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Review of Bundamba Water Reclamation Plant Capital Expenditure

Queensland Competition Authority

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Halcrow

Document History

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Queensland Competition Authority

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Abbreviations

Acronym	Description
EP	Equivalent Person or Population
ICIP	Ipswich City Infrastructure Project
STP	Sewage Treatment Plant
QCA	Queensland Competition Authority
QUU	Queensland Urban Utilities
WRP	Water Reclamation Plant

Executive Summary

Introduction

Halcrow has been commissioned by the Queensland Competition Authority (QCA, or the Authority) to assist with its Interim Price Monitoring review of the monopoly distribution and retail water and wastewater activities of Queensland Urban Utilities, Allconnex Water and Unitywater. In particular, Halcrow has been engaged to undertake an assessment of the prudence and efficiency of proposed capital expenditure on the Bundamba Water Reclamation Plant project to be constructed by Queensland Urban Utilities (QUU).

SKM has been engaged as the primary consultant for the review of capital expenditure as part of the Authority's price monitoring investigations, however, a conflict of interest has been identified in respect to this particular project and review by an alternative consultant was required.

Scope of Review

The scope of the review has involved, for each of the treatment plant projects:

- assessment of the application of QUU's policies and procedures for capital planning;
- an assessment as to whether the proposed expenditure is prudent;
- assessment as to whether the proposed expenditure is efficient;
- assessment of the proposed timing and deliverability of the proposed expenditure; and
- assessment of the implications (if any) for operating expenditure to be incurred by the respective entity.

Review Findings

Halcrow considers the proposed Bundamba WRP Upgrade Stage 5a project to be prudent on the basis of predicted growth (both population and industrial development) in the catchment and the need to maintain compliance discharge standards. It is noted, however, that the final form of the upgrade works and the timing of construction are still subject to the outcomes of a detailed review that is currently in hand.

Finalisation of the concept design (ie. the actual scope and output performance requirements) of the proposed works remains subject to a number of factors including plant loading (equivalent population services and raw sewage characteristics) and performance requirements (effluent standards and odour emission impacts). Accordingly, a definitive assessment of the efficiency of the proposed expenditure cannot be made at this stage.

Halcrow is, however, of the view that proposed expenditure of $2.05 million in 2011/12 is minimal (by comparison) and will be a prudent investment in respect of either finalising design and/or commencing construction of the proposed works.

1 Introduction

1.1 Background

Halcrow has been commissioned by the Queensland Competition Authority (QCA, or the Authority) to assist with its Interim Price Monitoring review of the monopoly distribution and retail water and wastewater activities of Queensland Urban Utilities, Allconnex Water and Unitywater. In particular, Halcrow has been engaged to undertake an assessment of the prudence and efficiency of proposed capital expenditure on the Bundamba Water Reclamation Plant project to be constructed by Queensland Urban Utilities (QUU).

SKM has been engaged as the primary consultant for the review of capital expenditure as part of the Authority's price monitoring investigations, however, a conflict of interest has been identified in respect to this particular project and review by an alternative consultant was required.

1.2 Scope of Review

The scope of this review of the prudence and efficiency of the proposed capital has comprised the following activities:

- Assess the application of QUU's policies and procedures for capital expenditure in relation to the water reclamation plant upgrade project.
- Assess whether the expenditure is prudent – the assessment is to consider if it is required as a result of a legal obligation, new growth (as approved by the Authority), renewal of existing infrastructure, or it achieves an increase in the reliability or the quality of supply that is explicitly endorsed or desired by customers, external agencies or participating councils. The consultant should identify where standards of service vary from industry benchmarks.
- Assess whether the expenditure is cost effective:
  - the scope of the works (which reflects the general characteristics of the capital item) is the best means of achieving the desired outcomes after having regard to the options available, including the substitution possibilities between capex and opex and non network alternatives such as demand management;
  - the standard of the works conforms with technical, design and construction requirements in legislation, industry and other standards, codes and manuals. Compatibility with existing and adjacent infrastructure is relevant as is consideration of modern engineering equivalents and technologies. Compliance with Strategic Asset Management Plans and Total Management Plans are likely to be highly relevant; and
  - the cost of the defined scope and standard of works is consistent with conditions prevailing in the markets for engineering, equipment supply and construction. The consultant must substantiate its view with reference to

relevant interstate and international benchmarks and information sources. For example, the source of comparable unit costs and indexes must be given and the efficiency of costs justified. The consultant should identify the reasons for any costs higher than normal commercial levels.

- Assess the deliverability and timing of the capital expenditure (for the specific projects).
- Liaise with the Authority's consultants appointed for the review, particularly the consultants responsible for the review of demand, to ensure that consistent advice is provided to the Authority.
- Take into account any previous reviews of relevant assets provided by the entities, such as Priority Infrastructure Plans (as they relate to each of the specific projects).
- Identify the value of any expenditure considered not to be prudent or efficient.

1.3 Scope of Report

This report sets out our findings in respect to the prudence and efficiency of the proposed capital expenditure on the identified sewage treatment plant upgrade and expansion projects. Review and assessment of each project is reported in the following manner:

- relevant reference documents are identified;
- a description of the project is presented;
- key drivers are identified and assessed; links to the entity's Asset Management Plan (or other overarching planning framework) are identified;
- the solution development (project planning process) is reviewed and assessed;
- cost estimates are identified and assessed;
- project timing and delivery mechanisms are discussed and assessed;
- any implications that the proposed capital expenditure will have in respect to operating expenditure are identified; and
- a summary of the assessment findings is presented.

1.4 Limitations of this Report

This report has been prepared for the QCA by Halcrow, for the sole purpose of providing an assessment as to the prudence and efficiency of forecast capital expenditure to be incurred by Queensland Urban Utilities in respect of the proposed Bundamba Water Reclamation Plant (Stage 5a) project. This report cannot be relied upon by any other party or for any other purpose.

Halcrow's assessment has been undertaken on the basis of information provided by Queensland Urban Utilities, including information provided in response to clarifications sought by Halcrow.

Importantly, Halcrow has not undertaken any independent verification of the reliability, accuracy or completeness of the information provided. Therefore, it should not be construed that we have carried out any form of audit or other verification of the adequacy, completeness, or reasonableness of the specific information provided by Queensland Urban Utilities.

2 Project Overview

2.1 Key Reference Documents

Key reference documents consulted in undertaking this review have included:

- Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated (refer **Appendix A**).
- Ipswich Water, *Bundamba STP; Feasibility Report*, prepared by KBR, 26 December 2008.
- Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011.
- Beca, *QUU 2011 Proposed Capital Works Review Part B – Review of Capital Projects*, 8 August 2011.
- Queensland Urban Utilities, Commissioning Model (MSExcel spreadsheet file *Commissioning Model 5yrs(404951_1).xls*).
- SKM/MMA, *Working Draft Report to the Queensland Competition Authority; Review of Demand Projections for South East Queensland*, 6 October 2011.
- Queensland Urban Utilities, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated (response to questions raised by Halcrow, 20 October 2011).

2.2 Project Description

This project involves increasing the capacity of the existing Bundamba Water Reclamation Plant from 120,000EP to 180,000EP. It may also involve upgrading of the biological nutrient removal process, although this is subject to final licence conditions which are yet to be confirmed.[1]

The works now proposed comprise Stage 5a of the development of the facility, which was most recently upgraded in 2003. Stage 5a is to be implemented in two (2) stages, as follows:[2,3]

- Stage 1 – Upgrade Bundamba STP to 140,000EP capacity by 2014; and
- Stage 2 – Upgrade Bundamba STP to 180,000EP capacity by 2018 at latest (completion of mechanical equipment purchase and fitout).

It is understood that, in order to increase the plant capacity to 140,000EP, a new clarifier system that will enable the plant to produce effluent to a 5mg/L total nitrogen and 2mg/L total phosphorus standard is to be implemented.[4]

[1] Beca, *QUU 2011 Proposed Capital Works Review Part B – Review of Capital Projects*, 8 August 2011, pg90.

[2] Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated.

[3] QUU, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated.

More specifically, it is understood that the Stage 5a upgrade works are currently proposed to include:[5]

- upgrade of the existing inlet works;
- purchase and installation of a new membrane/biological removal process train, including support services;
- refurbishment of existing plant components to remove hydraulic restrictions and create an aerobic sludge digester;
- installation of an odour treatment facility; and
- installation of new appurtenant facilities (service water chlorination; clarifier flow splitter; UV disinfection system; chemical dosing facility; and outfall to Bremer River).

It is noted that the actual scope and output performance of the proposed works remains subject to a number of factors, as discussed in **Section 4.5**. It is also noted that QUU is currently undertaking a detailed review of the staging (implementation timing) for the project (refer **Section 4.6**).

[4] Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated.

[5] Beca, *QUU 2011 Proposed Capital Works Review Part B – Review of Capital Projects*, 8 August 2011, pg92.

3 Key Drivers and Links to Asset Management Plan

3.1 General

Review of the available documentation indicated that the need for upgrade of the Bundamba WRP is driven principally by predicted growth in the catchment and effluent discharge licence compliance.

3.2 Population Growth

The Bundamba WRP has a current design capacity of approximately 120,000EP and a current loading in the order of 105,000EP. The population serviced by the facility is currently estimated to increase to 180,000EP by 2023,[6] although it appears that the timing at which this increase will be achieved is subject to further assessment.

In its draft *Review of Demand Projections*,[7] SKM/MMA presents information regarding QUU's demand forecasts for Ipswich. This shows an increase of 3.6 percent per annum in residential connections and 1.0 percent per annum in non-residential connections. By comparison, on the basis of OESR/PIFU[8] forecasts, allowance for growth rates of 5.3 percent per annum for both residential and non-residential connections is recommended.

Whilst forecast growth rates have not been presented in equivalent population (EP) terms, analysis reveals that achievement of 180,000EP by 2023 equates to growth of approximately 4.6 percent per annum. The proposed augmentation (upgrade) works are justified on the basis of predicted population growth.

3.3 Licence Compliance

It is understood that the Bundamba WRP currently achieves effluent standards of 5mg/L total nitrogen and 2mg/L total phosphorus in dry weather, however, hydraulic constraints result in operational difficulties and some non-compliant discharges during wet weather;[9] accordingly augmentation of the plant to achieve compliance in wet weather is required.

Furthermore, it is understood that upgrade of the plant to accommodate growth will trigger negotiation of a new discharge licence with the Department of Environment and Resource Management (DERM). DERM has previously indicated that a 3TN/1TP

[6] Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated.

[7] SKM/MMA, *Working Draft Report to the Queensland Competition Authority; Review of Demand Projections for South East Queensland*, 6 October 2011, Section 3.6.

[8] Office of Economic and Statistical Research (OESR) Planning and Information Forecasting Unit (PIFU) (now the Demography and Planning Unit (DPU)).

[9] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pgii & pgxvi.

(3mg/L total nitrogen and 1mg/L total phosphorus) effluent standard would be required on the basis that the Bremer River (point of discharge) has consistently 'failed' annual assessment under the *Healthy Waterways Partnership*.[10]

Whilst actual compliance requirements are yet to be negotiated, it is apparent that augmentation of the plant is justified on this basis.

3.4 Other Impacts

3.4.1 Environmental Impact

A Preliminary Environmental Assessment undertaken in 2008 identified a number of environmental issues that need to be addressed during operation of the upgraded Bundamba WRP.[11] These included:

- Increased odour – due to proximity of both residential receptors and industrial precincts, minimisation of potential odour is a high priority;
- Reduced water quality in the Bremer River – the quality and quantity of effluent to the Bremer River needed to be determined as a priority; and
- Localised flooding – appropriate mitigation measures are required given that the WRP is located within the 100 year ARI flood zone.

The assessment concluded that an Environmental Impact Statement was required given that the proposed WRP upgrade would constitute a Material Change of Use.

3.4.2 Flood Impact

A Flood Impact Report prepared in 2009 considered flooding and stormwater management in the vicinity of the WRP site. It proposed a flood protection strategy that comprised filling the proposed augmentation area to match the existing WRP platform level and locating critical assets above the nominated 100 year ARI flood level.[12]

A further Flood Impact Report prepared in 2011[13] concluded that, whilst the majority of the plant site lies within the 100 year ARI flood plain, the Bundamba WRP was not affected by the recent (January 2011) floods.

[10] *Healthy Waterways* is a not-for-profit, non-government organisation working collaboratively with government, industry, researchers and the community.

[11] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pg6.

[12] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pg7.

[13] Beca, *Flood Impact Assessment*, February 2011 referenced in Beca, *QUU 2011 Proposed Capital Works Review Part B – Review of Capital Projects*, 8 August 2011, pg91.

3.5 Summary

On the basis of the information reviewed, it is apparent that augmentation of the Bundamba WRP is justified on the basis of both population growth and the requirement to comply with prevailing effluent discharge standards.

4 Solution Development

4.1 Overview

Review of the documentation provided by QUU reveals that the proposal to augment the capacity of the Bundamba WRP, as currently proposed, has been the subject of planning and investigation over a number of years. The process has included undertaking a Feasibility Study (2008), development of a Concept Design (2009/10) and reworking of the Concept Design (2011).

QUU has identified[14] the extent of the studies undertaken to be as follows:

- MWH, ICIP Bundamba WRP - Preliminary Environmental Assessment, Sept 2008;
- KBR, Bundamba WRP – Feasibility Report, October 2008;
- SKM, ICIP Bundamba WRP – Flood Impact Report, September 2008;
- SKM, ICIP Bundamba WRP – 30% Concept Design Report, October 2009;
- SKM, ICIP Bundamba WRP – Bremer River Diffuser Report, October 2009;
- SKM, ICIP Bundamba WRP – Final Concept Design Report, January 2010; and
- SKM, ICIP Bundamba WRP – Review of Staging, May 2010.

A Concept Design Addendum Report,[15] prepared by QUU, presents the most recent proposals.

4.2 Feasibility Study

A *Feasibility Report*[16] prepared in 2008 assessed the capacity of the existing facility as 120,000EP,[17] and proposed an augmentation staging strategy comprising 60,000EP augmentations in 2013 (Stage 5) and 2023 (Stage 6). Two (2) options for biological treatment upgrades were considered, as follows:

- Case 1 (5N/1P) – augmentation to achieve effluent limits of 5mg/L total nitrogen and 1mg/L total phosphorus; and
- Case 2 (3N/0.5P) – augmentation to achieve effluent limits of 3mg/L total nitrogen and 0.5mg/L total phosphorus.

[14] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pg6.

[15] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011.

[16] Ipswich Water, *Bundamba STP; Feasibility Report*, prepared by KBR, 26 December 2008.

[17] The plant currently achieves effluent limits of 5mg/L total nitrogen and 1mg/L total phosphorus without chemical addition.

In both cases, the treatment process comprises a multi compartment BNR process with a pre-anoxic zone and conventional clarification; the addition of ethanol dosing and disc filtration is required to achieve the Case 2 standards. Ethanol dosing and sand filtration was proposed to upgrade the existing plant (Stages 1-4) to meet Case 2 standards.

Estimated capital costs, operating costs and net present value (NPV) over 25 years were as shown in **Table 4.1**.

Table 4.1: Estimated Costs for Stage 5 Augmentation (180,000EP total capacity) (2008 Feasibility)

Cost Element	Option Cost ($million)	
	Case 1	Case 2
Capital cost	137	178
Operating cost (per annum)	5	6
NPV (@ 7%)	214	271

The report concluded that, on the basis of non-water quality issues, Case 1 was preferable to Case 2 on the basis that it involved:

- lower capital and operating costs and NPV;
- less brown field issues;
- no hydraulic grade line issue, providing more available headspace;
- a less complicated process and fewer safety issues (as ethanol dosing is not required);
- reduced need for redundancy provisions; and
- fewer training requirements.

4.3 Concept Design

The concept design was initially prepared to 30 percent level of development before further developing the preferred option to a full concept design. Reports detailing development of the concept design were not provided for review, however, the scope and findings have been summarised in the *Concept Design Addendum Report*.[18]

The initial work (30 percent concept design) comprised a comparison of various process options based on the following:

- the existing (2010) load was taken as 110,000EP; the first augmentation stage (2012) was set at 180,000EP with a second stage (2023) at 240,000EP and ultimate capacity at 380,000EP;
- average dry weather flow (ADWF) was set at 230L/EP/day with peak wet weather flow (PWWF) of 5xADWF and peak instantaneous flow (PIF) of 1.25xPWWF;

[18] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pgs7-9 and pgs10-21.

- effluent quality target was set at 2.5mg/L total nitrogen and 0.8mg/L total phosphorus (median values) in anticipation of DERM licence limits of 3mg/L total nitrogen and 1mg/L total phosphorus (median values).

Treatment options broadly comprising the following were considered:

- Option BC – biological Phosphorus removal, conventional clarifiers and filters; and
- Option BM – biological Phosphorus removal and membranes.

Estimated capital costs, operating costs and net present value (NPV) over 25 years were as shown in **Table 4.2**.

Table 4.2: Estimated Costs for Stage 5 Augmentation (180,000EP total capacity) (Concept Design 2009/10)

Cost Element	Option Cost ($million)	
	Option BC (Clarifier)	Option BM (Membrane)
Capital cost	102.0	96.1
Operating cost (per annum @ 2022)	3.3	3.7
NPV (30 years @ 6.4%)	198.4	199.8
NPV (25 years @ 6.4%)	184.8	186.2
NPV (20 years @ 6.4%)	170.3	170.1

Option BM attracted lower capital cost, but higher operating costs; NPVs were similar for both options. The options scored closely (almost equal) on the basis of project key result areas including technical performance, robustness and reliability, financial, operability, maintainability and standardisation, and sustainability.

Option BM was adopted as the preferred process on the basis of cost, odour impact and reduced footprint; it also provided greater future flexibility in terms of site utilisation and reuse potential.

Concept design of the preferred option was further developed to a full concept design level. It is understood that a cost estimate for the final concept design has been independently prepared,[19] however, has not been provided for the purposes of this review.

4.4 Review of Augmentation Staging

A review of the proposed Bundamba WRP augmentation staging was undertaken in 2010 with view to deferring the capital and operating costs whilst meeting discharge obligations. This assessment adopted a base case of a staged upgrade to 180,000EP

[19] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pg21.

capacity (based on the preferred Option BM) by 2018 (previously proposed by 2012), and considered the following:

- potential use of a transitional environmental plan (TEP) to further defer capital and operating cost and to accommodate risk of licence non-compliance in the short to medium term;
- maximising use of the Bundamba Advanced Water Treatment Plant (AWTP) to minimise discharge to the Bremer River (minimum effluent quality from the Bundamba WRP would need to be maintained);
- deferment of non-essential components and working the plant harder;
- working to a design and staged upgrade that would achieve improved treated water quality and licence conditions (as per Option BM), but at a later date; and
- accepting that breaking the work into smaller stages would reduce initial cash flow but will ultimately cost more.

The assessment involved consideration of an alternative Option TEP, which provided for short term augmentation prior to full implementation of the Stage 5 capacity by 2017. Option TEP was found to have the potential to realise savings of $85-90 Million over the period to 2015, however, the costs at 2023 would be relatively similar. Comparative costs are presented in **Table 4.4**.

Table 4.3: Comparison of Costs for Stage 5 Augmentation (2010 Review of Staging)

Cost Element	Option Cost ($million 2010)		
	Option BM	Option TEP	Saving for Option TEP
Capital Cost to 2015	142.20	41.61	102.59
Capital Cost to 2023	160.91	162.65	-1.74
NPV to 2015	151.57	63.66	87.91
NPV to 2023	222.99	212.92	10.06

On the basis of this assessment, it was recommended that:

- Option BM be confirmed as the proposed configuration for the Stage 5 upgrade of the Bundamba WRP; and
- More detailed process modelling and cost estimation is undertaken to confirm the viability of Option TEP (in respect of providing short term capacity) and to better define the potential cost savings.

4.5 Updated Concept Design

A review of the previously developed concept design was commissioned in December 2010, with the objective of assessing standardisation of WRP design across QUU, identifying opportunities for cost savings and confirming the design based on new effluent characterisation. The update was based on the following flow criteria:

- average dry weather flow (ADWF) of 210L/EP/day;
- peak wet weather flow (PWWF) defined as 5 times average dry weather flow (ADWF); and
- inlet treatment works to screen and de-grit 5xADWF, with biological treatment works to treat 3xADWF. Screened and de-gritted flows in excess of 3xADWF to be bypassed to the outfall.

The final concept design (Option BM, ie. ICIP 3TN/1TP Membrane Plant) was revised in view of these revised flow loadings and a nominal 3TN/1TP (3mg/L total nitrogen and 1mg/L total phosphorus) effluent quality. A clarifier type plant that would produce a nominal 5TN/2TP (5mg/L total nitrogen and 2mg/L total phosphorus) effluent quality was also considered.

The assessment concluded that, whilst these options are not directly comparable as they have different effluent quality performance criteria, the 5TN/2TP Clarifier Plant is less expensive than the 3TN/1TP Membrane Plant. The cost of the Clarifier Plant option is, however, dependent upon the assessed performance of the existing facility.

Estimated costs associated with each of the options are presented in **Table 4.4**.

Table 4.4: Estimated Costs for Stage 5 Augmentation (QUU Addendum Design)

Cost Element	Option Cost ($million 2010)		
	ICIP Concept Design - 3TN/1TP Membrane	QUU Addendum Design - 3TN/1TP Membrane	QUU Addendum Design - 5TN/2TP Clarifier
Capital cost	133	119	110
Operating cost (per annum @ 180,000EP loading)	9.2	8.7	7.1
NPV (30 years @ 6.4%)	192	175	156

It is noted that the actual scope and output performance of the proposed works remains subject to a number of factors, but of primary influence:[20]

- Plant loading – both population projections and industrial load projections are to be reviewed;
- Raw sewage characteristics – development of a site specific characterisation of raw sewage quality;
- Odour emission – sampling of actual performance to inform design requirements;
- Effluent standard – a detailed treated water standard is yet to be agreed with DERM (Department of Environment and Resource Management).

[20] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011, pgxviii.

4.6 Further Detailed Review

QUU has advised[21] that it "*is currently undertaking a detailed review of the staging for this* [Bundamba WRP Upgrade] *project – as recommended by SKM in the May 2010 Review of Staging – with a view to optimising capital and operating expenditure. Future budgets will reflect the outcomes of this review process and are likely to include deferral of capital expenditure for this project. The latest study will use actual and projected mass loadings to determine what upgrade works will be required and at what mass loading limits the upgrade works will be required. These will be converted to EP capacity for convenience.*"

On the basis of this most recent advice, it appears that whilst the nature of the proposed upgrade has been identified in principle, the actual scope and, more specifically, timing of the proposed works is subject to further detailed assessment.

4.7 Summary/Conclusion

The proposed upgrade of the Bundamba WRP has been the subject of an extensive and robust planning process over a number of years, although this process is yet to be finalised. Augmentation of the existing facility to a total capacity of 180,000EP has remained a consistent objective, however, the timing and output requirement (effluent standard) is yet to be confirmed.

It is apparent that the planning process has been driven by the objective of deferring capital and operating costs to the extent possible, whilst continuing to meet discharge obligations. Finalisation of the concept design (ie. the actual scope and output performance requirements) of the proposed works remains subject to a number of factors including:

- plant loading (equivalent population services and raw sewage characteristics); and
- plant performance requirements (effluent standards and odour emission impacts).

[21] QUU, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated.

5 Cost Estimate

5.1 Forecast Expenditure

In its Commissioning Model,[22] QUU has proposed expenditure amounting to a total of $148.9 million over the period 2011-15, with $2.1 million to be incurred in 2011-12. When combined with expenditure incurred prior to 2011-12, this results in a total project cost of approximately $155.2 million, as shown in **Table 5.1**. This is consistent with the information presented in the Project Summary document[23] for the Bundamba WRP Upgrade Stage 5a project.

Table 5.1: QUU Actual/Proposed Capital Expenditure ($'000 nominal)

Project	Prior Years	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Project Total
Bundamba WRP Upgrade Stage 5a	5,128	653	2,051	106,147	40,495	256	0	155,157

Alignment of this expenditure forecast with the estimated costs of options assessed as part of the planning process is not readily apparent. The total project cost to 2015 is, however, broadly consistent with that identified as a result of the 2010 Review of Augmentation Staging (refer **Section 4.4**). QUU has confirmed that this is the information upon which its 2011/12 budget allowance has been based.[24]

It is noted that activity in 2011/12 is expected to involve commencement of construction. On the basis of the actual/forecast expenditure allocation presented in **Table 5.1**, it appears that construction (implementation) costs are estimated at approximately $149 million, with planning costs amounting to approximately $5.9 million or 4 percent of the implementation costs. This is considered reasonable.

Whilst a detailed breakdown of the estimated cost developed in conjunction with the 2010 Review of Augmentation Staging have not been sighted by Halcrow, it is noted that cost estimate summaries presented in respect of the Feasibility Study and Concept Design both include appropriate cost elements and allowances for contingencies, engineering design, project and construction management and QUU overheads, etc.

It is noted that the costs estimates presented in feasibility and concept design reports the show considerable variation (refer **Section 4**). This is, in part, reflective of the various treatment standards (effluent quality targets) and per capita (EP) hydraulic loading assumptions that have been adopted for the various options considered during the solution development process.

[22] Queensland Urban Utilities, Commissioning Model (MSExcel spreadsheet file *Commissioning Model 5yrs(404951_1).xls*), Worksheet "CIP".

[23] Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated.

[24] QUU, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated.

5.2 Cost Comparison

In order to provide a further assessment of the estimated capital cost, the effective unit rate cost, ie. capital cost per EP capacity, has been determined. Given that the capital cost of $155,157,000 will augment the plant by 60,000EP, the unit rate cost equates to approximately $2,600 per EP. This compares favourably to the unit cost of wastewater treatment plant works (both upgrades and new facilities) assessed by Halcrow in support of the 2010 SEQ Water and Wastewater Price Monitoring Review; **Table 5.2** presents unit rate costs determined as part of that review.

Table 5.2: Comparative Unit Rate Costs (of wastewater treatment facilities)[25]

Project	Selected Option	Estimated Cost ($million)	Current Capacity (EP)	Proposed Capacity (EP)	Capacity Increase (EP)	Unit Rate Cost ($/EP)
Goodna Sewage Treatment Plant Upgrade	Option 3 Modified Regional Approach	$110m	65,000	90,000	25,000	$4,400
Lockyer Valley East Sewerage Scheme	Option 1, Stage 1	$18.5m (including pipes and pump station)	8,000	13,000	5,000	$3,700 (including pipes and pumping station) $1,100 (treatment only)
Somerset Fernvale Sewage Treatment Plant Upgrade	4,000EP STP for Fernvale only	$17.5m	New plant	4,000	4,000	$4,400
Bromelton (Scenic Rim) Regional Sewage Treatment Plant	Subdivide into 3 sewerage catchments	$102.8m	New plant	36,400EP (14,000ET)	36,400EP	$2,800
Stapylton Wastewater Treatment Plant	Stage 1	$58.1m	New plant	13,800	13,800	$4,200

5.3 Summary

Whilst alignment of the proposed expenditure with the estimated costs of options assessed as part of the planning process is not readily apparent, it appears that the total project cost is of the appropriate order. This has been verified, at an indicative level, by comparison with unit costs previously identified for other wastewater treatment plant development/augmentation works.

It is, however, apparent that cost estimates need to be further developed and assessed once drivers (specifically effluent compliance standards; refer **Section 3.3**) of the nature/scope of the augmentation are confirmed.

[25] Source: Halcrow, *SEQ Interim Price Monitoring: Assessment of Capital Expenditure on Various Sewage Treatment Plants; Review Report*, October 2010, Table 7.1.

6 Timing and Deliverability

6.1 Delivery Timeline

In its Commissioning Model,[26] QUU has outlined the timing of its proposed expenditure in respect of the Bundamba WRP Upgrade Stage 5a project, as shown in **Table 5.1**. The expenditure profile suggests that the majority of construction (implementation) works will be undertaken within a two (2) year time frame (ie. 2012/13 and 2013/14); this is considered appropriate for the scope of work proposed.

Assessment of the available planning documentation and growth predictions confirms that the capacity of the existing facility (120,000EP) will be exceeded by 2014; consequently, initial augmentation will need to be completed by that time.

Notwithstanding the current forecasts, as outlined in **Section 4.6**, QUU has also advised[27] that it "*is currently undertaking a detailed review of the staging for this* [Bundamba WRP Upgrade] *project – as recommended by SKM in the May 2010 Review of Staging – with a view to optimising capital and operating expenditure. Future budgets will reflect the outcomes of this review process and are likely to include deferral of capital expenditure for this project.*" The outcomes of this additional review should be used to inform the ultimate timing of the proposed upgrade works.

It is, however, noted that if construction activity is to commence in 2011/12 as indicated in the Project Summary document,[28] Halcrow would expect that project scoping would be more advanced than indicated by both the *Concept Design Addendum Report*[29] dated April 2011 and QUU's advice[30] of October 2011.

6.2 Delivery Mechanism

The documentation reviewed by Halcrow does not specifically identify the proposed delivery mechanism for the Bundamba WRP Upgrade Stage 5a project. It is inferred, however, by multiple references to "detailed design" that a traditional detail design followed construction (under contract) is proposed.

Given that the upgrade works are to be undertaken on an existing facility that will need to remain operational throughout construction, and will involve modification of components of the existing facility, this delivery approach is considered appropriate, and likely to result in greater certainty (and therefore efficiency) in delivery costs.

[26] Queensland Urban Utilities, Commissioning Model (MSExcel spreadsheet file *Commissioning Model 5yrs(404951_1).xls*), Worksheet "CIP".

[27] QUU, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated.

[28] Project Summary document provided by QCA (source not identified), *Ipswich Bundamba STP Upgrade – Stage 5a*, undated.

[29] Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011.

[30] QUU, *Bundamba WWTP; QUU Ref: BUND-QUUR02*, undated.

7 Implications for Operating Expenditure

The proposed plant upgrade will attract additional operating and maintenance costs to those currently incurred in respect of the Bundamba WRP. Review of the planning documentation reveals that operating expenditure has been considered as part of the comparative assessment of upgrade options. The impact of operating costs over the longer term (typically 25 or 30 years) has been considered by way of a net present value (NPV) assessment.

Whilst estimated annual operating costs (operations and maintenance) have not in all cases been presented in the documentation provided for review,[31] these costs may total to an amount in the order of $9 million per annum. Halcrow notes that actual operating costs will be dependent upon the adopted effluent compliance standards and the nature and extent of the plant facilities required to achieve them.

[31] Some elements of the review have been based on summary information presented in: Queensland Urban Utilities, *Addendum to Bundamba Water Reclamation Plant; Concept Design Report (Project Reference No: IWWTAA24)*, Revision 2, 21 April 2011.

8 Summary of Assessment Findings

Based on the assessment outlined above, the following conclusions are made in respect to the proposed Bundamba WRP Upgrade Stage 5a project:

- *Key drivers:* Augmentation of the Bundamba WRP is justified on the basis of both population growth and the requirement to comply with prevailing effluent discharge standards.
- *Solution development:* The proposed upgrade of the Bundamba WRP has been the subject of an extensive and robust planning process over a number of years, although this process is yet to be finalised. Augmentation of the existing facility to a total capacity of 180,000EP has remained a consistent objective, however, the timing and output requirement (effluent standard) is yet to be confirmed. Finalisation of the concept design (ie. the actual scope and output performance requirements) of the proposed works remains subject to a number of factors including plant loading (equivalent population services and raw sewage characteristics) and performance requirements (effluent standards and odour emission impacts).
- *Cost estimates:* On the basis of the information provided for review, it appears that the total project cost as proposed by QUU in its Project Summary and Commissioning Model is of the appropriate order. This has been verified, at an indicative level, by comparison with unit costs previously identified for other wastewater treatment plant development/augmentation works. It is, however, apparent that cost estimates need to be further developed and assessed once drivers (specifically effluent compliance standards) of the nature/scope of the augmentation are confirmed.
- *Timing and deliverability:* The proposed timing of construction of the Bundamba WRP Upgrade appears to be appropriate, although is currently under review. Halcrow would expect the project scoping to be further advanced if construction is to commence during 2012/13.

  Whilst not specifically defined, it appears that a traditional delivery mechanism is proposed; this is considered appropriate in view of the works being concentrated on the existing facility.
- *Implications for Operating Expenditure:* The proposed plant upgrade will attract additional operating and maintenance costs to those currently incurred in respect of the Bundamba WRP. Whilst operating expenditure has clearly been considered as part of the comparative assessment of upgrade options, an appropriate annual allowance has not been identified, however, may be in the order of $9 million per annum. It is noted that the actual operating costs will be dependent upon the adopted effluent compliance standards and the nature and extent of the plant facilities required to achieve them.

In summary, Halcrow considers the Bundamba WRP Upgrade Stage 5a project to be prudent on the basis of predicted growth (both population and industrial development) in the catchment and the need to maintain compliance discharge standards. It is noted, however, that the final form of the upgrade works and the timing of construction are still subject to the outcomes of detailed review that is currently in hand. Accordingly, a definitive assessment of the efficiency of the proposed expenditure cannot be made at this stage.

Halcrow is, however, of the view that proposed expenditure of $2.05 million in 2011/12 is minimal (by comparison) and will be a prudent investment in respect of either finalising design and/or commencing construction of the proposed works.

Appendix A. QUU Project Summary – Bundamba STP Upgrade Stage 5a