Gates project.

Works were updated following stakeholder review, this included updates to the crop mixes, on farm costs, returns for solar and hydro developments and separation of the Townsville water pipeline from the broader project scenarios.

# 4. Results

The development of the proposed Hells Gates Dam is a challenging investment proposition given its nation building scale and the likely ramp-up time for production of high value tree crops. It is the opportunity of a lifetime to develop a large tract of highly viable land, create 4,000+ jobs and inject $1.3 billion of GRP annually into the North Queensland economy.

Modelled water costs are well above those seen in established irrigation areas that have viable economic scenarios growing broadacre crops (for example the established horticulture areas such as the Murray-Darling Basin). This is not an unexpected outcome – this greenfield site was never intended to compete domestically with Murray-Darling sourced produce, while the 2014 study that concentrated on sugar cane showed that traditional broadacre cropping was highly unlikely to be internationally competitive.

A critical message from this study is that delivery of an attractive investment proposition requires expansion of export quantities to the ASEAN and European markets for high value crops, and/or a substantial increase in grower returns for traditional broadacre cropping.

Hells Gates Irrigation Scheme needs to be set up to maximise a mosaic of high value produce such as tree crops (avocado, citrus, table grapes) and premium vegetables (capsicum, pumpkin, pulses) for the export market while not flooding those markets with single crops. There is potential for broadacre farming of crops such as sugar and cotton, but these lower value crops would not form the core investment return for the scheme.

Despite these challenges, the scheme represents a significant opportunity for the development of Northern Australia. The identified scheme has unique scale, at up to 50,000 ha, providing significant synergies in the development of new and existing markets. Furthermore, the high-security water supply allows for the development of a broad range of high-value perennial and annual crops, with long-view investment in foodbowl production for the emerging middle class of Asia.

## 4.1. De-risking Activities

The timeframes for development allow for positive macroeconomic trends, including rising emerging market demand for agricultural produce. Key steps to support and de-risk the proposed Hells Gates Dam development include:

- Releasing water allocations for development and irrigation of parcels of land adjacent to the Burdekin River, referred to as the Burdekin Zone, prior to Dam construction
- Supporting trial cropping to de-risk production on a significant scale, especially within the initial developments of the Burdekin Zone and to secure water supply available from the near-term construction of Big Rocks Weir
- Gaining environmental approvals and delivering developed engineering works to reduce the identified capital costs. The current early-stage design retains significant risk factors that are highly likely to be reduced with further research and design development
- Financial support for the development, including through Commonwealth and State grants
- During construction, support through the National Water Infrastructure Loan Facility and the Northern Australia Infrastructure Facility, potentially complimented by the Clean Energy Finance Corporation
- Further development of related high-return opportunities such as the prospective large-scale pumped hydro-electric scheme (PHES) that could improve the overall scheme CBR, NPV and IRR results significantly if proven to be technically viable.

## 4.2. Economic Outcomes

Excluding the prospective PHES and bulk water supply to Townsville, construction of the proposed Hells Gates Dam development has the potential to support substantial economic activity for North Queensland. During construction, the project is estimated to support:

- $5.7 billion in total output (including $3.7 billion directly)
- A $2.3 billion contribution to gross regional product (GRP) (including $1.4 billion directly)
- $1.0 billion in income for local workers (including $474 million directly)
- 10,855 FTE jobs (including 4,607 direct FTE positions).

On an annual basis, the agricultural precinct (once fully-operational and assuming a mix of horticultural and broadacre cropping, and excluding the Townsville pipeline and PHES) is expected to provide:

- $1.5 billion in total industry output (including $1.2 billion directly)
- A $823.4 million contribution to GRP (including $669.5 million directly)
- $341.0 million in income for households (including $273.9 million in direct wages and salaries)
- FTE employment totalling 5,564 jobs (including 4,565 direct FTE positions).

Flow-on impacts to the state and national economies are estimated to be even larger, where the scheme can be developed on a sustainable basis and where horticultural production based at the site does not negatively affect existing producers.

## 4.3. Cost-Benefit Assessment (CBA)

The CBA examined the construction and operating costs associated with the project over a 30-year timeframe. Specifically, the following costs and benefits were assessed:

- Costs:
  - Water storage capital costs
  - Water storage operational costs
  - On-farm capital costs.
- Benefits:
  - Agricultural net revenues
  - Operational wages
  - Local recreational amenity
  - Asset residual value.

The economic analysis undertaken outlines the present value (PV) of the identified costs and benefits between the financial year ending June 2027 and the financial year ending June 2056, at discount rates of 4%, 7%, and 10%.

The CBA modelling at the discount rate of 7% produced the following results:

- Mixed cropping scenario – net present value (NPV) of -$1.5 billion, benefit-cost ratio (BCR) of 0.70, and internal rate of return (IRR) of 4.3%
- Perennial cropping scenario – NPV of $1.5 billion, BCR of 1.33, and IRR of 9.3%.

These economic results remain the result of preliminary investigations, and are indicative of a highly attractive project that is deserving of further investigation. These investigations are to be aimed at confirming design characteristics, delivering environmental and cultural heritage clearance, to de-risk the project and reduce risk elements in the cost estimation that would likely see the overall capital investment amount reduce. During the period of project development in the next 4 years, agricultural produce prices are likely to increase significantly with the emergence of the Asian middle class, thus improving the potential cost-benefits on both sides of the CBR equation.

## 4.4. Technical Outcomes

The technical outcomes of the investigation support the development of a 2,100 GL storage dam in the upper Burdekin, which could be the catalyst for:

- Staged development of infrastructure to support 50,000 ha of irrigated horticulture, including fruit, vegetables, pulses / legumes, and broad-scale agriculture of both perennial and annual crops
- Upgrades to the road network to handle freight and tourism traffic
- Economic development opportunities in food processing in Charters Towers and the Townsville State Development Area
- Export opportunities of fresh foods and processed foods through the Port of Townsville and Townsville Airport to south-east Asia and southern Australian cities
- A 1200 MW pumped hydroelectric scheme
- A 20 MW solar farm and 15 MW run-of-river hydro facility at the toe of the dam
- Major upgrades to the power network in the Charters Towers region to allow development of on-farm water pumping and food processing
- Long-term water security for the City of Townsville, post-2035 (from Hells Gates Dam)
- Long-term water security for Charters Towers Regional Council (from Big Rocks Weir)
- Recreational (fishing, water sports) and tourism (caravan parks, gourmet foods) activities on a dam that will hold more capacity than the current largest dam in Queensland (Burdekin Falls) within 2.5 hours of Townsville.

## 4.5. Social Impact Evaluation

Hells Gates is a project of such a size that it has the potential to create broad social and economic change. At a strategic level, the Hells Gates project supports the vision of the Federal Government's Northern Infrastructure Facility. As outlined in the Our North, Our Future: White Paper on Developing Northern Australia (2015), the key concept is that a strong northern Australia is central to a strong nation. Containing abundant natural resources, northern Australia has great potential for growth and development and is Australia's connection into Asia and key trading partners. The vision is to accelerate development in northern Australia on the foundations of land, labour, water and infrastructure. Enabling infrastructure provides the catalyst for further growth and development and broad social and economic change. The Hells Gates project aligns with the objectives of the Northern Infrastructure Facility and the Burdekin River catchment has been identified as a key water resource capable of being further developed.

If constructed, the Hells Gates project would result in an estimated $2.7 billion contribution to Gross Regional Product (GRP) with the resultant agricultural precinct (once fully-operational) contributing an estimated $823 annually in terms of gross regional product and stimulate 1.5 billion annually in total industry output. The project would create an estimated 12,000+ FTE jobs in construction and the agriculture precinct is estimated to create 4,673 FTE jobs (3,845 direct) (AEC, 2018). Generation of such economic outputs will stimulate population growth which will lead to broad social change.

A range of beneficial and negative effects were identified and assessed in terms of (unmitigated) significance. These are addressed in detail in the Social Impact Evaluation added to Chapter 2 Technical Feasibility.

While a large number of negative effects were identified, many of these are of moderate to low significance and are able to be effectively mitigated. Effective implementation of mitigation measures would further reduce the significance rating of these impacts.

Considering the magnitude of positive economic and developmental outcomes generated by the Hells Gates Dam project, the overall social effect would be positive if relatively lesser significant socio-economic impacts are effectively mitigated.