Final Report:
Inquiry on the Cost of Supplying Bulk Potable Water to Kalgoorlie-Boulder

14 October 2005

Economic Regulation Authority
WESTERN AUSTRALIA

CONTENTS

EXECUTIVE SUMMARY

This report provides the results of the Economic Regulation Authority's (**Authority**) analysis of two options to provide bulk potable water to Kalgoorlie-Boulder and surrounding regions. These are: the expansion of existing supplies along the Water Corporation of Western Australia's (**Corporation**) Goldfields and Agricultural Water Supply (**G&AWS**) scheme; and an alternative proposal by United Utilities Australia (**UUA**) to desalinate seawater in Esperance and pipe the potable water to Kalgoorlie-Boulder. The terms of reference for this inquiry required the Authority to investigate these two options. Other options that may be available have not been considered.

The Authority has estimated the prices at which the Corporation is expected to be neutral between continuing to supply using its own sources and purchasing bulk water from a third party. This would be the case if the Corporation's avoided costs – the costs that it would avoid incurring if it entered into arrangements with UUA – were equal to the costs to the Corporation of purchasing bulk water from UUA. The Corporation's avoided costs for supplying Kalgoorlie-Boulder (in particular, the costs of source water from Perth) depend on assumptions about climate trends: the "8-Year Climate Scenario" assumes lower streamflows into Perth's dams (and higher source water costs) than the "30-Year Climate Scenario".

The Authority estimates the Corporation's per unit avoided costs of delivering bulk potable water, in 2005/06 dollars and based on a weighted average cost of capital of 6 percent real pre-tax, to be in the order of:

Avoided Cost to Water Corporation	8-Year Climate Scenario	30-Year Climate Scenario
Existing supply to Kalgoorlie-Boulder	$1.11/kL	$0.72/kL
Growth demand in Kalgoorlie-Boulder	$4.65/kL	$4.40/kL
Esperance demand	$0.25/kL	$0.25/kL

By comparison, it is estimated that the per unit cost of water from the UUA project, also at a 6 percent real pre-tax rate of return, is between $2.05/kL and $2.20/kL, depending on the uptake of demand. However, given the uncertainty and risks associated with the sales to mines and industrial users, it is likely that UUA would require a return higher than 6 percent, which would result in higher prices. As the Corporation's costs of meeting new demand in the Kalgoorlie-Boulder region are significantly higher than UUA's costs, it follows that there is a level of demand at which it would be less costly to source water from the desalination plant in Esperance.

Current demand for water in the Kalgoorlie-Boulder and Esperance region is around 38 ML/d and, based on a medium growth scenario, could be expected to expand at 1.5 percent per annum and 2 percent per annum respectively. The demand scenarios that have been evaluated as part of this inquiry are based on an initial increase in current demand to 60 ML/d further increasing to between 100 ML/d and 130ML/d over a period of up to 50 years. The higher levels of demand that would be required for the proposed desalination plant to be viable would involve supplying potable water to existing and new mining and other industrial customers that either currently use hypersaline water or whose demand for water is not currently met.

Given the significant increases in the amount of water needed for the desalination plant to be viable, there is clearly uncertainty as to whether such levels of demand will eventuate. This

is a commercial decision facing UUA as the proponent of the desalination plant. An important factor in this decision is the price that existing and new mining and other industrial customers are able to pay for desalinated water. Based on information provided by UUA, for the purposes of this inquiry, it has been assumed that existing and new mining and other industrial customers would pay $3.68/kL and that there is a substantial increase in demand at the time the UUA project commences.

The Authority's analysis has shown that, based on a 6 percent discount rate (real pre-tax), the UUA project produces net benefits at nearly all of the demand scenarios evaluated. However, as indicated above, given the uncertainty and risks associated with the sales to mines and industrial users, it is likely that UUA would require a return higher than 6 percent. If water supplied to mining and industrial users is priced at its assumed avoided cost (i.e. $3.68/kL), water supplied to Kalgoorlie-Boulder and Esperance is priced at their respective avoided costs, and UUA is paid for the benefits associated with improving the quality of water in Esperance and releasing the borefield land in Esperance for development, the resultant project return is likely to be around 6 percent for the lower demand scenarios evaluated and up to 8 percent for the higher demand scenarios.

An important factor relating to future demand in the areas to be serviced by the desalination plant is that in order to be successful, UUA would need to develop the market for desalinated water. It is anticipated that this would involve a departure from the approach taken by the Corporation, including the manner of charging, often involving high up-front headworks charges which can have the effect of depressing demand.

UUA may be able to reduce the uncertainty by investing in further market research to prove-up the initial demand. However, it will be difficult to form a clear view on growth in demand from existing and potential new mines given the uncertainties involved.

The Authority accepts that the Corporation can incrementally expand the G&AWS in line with increases in demand for water in the region served by this system. In these circumstances, it would be inappropriate for the Corporation to assume risks associated with growth rates in demand for water in the Kalgoorlie-Boulder and Esperance regions. Alternatively, if the Corporation is to accept higher risks than at present, it could expect prices lower than those indicated above.

A range of benefits of this project have been claimed in submissions and at the public forums. An important distinction to draw when assessing a project is between private and public benefits. The total benefit of a project to society is called its social benefit, and is the sum of private benefits and public benefits. Private benefits are the gains to parties directly engaged in the project (suppliers, shareholders, employees, customers, etc), while public benefits are gained by the wider community not directly involved in the project, for example through environmental improvements or the provision of public amenities.

The fact that, for example, the provision of better quality and cheaper water to a particular market is defined as a private benefit rather than a public benefit does not mean that the community gains nothing from such an arrangement. Rather, it means that the members of the community who gain comprise the consumers, producers, employees, suppliers, etc who are party to the project.

The private benefits of this project include:

- improvements in water quality at Esperance, which are valued at around $0.47/kL;
- greater utilisation of the Wind Farm, which is understood to be off-line at night due to insufficient demand;

- benefits to Western Power and the Esperance Port Authority, which would accrue from the renegotiation of their tariffs that would be triggered by the extra energy demanded by the desalination plant; and
- an amount associated with the Esperance borefield land that would be available for development if the desalination project were to proceed.

It is possible that UUA could commercially negotiate arrangements to gain all of the private benefits attributable to the project and for the purposes of this analysis the Authority has assumed that they do, other than in the case of the benefits to Western Power and the Esperance Port Authority, which the Authority has been unable to quantify but which can be captured in commercial negotiations.

The possible impact of another major water provider in the Kalgoorlie-Boulder region on the Corporation is in the nature of a public benefit that cannot be captured by UUA through commercial negotiation. In particular, the Corporation may be encouraged to seek and develop new markets and cost efficiency gains as a result of a demonstration that another supplier of bulk potable water to Western Australia would provide.

For the UUA project to have net State-wide economic impacts, it would need to generate positive private benefits, which would require an eventual demand in the order of 100 to 120 ML/d. If the pipeline is constructed, but that level of demand is not forthcoming, then it is likely that the option of continuing to expand the G&AWS would have produced a better economic outcome.

Factored into the analysis undertaken by the Authority is that the desalination project would have regional rather than State-wide economic impacts, as the project would involve a total expenditure of $790 to $970 million in present value terms. This compares with the alternative involving an expansion of the G&AWS, which would entail a total expenditure of around $400 million in present value terms. The additional expenditure associated with the desalination plant and pipeline over and above the alternative involving expansion of the G&AWS is of course an important regional benefit if there is sufficient demand to warrant its construction.

The impact on State finances would depend on whether:

- the Corporation could purchase water from UUA at a price that is less than its avoidable cost, in which case Community Service Obligation (**CSO**) payments would be reduced (though the net impact is lessened due to the counteracting effect of lower tax equivalent and dividend payments). However, the Authority's analysis assumes the Corporation pays UUA the avoided cost if the project were to proceed;
- UUA negotiate arrangements to capture the Esperance water quality benefits, for example through a contribution from the State Government in the form of a CSO payment to the Corporation commensurate with a higher price being paid to UUA for the higher quality water (the Authority's analysis has assumed that UUA does capture this benefit);
- the financial benefits to the Esperance Port Authority and Western Power are captured by UUA through commercial negotiations; if not, the Government would receive greater dividends from these organisations;
- UUA's price of water to the mines would encourage an expansion of the mining industry. However, the resulting increase in royalties could be counteracted by consequent changes to Commonwealth Grants Commission payments; and

- the financial benefits from releasing the Esperance land used as borefields for private development are entirely captured by UUA (the Authority's analysis has assumed that UUA does capture this benefit).

Residential customers in the Goldfields and Esperance regions would continue to pay current prices, as determined by the State's uniform pricing policy. However, they would benefit from the greater amenity value associated with higher availability of water and improved water quality in the case of Esperance.

In conclusion, the Authority has been able to publish independent information on the Corporation's avoidable costs and to identify any benefits that are of a public nature that cannot be captured by the parties through commercial negotiation. With the exception of greater competitive pressure on the Corporation from the potential for new entrants into the market, the benefits associated with the proposal are private in nature and are capable of being internalised through commercial negotiation by UUA if the projected demand for potable water necessary for a commercial project can be realised.

UUA has indicated that it is not seeking Government financial support to make the project commercially viable. However, UUA has suggested to the Authority that, given the Corporation's dominant role in the water industry, there may be a role for Government during any commercial negotiations that any proponent might have in the future with the Corporation. The Authority concurs with this view.

1 INTRODUCTION

On 13 January 2005, the State Government of Western Australia gave written notice to the Economic Regulation Authority (**Authority**) for it to undertake an inquiry into the cost of supplying bulk potable water to Kalgoorlie-Boulder and surrounding regions. The request is in accordance with section 32(1) of the *Economic Regulation Authority Act 2003* (**Act**).

As required under the terms of reference, the Authority has compared the costs and benefits of two options for the existing and future supply of bulk potable water to Kalgoorlie-Boulder. These are: the expansion of existing supplies along the Water Corporation of Western Australia's (**Corporation**) Goldfields and Agricultural Water Supply (**G&AWS**) scheme; and an alternative proposal by United Utilities Australia (**UUA**) to desalinate seawater in Esperance and pipe the potable water to Kalgoorlie-Boulder.

In accordance with section 45 of the Act, the Authority has acted through all members in conducting this inquiry.

1.1 Terms of Reference

Under the Terms of Reference for the inquiry (see Appendix 1) the Authority is required to report on:

- the current cost to the Corporation of providing bulk potable water to Kalgoorlie-Boulder, including the cost to the State Government of associated Community Service Obligation (**CSO**) payments to the Corporation;
- the cost that UUA could provide bulk potable water to Kalgoorlie-Boulder over the next 25 years;
- the cost saving to the Corporation if UUA were to supply bulk potable water to Kalgoorlie-Boulder;
- the impact of each option on the State Government's finances, including borrowings, capital expenditure, tax equivalent and dividend revenue and CSO payments; and
- the overall costs and benefits of each option, including the impact on the end consumer and the potential to enhance regional economic development in Kalgoorlie-Boulder and the State in general.

1.2 Background to the Inquiry

The existing and future provision of sustainable water supplies to the Goldfields has been a matter of study and debate over the past decade. Issues of concern include the need to meet growing residential water demand in future decades, the availability of groundwater resources, the costs to the mining industry of using hypersaline ground water, and the restrictions to industrial expansion due to the high costs of supply and consequential high headworks charges.

This focus on existing and future provision of sustainable water supplies to the Goldfields mirrors similar attention devoted to the future demand/supply balance for water in the Perth metropolitan area and development of a State water strategy. An important link between the metropolitan and Goldfields strategies, at least currently, is that the source cost of water to the Goldfields is determined by the source cost of water to the metropolitan area.

In February 2001, the Government called for expressions of interest on the sustainable supply of water to the Goldfields Esperance region. This led to the development of an interdepartmental water supply strategy for the Goldfields Esperance region, with the final report published in January 2003.[1] The strategy examined a range of options for supplying bulk water to the region, including:

- continuing to use the G&AWS;
- piping seawater from Esperance and desalinating at Kalgoorlie;
- piping desalinated water from Esperance to Kalgoorlie; and
- developing the Eucla or Officer Basin groundwater aquifers.

The water supply strategy drew upon several background studies on the sustainability of palaeochannel reserves in the region, the costs and benefits of alternative supply options, and the true cost of water delivery to the Goldfields through the G&AWS. One of the recommendations in the final report was that the various options, including the piping of desalinated water from Esperance and continued use of the G&AWS, should be evaluated in more detail to identify the preferred option to progress to the detailed feasibility stage.

The Government sought further advice in 2003 on the proposal to pipe desalinated seawater from Esperance to the Goldfields from a steering committee comprising the Managing Director of the Corporation, the Coordinator of Water Services, and the Managing Director of UUA.[2] The study concluded that:

> A project to pipe desalinated seawater from Esperance and pipe it to the Goldfields is not viable as a completely stand-alone project at the currently-identified demands and prices. However, the project becomes viable as a commercial project if:
>
> - government is prepared to consider an annual subsidy in the region of $10 million to $32 million, taking into consideration strategic factors beyond the remit of this review; and
> - the mining industry is prepared to make a commitment to water volumes and prices.

During 2003/04, UUA continued to investigate potential demand from mining operations primarily between Kalgoorlie and Norseman. Based on its investigations into the feasibility of the project, UUA believes it has a sound understanding of the technical and economic fundamentals.

On 8 September 2004, the Minister for Government Enterprises issued a press release indicating that UUA had received "substantial commitments" from a "number" of Goldfields companies to purchase water. The Minister also indicated that the Government, on the request of UUA, had referred this matter to the Authority for review.

1.3 Review Process

Following the request by the State Government, the Authority appointed consultants, through a public tender process, to assist it in the analysis of technical and economic issues covered

[1] Department of Mineral and Petroleum Resources, Water and Rivers Commission, Office of Water Regulation, Department of Planning and Infrastructure, Goldfields and Esperance Development Commission (January 2003), *Goldfields Esperance Water Supply: Water Supply Strategy, Final Report.*

[2] Water Corporation of Western Australia, United Utilities Australia and the Office of Water Regulation (August 2003), *A New Water Supply to the Goldfields: Review of the Viability of a Desalinated Seawater Pipeline from Esperance to Kalgoorlie-Boulder. Final Report for the Western Australian Government's Water Taskforce.*

by the inquiry. The selected tenderer, Marsden Jacob Associates, was appointed on 2 March 2005.

On 3 May 2005, the Treasurer amended the Terms of Reference for the inquiry to extend the timetable to provide additional time for the receipt of technical information from the parties. Under the revised Terms of Reference, the Draft Report was to be made available by 30 June 2005 and the Final Report was to be completed no later than 16 September 2005.

The Draft Report was published on 30 June 2005. Members of the public were invited to make written submissions to the Authority, by 29 July 2005, on any matter dealt with in the Draft Report. Thirty stakeholders made submissions to the Authority (see Appendix 2). The Draft Report and submissions received are available on the Authority's website (www.era.wa.gov.au).

Reflecting the commercial nature of the UUA proposal, the consultants worked closely with UUA and the Corporation on their respective assessments and costings. During the inquiry, the Authority convened three workshops between the parties to discuss technical and analytical issues. The Authority participated in public forums in Kalgoorlie and Esperance on 21 and 22 July 2005 to explain the analysis and conclusions in the Draft Report, and held its own forums in Esperance and Kalgoorlie on 1 and 2 September 2005 to seek further public views on the issues in the Draft Report.

At a workshop on 17 August 2005, several issues were identified which required further information from the parties and additional modelling by the consultants. The Authority therefore sought a further extension to the inquiry, and the Treasurer amended the reference to require that the final report be made available by 14 October 2005.

In accordance with the amended reference, this Final Report is delivered to the Treasurer on 14 October 2005, who will have 28 days to table the report in Parliament.

1.4 Current Volumes

Volumes relating to the G&AWS scheme and the proposed Esperance Kalgoorlie Pipeline (**EKP**) are measured on two bases:

- Gigalitres per annum (**GL/annum**), which are most relevant when referring to the total demand and supply of water resources for the Goldfields; and
- Megalitres per day (**ML/d**) which are most relevant when referring to average or maximum daily flow rates. When expressed as an average, there is clearly an annual equivalent.

Table 1.1 shows volumes and flows for the G&AWS scheme in 2004-05.

Table 1.1 Volumes and Flows in the G&AWS (2004-05)

	Total volume GL/annum	Average flow ML/d
Volume into the G&AWS at Mundaring Weir	26.8	73.3
Volume to agricultural areas	15.0	41.1
Volume to Goldfields	11.8	32.3

Source: Water Corporation

Notes: Rounding errors may occur.

The Corporation advises that the current maximum sustainable inflow rate into Kalgoorlie during summer is 34 ML/d. After the construction of the 400 ML Binuli storage this is expected to increase to around 40.8 ML/d. The Corporation expects this to satisfy requirements until 2010. The required sustainable inflow rate by 2015 is projected by the Corporation to be 45 ML/d and by 2020 50 ML/d. The extended summer capacity is 34 ML/d.

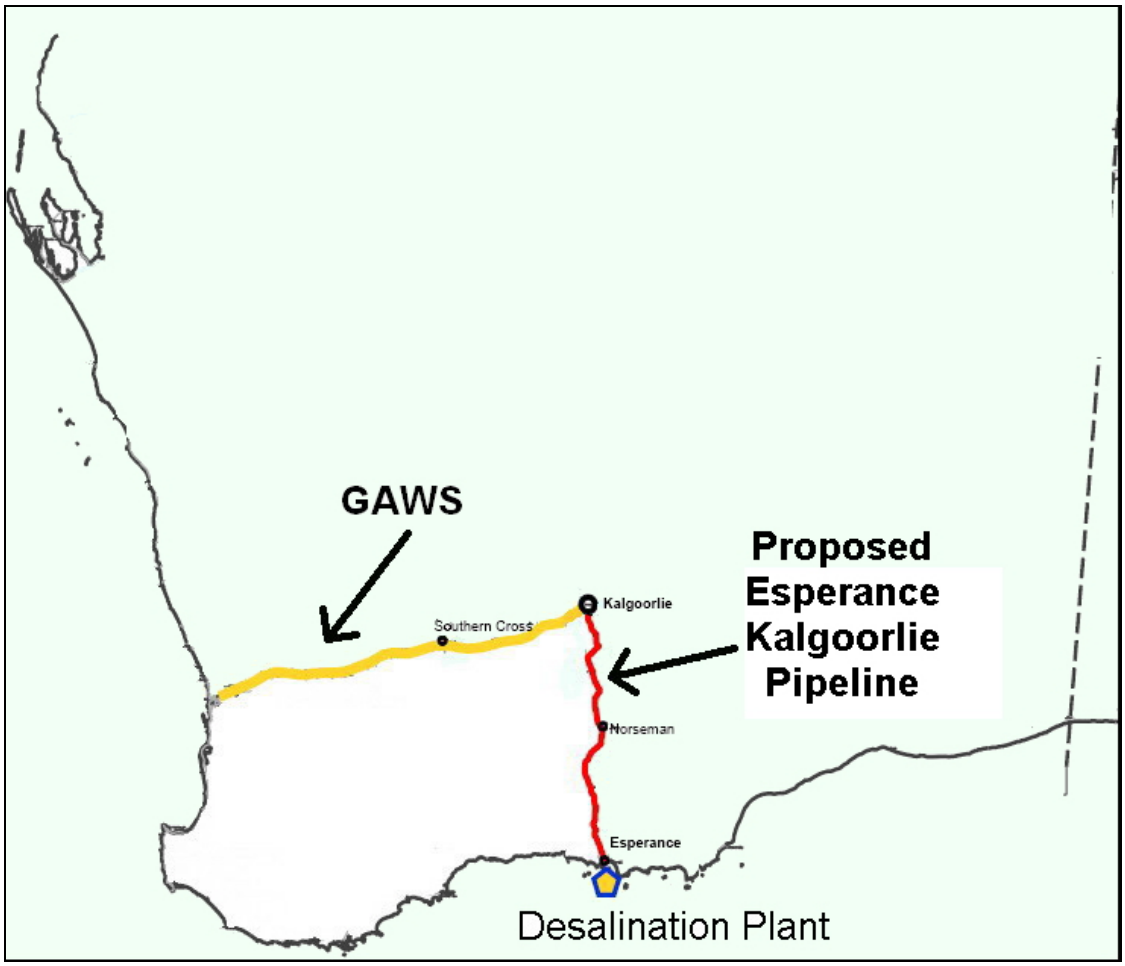
Currently, mining operations in the Goldfields region use large quantities of groundwater in their operations. Increased realisation of the hidden costs of using hypersaline groundwater and the potential to substitute potable water for this hypersaline water suggests, depending on the price of that water, the possibility of a step increase in demand for potable water in the region. Most of the expected new demand lies between Kalgoorlie-Boulder and Norseman.

The Kalgoorlie-Boulder region and the area southward to Norseman is an area of very low rainfall and very high mineral worth. Since 1903, the area has been supplied by the G&AWS scheme, which pipes water from Mundaring Weir through the agricultural areas to the Goldfields.

2 OVERVIEW OF PROJECTS

Figure 2.1 provides a schematic of the existing source of supply for the Kalgoorlie-Boulder Region (the G&AWS) and the proposed water supply option for the Goldfields region (the Esperance-Kalgoorlie Pipeline, or EKP).

Figure 2.1 Existing and Proposed Bulk Water Supply Options for the Goldfields Region



2.1 Goldfields and Agricultural Water Supply Scheme

Kalgoorlie-Boulder's bulk water is currently supplied by the Corporation by means of the Main Conduit of the G&AWS scheme, which transports treated potable water 549 km from Mundaring Weir (part of the Perth Integrated Water Supply System (**IWSS**) to Kalgoorlie-Boulder). The original pipeline, designed by C. Y. O'Connor, commenced supply to Kalgoorlie in 1903, and has been progressively upgraded and replaced. Thus, while the system is old, it mainly comprises new pipes and new pumps. In its current format, the G&AWS Main Conduit can supply an average 34 ML/d and 45 ML/d for short-term peaks.

The Corporation estimates that current water consumption in the Goldfields supplied by the G&AWS (2004-05) is 11.82 GL per annum, comprising:

Kalgoorlie	9.17 GL
Kambalda	1.97 GL
Norseman extension	0.40 GL
Other	0.28 GL
Total	**11.82 GL**

The G&AWS Main Conduit also supplies parts of the Perth metropolitan area and agricultural regions: 50 percent of the water on the G&AWS goes to agricultural areas between Mundaring Weir and Southern Cross.

At Kalgoorlie, there are several reservoirs. The G&AWS Main Conduit spurs off to Norseman, with another spur to Kambalda West and Kambalda East.

Beyond the G&AWS, between Norseman and Esperance, is Salmon Gums, which is supplied from two surface water catchments, and Esperance itself, which is supplied by borefield water. Current supply to Esperance is around 5.5 ML/d or 2 GL/annum.

2.2 UUA Proposal

The essential concept of UUA's proposal is a desalination plant at Esperance with a pipeline to Norseman and Kalgoorlie. The final scale of the plant and the size and timing of upgrades is not precisely defined at this stage.

The technical description of the proposal, based on initial demand at 60 ML/d rising to 100ML/d at 30 years, is as follows:[3]

- a desalination plant in Esperance which would draw water from the Bay of Isles via a 200m inlet pipe and desalinate it using a reverse osmosis process, producing up to 100 ML/d of potable water. The brine by-product of the process would be returned to the bay via a 1.6 km outlet pipe with the contingency for this to extend to a maximum of 2.5 km depending upon the outcome of environmental studies. The desalination plant would operate on power from the adjacent Esperance Power Station Pty Ltd gas-fired power station, with tree planting programmes proposed to offset associated carbon emissions;

[3] Based on information in United Utilities (2005), *New Water New Growth - a Long Term Solution*. *The Goldfields Esperance Water Supply Project* and information provided to the Authority in United Utilities Australia (11 March, 2005), *Goldfields Water Supply Esperance-Kalgoorlie Pipeline, Technical Description, 60 ML/day Winter Capacity*.

- potable water would be stored in a new balancing reservoir near Esperance and piped through Esperance and then north towards Kalgoorlie-Boulder. Since the desalination plant is most efficiently operated at a stable flow, additional storages at major supply points along the pipeline would be necessary to meet seasonal peaks;
- the envisaged pipeline under the base case scenario is a 957 mm steel cement-lined pipeline, laid in a shallow trench for the majority of its length. The pipeline would most likely start with three pump stations, rising to five as throughput increases. The pipeline would operate satisfactorily at 60 ML/d, with practical capacities ranging from 100 ML/d up to 130 ML/d depending on the final configuration;
- the desalinated potable water would be delivered to existing storage reservoirs in Kalgoorlie (including the Corporation's proposed new 400 ML storage);
- the controls for the pipeline would be at Esperance, with shadow controls at Kalgoorlie-Boulder for security of supply purposes. Staffing would include approximately 10 of UUA's own staff and other local contractors;
- UUA estimates that the desalination plant and pipeline would take 12-18 months to build following financial closure and approval by the Environmental Protection Authority. The earliest estimate for the start of the scheme is therefore late 2007-08; and
- based on UUA's cost modelling, the initial capital cost of the scheme is estimated to range from around $439 million to around $462 million, depending on the final configuration chosen. These estimates include allowances for contingency, commissioning and other preliminary costs. Additional capital is planned to be spent over the 50 year period to cater for scheme augmentation, asset replacement and replacement of the membranes in the reverse osmosis plant. Depending on the chosen configuration, annual operating costs range from $21 million to $27 million in the initial years increasing to between $37 million and $48 million once the ultimate demand is reached. Energy costs account for around 65 percent of total operating costs.

The base proposal advanced by UUA envisages closure of the G&AWS Main Conduit at Southern Cross. This envisaged closure would raise issues relating to water quality in the pipeline since the prime determinant of the water quality is the number of days since chloramination (a disinfection process involving the addition of chlorine and ammonia) and therefore the rate of flow.

The base proposal advanced by UUA also envisages the closure of the Corporation's borefield supply at Esperance. This appears to raise minimal interface issues but would offer prospective benefits in terms of improved water quality since the borefield water does not meet aesthetic criteria in the Australian Drinking Water Guidelines (1996) relating to hardness and Total Dissolved Solids.[4]

The costs and benefits associated with these two interfaces and associated options are discussed in Section 4.2.4.

[4] Water quality issues in Esperance are discussed in detail in Section 4.2.6.

3 ASSESSMENT METHODOLOGY

3.1 Application of the Terms of Reference

The Terms of Reference requires the Authority to examine, and report on, the costs of supplying potable water to Kalgoorlie-Boulder and surrounding regions and the cost savings to the Corporation if UUA provided bulk potable water to that region through its proposed desalinated seawater pipeline. The purpose of the inquiry is to assist interested parties, particularly UUA, the Corporation and Government, by bringing together relevant information through a public and transparent process on the proposal. The inquiry is not a pre-feasibility or feasibility study, which are matters for the proponents should they wish to proceed.

While the inquiry is to identify the overall costs and benefits of the two alternative supply options, the inquiry is not intended to provide a definitive statement on the viability of the EKP proposal. The inquiry is unable to be so definitive, recognising the relatively high degree of uncertainty associated with the options. The inquiry simply seeks to provide information on the relevant costs, benefits and uncertainties to assist the proponent in any future commercial dealings with the Corporation and other potential customers of desalinated water in the regions.

The first Term of Reference requires the Authority to report on *"the current cost to the Corporation of providing bulk potable water to Kalgoorlie-Boulder*." One possible interpretation of the "current cost" of supply is the cost of replacing the G&AWS Main Conduit with modern assets that provide an equivalent service. This measure provides an estimate of the efficient cost of monopoly infrastructure, such as the G&AWS Main Conduit, and is frequently used in setting the maximum price/revenue level that a regulated monopoly can charge.

While it would be possible to undertake an engineering exercise to establish the cost of replacing the G&AWS Main Conduit with modern assets that provide an equivalent service, the value that would be calculated from such an analysis would not be relevant to the Corporation in its negotiations with the proponent. This is because it is the value of the G&AWS Main Conduit assets that is in doubt as a result of the EKP proposal and the Corporation may no longer be able to justify earning a rate of return on assets that potentially could be bypassed.

The cost that is of relevance to the negotiations is the amount that the Corporation would be willing to pay to purchase water from a third party. In effect, these are the costs that the Corporation would otherwise incur to continue supplying its customers and future new demand from existing and expanded facilities in the regions that the Corporation currently supplies, including Esperance. These cost savings are referred to as "avoided costs" because the Corporation would avoid incurring them if it entered into arrangements with UUA for alternate supplies of desalinated seawater from Esperance.

For this reason the Authority has interpreted the "current cost of supply" in the first Term of Reference as the costs that the Corporation would avoid (or save) if UUA were to supply bulk potable water to Kalgoorlie-Boulder.

The second Term of Reference requires analysis of the cost that UUA could provide bulk water to Kalgoorlie-Boulder over the next 25 years. In addition to the direct costs of the project, there would be associated costs such as the need to deal with water quality issues that would otherwise arise with the foreshadowed closure of the G&AWS Main Conduit at Southern Cross. On the other hand, there are potential cost savings in Esperance. Thus,

the Authority has examined not only direct costs to UUA but the broader concept of the costs and benefits of the UUA proposal.

The third Term of Reference specifically requires the Authority to consider the avoided costs to the Corporation as a result of the EKP proposal. The Authority has therefore treated the first and third Terms of Reference in the same way for the reasons stated above.

The fourth Term of Reference requires advice on the impacts of each option on State Government finances, including the impact on Community Service Obligation payments, and on the potential to enhance regional development in Kalgoorlie-Boulder and in the State in general.

The fifth Term of Reference requires advice on the overall costs and benefits of each option including the impact on end consumers. The relevant end consumers include residential consumers in the Goldfields and in Esperance but importantly include potential new demand from mines which would otherwise (continue to) use hypersaline groundwater.

3.2 Analysis of Costs and Benefits

3.2.1 Defining Cost-Benefit Analysis

Cost-benefit analysis is the most commonly used approach to economic evaluation and the only one described in the WA Department of Treasury and Finance (January 2002) *Project Evaluation Guidelines.*[5] It examines projects by comparing their costs and benefits, including their social costs and benefits.[6] It can cover a region, state or country, and is generally applied over the life of a project. The analysis is usually comparative – the project under consideration is typically compared to a baseline such as the *status quo* or a competing project. When conducted by policy makers, cost-benefit analysis is usually concerned mainly with aggregate costs and benefits to the community as a whole, rather than focusing on particular effects such as on government revenue or consumer prices. Some effects such as environmental impacts cannot easily be quantified in monetary terms, but these, too, should be identified and described in cost-benefit analysis, even if they cannot readily be given a dollar value.[7]

Because it focuses on overall costs and benefits, cost-benefit analysis is not concerned with policy changes that lead to transfers between parties, only with changes in the net costs and benefits of those transactions.

For example, when a business reduces the prices it charges because of a commercial decision or competitive pressure, this will have little or no effect on net benefits. The price

[5] Cost-benefit analysis is a standard framework for the economic appraisal of investment options. For a description of the principles and techniques of cost-benefit analysis, see Campbell and Brown (2003), *Benefit-Cost Analysis: Financial and Economic Appraisal Using Spreadsheets*; and the UK Treasury (2002), *The Green Book – Appraisal and Evaluation in Central Government*.

[6] For simplicity, this section talks in general terms about "gains" and "benefits". What the Authority means by these terms is what economists call "consumer surplus" and "producer surplus". Consumer surplus is the net benefit gained by consumers because what they pay for a good is almost always less than the maximum they would have been prepared to pay for it. It is defined as the difference between the maximum amount consumers would be willing to pay and what they actually pay for the units of the good purchased. Similarly, producer surplus is defined as the difference between the minimum amount producers would be willing to charge and what they actually charge for the units of the good sold. Producer surplus simply equals profit plus fixed costs. Consumer surplus can be thought of similar to "profit" - as the gap between what consumption of a good or service is worth to consumers, and what it costs them.

[7] The Authority published a paper prepared by Marsden Jacob Associates (22 July 2005), "Frameworks for economic impact assessment and benefit-cost analysis", setting out the Authority's approach to the evaluation of costs, benefits and economic impacts.

cut means that the business loses because profits are lower, but consumers gain because they can buy the product at lower cost (and will typically buy more of it). On balance, the producer's loss is generally offset by the consumers' gain, and there is no change in net benefits.

Similarly, transfers between customers do not affect the bottom line of cost-benefit analysis. For example, when a market expands because new buyers enter, and if economies of scale result in lower costs and therefore lower average prices charged to existing as well as new customers, there is a transfer between new customers and the original customers.

3.2.2 Private or Public Benefits?

Another important distinction to draw when assessing a project's costs and benefits is between private and public benefits. The total benefit of a project to society is called its social benefit, and is the sum of private benefits and public benefits. Private benefits are the gains to parties directly engaged in the project or contracts arising from it, and include gains to suppliers, shareholders, employees and customers. Public benefits are gained by the wider community but not reflected in transactions related to the project, for example through environmental improvements or the provision of public amenities.

If markets are working well, policy makers should not be overly concerned with private benefits as businesses and their suppliers and customers can be expected to come up with mutually beneficial ways to supply the goods or services concerned. Intervention may be warranted if there are public benefits that cannot be "captured" by market participants, or if there is an impediment (such as monopoly power) that stops parties coming to mutually beneficial commercial arrangements that yield private benefits.

So while, for example, the provision of more reliable and cheaper water to a particular market will generally be defined as a private benefit rather than a public benefit, this does not mean that the community gains nothing from such a project. Rather, it means that the members of the community who gain comprise the consumers, producers, employees, suppliers, etc, who are engaged in commercial relationships that arise from it.

It is also important that these benefits should not be double counted. For example, if a benefit arising from a project accrues as a "private" gain to suppliers and consumers, it should not also be counted as a "public" benefit, even though the community as a whole may benefit from it.

3.2.3 Economic Impact Analysis

The economic impacts of a project are not typically included in the cost-benefit analysis for the reason that if the project did not go ahead the resources that were to be used in the project would not lay idle but would be used elsewhere in the economy to create economic value. For example, the funds that would have been used by UUA to construct the EKP would instead be used by the Corporation to meet existing and future demand using the G&AWS and by mines to meet existing and future demand using hypersaline water. In general, it is only when the cost-benefit analysis produces a positive net benefit that the project would also have a positive net economic impact.

Nonetheless, economic impact analysis does have a purpose: to quantify and describe the impacts of a project proceeding, such as the number of jobs created during the construction period of a major piece of infrastructure or the amount of income generated.

Economic impact analysis can be complicated because it involves identifying the second-round flow-on effects that are triggered from the initial expenditure. For example, such flow-

on effects depend on the extent that the expenditure leaks out of the economy (whether local, regional or State) due to payments for imports or the payment of dividends and taxes.

3.3 Treatment of Risk and Uncertainty

The Authority's assessment acknowledges several sources of uncertainty and of risk. The areas of uncertainty include:

- demand growth for existing customers in Kalgoorlie-Boulder and Esperance;
- climate change and therefore the costs of additional water required from the IWSS for growth in Kalgoorlie-Boulder or the value of reductions in water needs from IWSS sources as would occur if the EKP were to proceed;
- the initial level of new demand from mines (switching from hypersaline groundwater to potable supply);
- the net growth in demand by existing mines; and
- the extent to which mining activity might be induced as a result of the reduction in the price of water.

The risks include issues such as delivery risk, i.e. the possibility that the delivered costs of a project are lower or higher than initial estimates. Risks of this type tend to be well known and are not specific to the particular project. The Authority's approach to such risks is to use the best available estimate, i.e. the expected values. Thus the Authority has used the expected values for key parameters such as the cost of the EKP or, say, the reduced cost of power to the Esperance Port Authority as the best estimates.

This approach cannot be appropriately adopted for the major uncertainties identified, such as demand growth and streamflows, since there is insufficient information to form a meaningful judgement on expected values of these parameters.

Instead, the Authority has examined the costs, benefits and impacts of the two competing proposals under a range of scenarios. Each scenario allows the benefits and costs resulting from that particular scenario to be examined. It does not require the Authority to make a judgement on the probability of that scenario being fulfilled.

The Authority notes that for some – but not all – of the sources of uncertainty it would be possible to reduce the level of uncertainty by investing in market analysis and development. UUA may wish to continue to pursue this investment where, and if, it is judged profitable to do so.

3.3.1 Discount Rate

The rate of return represents the return expected by investors for investments of a given level of risk. The rate of return is that which provides a stream of income from the investment of funds that would be sufficient to attract and retain that investment.

The most commonly used and widely understood model for estimating the rate of return is the Capital Asset Pricing Model (**CAPM**). There is a substantial amount of information available that can be drawn upon to assist in the application of the CAPM, which is not generally the case for other models of asset returns. The principles and parameters used in the CAPM are outlined in Appendix 3.

As part of its other current inquiry into urban water and wastewater pricing, the Authority has given consideration to what would be an appropriate weighted average cost of capital (**WACC**) for the Corporation. In its draft report for that inquiry, the Authority considered that a WACC of 6.5 percent (real pre-tax) was appropriate.[8] Since that time, however, the risk free rate as measured by the long term government bond rate has reduced and it is anticipated that the WACC for the Corporation would now be below 6 percent real pre-tax (all rates of return used in this report are real pre-tax).

The Corporation's WACC is important to this inquiry because it is one of the determining factors of avoided costs. As the Corporation's WACC will vary over time, sensitivity analysis has been used to estimate avoided costs at different values of the WACC, which is also used as the discount rate to compare the two options under consideration.

It is noted that UUA's WACC is likely to be higher than that of the Corporation. In addition, UUA may require yet another "hurdle" rate of return which it uses as a discount rate to determine whether or not to proceed with a particular project given the risks and uncertainties involved. However, for the purposes of determining avoided costs, it is the Corporation's WACC which is relevant.

3.4 Future Demand

3.4.1 Critical Relevance of Future Demand to Option Comparisons

The costs of the two options for future supply to the Goldfields are sharply different:

- The G&AWS has very low avoidable costs for current levels of supply. As detailed below, these avoidable costs are estimated to be in the range of $0.58/kL to $1.16/kL depending upon assumptions. However, the cost of supplying additional water beyond existing levels is substantially higher, ranging from $3.94/kL to $6.11/kL, depending upon assumptions; and
- In contrast, the EKP proposal has high initial capital costs reflecting the need to build the desalination plant and the pipeline. Supplying small volumes only would therefore be very expensive and uneconomic. However, the marginal cost of additional supply is relatively low so that the average cost falls as volumes expand.

The relative costs of the two options therefore depend critically upon the volumes of future demand.

For the EKP proposal, potential demand comprises:

- bulk supply to the Corporation for existing demand and growth in demand in Kalgoorlie-Boulder;
- bulk supply to the Corporation for existing demand and growth in demand in Esperance; and
- new demand for potable water by mines, and other industrial users, primarily between Kambalda and Norseman, which are not currently supplied by the Corporation.

[8] Economic Regulation Authority (18 March 2005), *Inquiry on Urban Water and Wastewater Pricing: Draft Report*, p67.

3.4.2 Future Demand in Kalgoorlie-Boulder and Esperance

While UUA has devoted considerable attention to the initial magnitude of mining and industrial demand, future rates of growth in demand for water in the Goldfields and Esperance are also of considerable importance.

For the Draft Report, the growth in demand for water in both Kalgoorlie-Boulder and Esperance was based on the Corporation's planning assumptions. However, subsequent investigations have shown that the Corporation's planning assumptions have been set toward the upper end of the range as compared with past rates of growth for these areas. The Corporation's planning assumptions for growth include a margin to ensure that future supply shortages are unlikely.

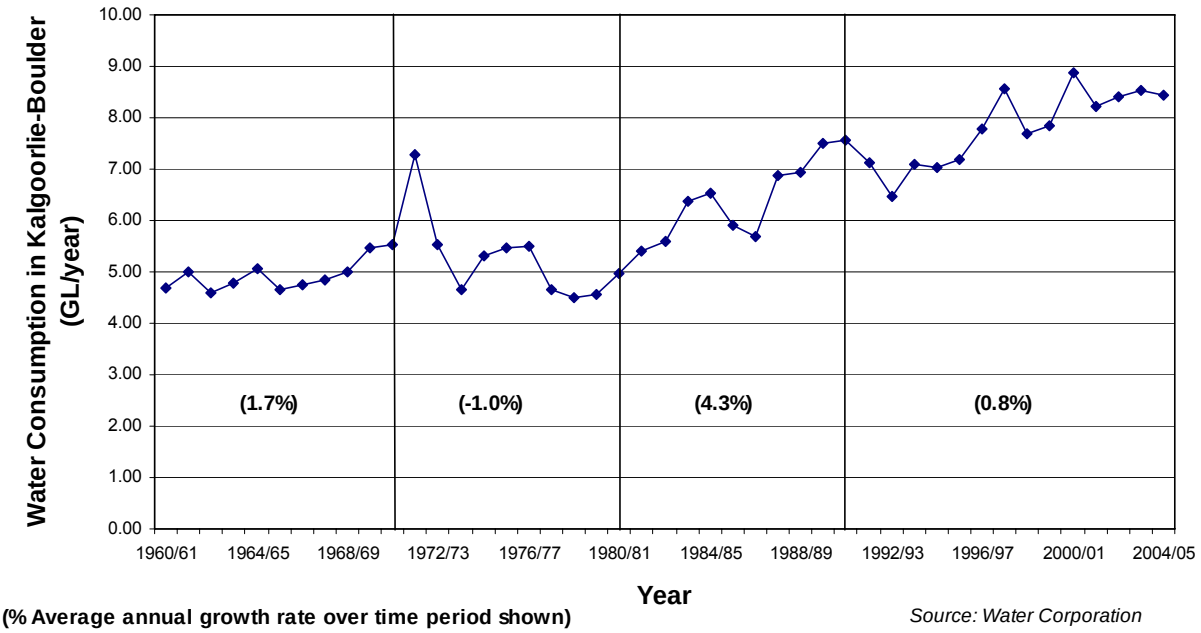
Both the G&AWS scheme and the Esperance borefields can be readily extended on an incremental basis. In such circumstances, the Corporation can set planning assumptions based on high demand growth assumptions recognising that the capital program can be scaled back if that growth in demand does not eventuate. In effect, the Corporation has some flexibility in managing its capital program in line with reductions or increases in demand growth.

In contrast to the flexibility that the Corporation has in managing its capital program with respect to growth assumptions afforded by incremental systems, the impact of different growth assumptions is critical for investment proposals such as the EKP. This is because new investment proposals such as the EKP typically involve large upfront expenditure commitments.

In the case of Kalgoorlie-Boulder, growth in water demand has been highly variable over the past fifty years (see Figure 3.1). Since 1960, growth in consumption volumes has been:

- 1.7 percent per annum for the decade beginning 1960;
- -1.0 percent per annum for the decade beginning 1970;
- 4.3 percent per annum for the decade beginning 1980;
- 0.8 percent per annum from 1990 to today; and
- 1.4 percent per annum from 1960 to today.

Figure 3.1 Annual Water Consumption in Kalgoorlie-Boulder (1960-Present)



(% Average annual growth rate over time period shown)

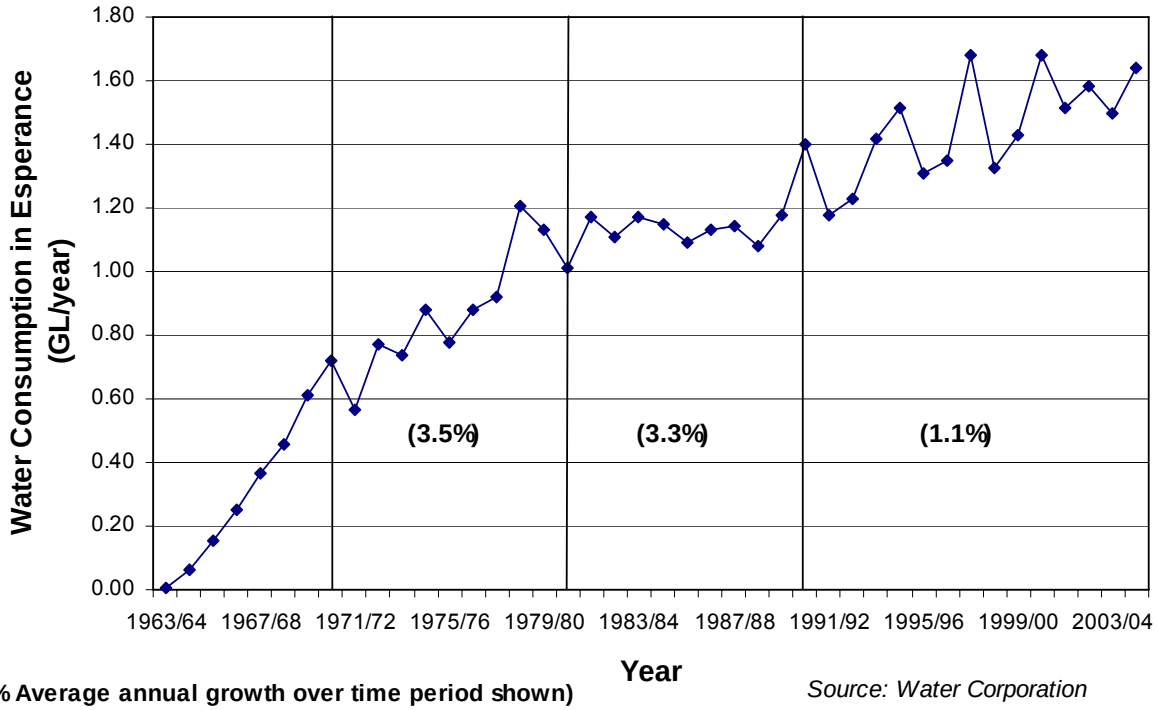
Source: Water Corporation

Based on this experience, the Authority adopted growth rates of 0.5 percent, 1.5 percent and 2.5 percent per annum for the Low, Medium and High growth scenarios for Kalgoorlie-Boulder.

In Esperance, water consumption volumes since 1960 (Figure 3.2) have grown by:

- 3.5 percent per annum for the decade beginning 1970;
- 3.3 percent per annum for the decade beginning 1980; and
- 1.1 percent per annum for the period 1990 to date.

Figure 3.2 Annual Water Consumption in Esperance (1964-Present)



(% Average annual growth over time period shown)

Source: Water Corporation

Based on past experience, the expected rates of growth in water demand in Esperance appear likely to exceed those of Kalgoorlie-Boulder. The Authority has adopted growth rates of 1 percent, 2 percent and 3 percent per annum for the Low, Medium and High growth scenarios for Esperance.

3.4.3 New Demand from Mines and Other Industrial Users

An important factor relating to future demand in the areas to be serviced by the desalination plant is that in order to be successful, UUA would need to develop the market for desalinated water. It is anticipated that this would involve a departure from the approach taken by the Corporation, including the manner of charging, often involving high up-front headworks charges which can have the effect of depressing demand.

Existing mines in the Goldfields currently make extensive use of hypersaline groundwater that can be obtained at low direct cost for the water itself. More substantial costs, which vary from mine to mine, are incurred as a result of using this water (for example, the costs of chemicals, bore operation and maintenance, and machinery maintenance and replacement due to corrosion by hypersaline water). There is therefore a potential market for potable water depending on the price of potable supply and the costs of using hypersaline water to each mine.

Similar possibilities to substitute potable for hypersaline water will arise with mine expansions and new mines. In addition, there may be some mines and processing activities where hypersaline water cannot be used and the mines and associated activities will not proceed unless potable water is available at an economic price.

UUA submitted that it had received letters of support and interest in the purchase of water from several mines primarily in the Norseman-Kambalda area, indicating total demand of up

to 24 ML/d.[9] In addition, UUA submitted that interest in taking water for the project has been expressed verbally by other mines with at least equivalent potential demand.

Other potential customers for potable water from the EKP include agricultural customers, to meet water shortages during drought periods or to produce new high-value agricultural products, and other industrial customers (e.g. industrial parks at Shark Lake and Mungari).[10]

3.4.4 Demand Estimates and Costs of EKP Supply

The Authority requested UUA to provide financial information for two specific scenarios which directly link the supply volumes to demand projections. These are:

A) Supply levels beginning at 60 ML/d and increasing over the 50 year period (to 107ML/d) in order to satisfy demand levels set by:

   i) demand from Kalgoorlie-Boulder and Esperance increasing at slightly above the long-term averages, i.e. at 1.5 percent and 2.0 percent p.a. respectively over the 50 year period; and

   ii) industrial (mine) demand held constant at the initial level for the entire 50 year period.

B) Supply levels beginning at 60 ML/d and increasing over the 50 year period (to 130ML/d) in order to satisfy demand levels set by:

   i) demand from Kalgoorlie-Boulder and Esperance increasing at slightly above the long-term averages, i.e. at 1.5 percent and 2.0 percent per annum respectively over the 50 year period; and

   ii) industrial (mine) demand increasing from the initial level at 1.5 percent per annum over the 50 year period.

In addition, UUA provided financial information for the different specifications of the EKP. The financial information was provided by UUA for a period of 30 years and then extended by the Authority to a period of 50 years so that all scenarios are of a comparable nature:

C) 60 ML/d rising to 100 ML/d by Year 30;

D) 60 ML/d rising to 120 ML/d by Year 30; and

E) 75 ML/d rising to 120 ML/d by Year 30.[11]

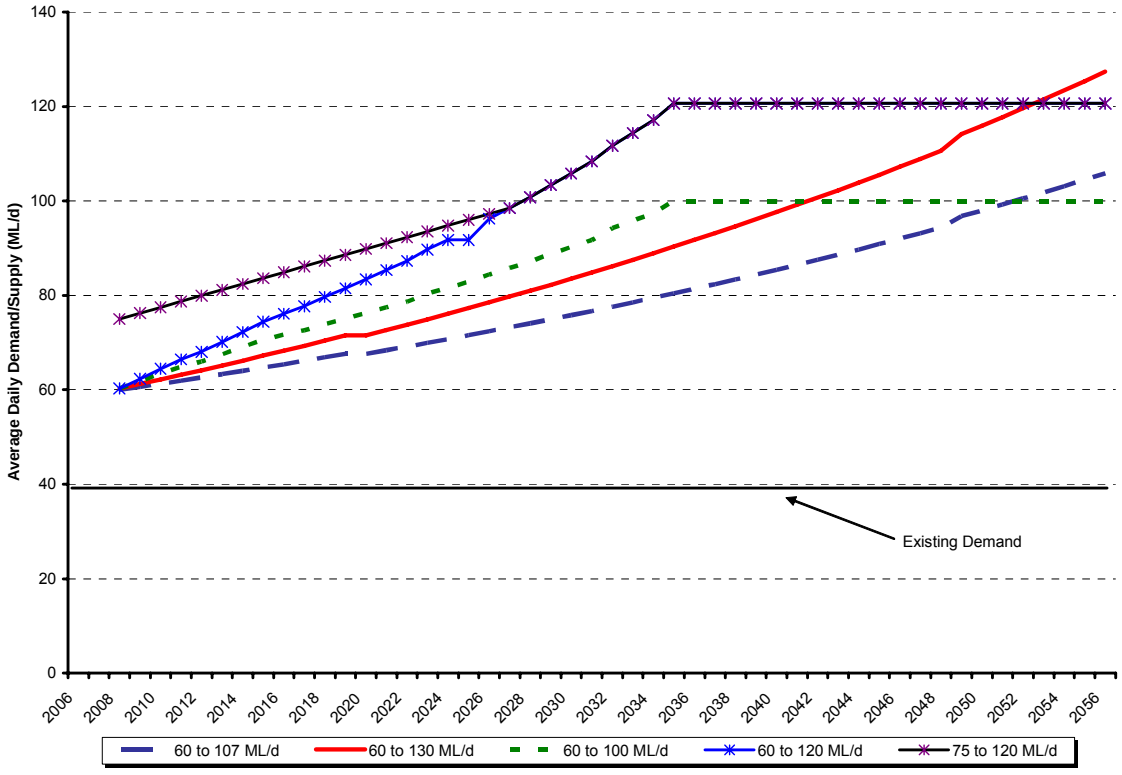
Figure 3.3 illustrates the average daily demands for the five output/demand scenarios evaluated. It should be noted that the initial demand levels of 60 ML/d compare with existing demand for Kalgoorlie-Boulder and Esperance of around 38 ML/d.

[9] UUA submission on Growth Water Demand, p3 and p5.

[10] See submissions by Esperance Port Authority, WAFarmers, Michael Ietto, Tony Ietto, Neil Wandel and the Goldfields and Esperance Development Commission.

[11] 45 ML/d rising to 100 ML/d by Year 30 was also considered but not reported.

Figure 3.3 Average Daily Demand for the Evaluated Demand Scenarios



Source: based on cost models provided by UUA

4 ASSESSMENT OF INDIVIDUAL COSTS AND BENEFITS

The Authority sought information and submissions from UUA, the Corporation and other interested parties, including via the forums at Esperance and Kalgoorlie-Boulder, on the sources of individual costs and benefits. The Authority's assessment on these costs and benefits is itemised below.

4.1 Water Corporation Proposal: Extension of G&AWS

4.1.1 Avoidable Costs for G&AWS – Existing Demand

Based on the Corporation's engineering and financial information, the main costs that would be avoided were the EKP to proceed are discussed below.

Maintenance costs to service existing demand

Maintenance costs for Zones 5 and 6 of the G&AWS system would be avoided if the pipeline were closed at Southern Cross. These avoided costs are estimated to be around $0.31/kL (at 6 percent real pre-tax discount rate).

G&AWS pumping costs to service existing demand

If the EKP option were to proceed then pumping costs of 11.8 GL/annum to supply the existing demand at Kalgoorlie-Boulder and other supply points beyond to Norseman would be avoided. These costs are estimated at $0.10/kL (at 6 percent real pre-tax discount rate).

Source costs of water to service existing demand

The source cost of the existing 11.8 GL/annum supplied to Kalgoorlie-Boulder and beyond may be valued at its opportunity cost, i.e. the estimated highest alternative value of that volume of water no longer required to be supplied to Kalgoorlie-Boulder and beyond.

The opportunity cost of this 11.8 GL/annum is estimated using the LRMC models recently developed for the Authority by The Allen Consulting Group and the Corporation. Consistent with all modelling undertaken for this current review the estimates are based on a 50-year time period.

The source development schedule and the associated LRMC estimates are sensitive to assumptions made on climate change and variability and the options for supply. Reflecting on the reductions in rainfall since 1974, which are compounded in reductions in streamflow, the Corporation has developed for planning purposes the assumption that, for the future, the means of the distributions of streamflow are best represented by the mean levels of streamflow in the period since 1996. This is referred to as the "8-year climate scenario". In addition, as a reference, the Corporation uses a counterpart 30-year climate scenario.

If a less cautious scenario is adopted (for example, by assuming that the future is best represented by streamflow distributions centred on the mean of the period since 1974, i.e. the 30-year climate scenario), then the requirements for source development are substantially downscaled. Such a downscaled source development schedule has consequential reductions in the forward costs of sourcing water for growth and therefore in the estimated LRMC.

The Authority estimates that the unit cost per kL of the water to service existing demand to be $0.71/kL for the 8-year climate scenario, and $0.32/kL for the 30-year climate scenario, assuming a discount rate of 6 percent (real pre-tax).

Since source costs are an important component of the costs avoided if the EKP proposal proceeds, these are explored in more detail in Table 4.1.

Table 4.1 Definition and Exploration of Source Costs for G&AWS

The G&AWS draws its water from Mundaring Weir and is therefore part of the IWSS. The long run marginal cost of water (LRMC), which is the forward looking cost of supplying an additional unit of water to meet increases in projected demand, was recently examined for the Authority in the context of the inquiry into Urban Water and Wastewater Pricing using the Hanke-Turvey method, sometimes described as the incremental long run marginal cost. The Authority has applied these models to examine two questions:

- What is the LRMC incurred by supplying the additional demand envisaged in the G&AWS extension, i.e. the increase from the current level of approximately 11 GL/annum to around a total of 22 GL/annum?
- What is the LRMC that would be avoided by reducing demand on the IWSS by supplying Kalgoorlie-Boulder's existing demand from a desalination plant at Esperance?

As the wording of these two questions suggest, costs incurred when demand is increased may differ from the costs avoided when demand is reduced.

The LRMC reflects the costs of each additional water source on the schedule showing the order of development of sources over the medium or longer term. (Under the Hanke-Turvey method, the LRMC is defined as the change in the present value of costs divided by the change in the present value of volumes supplied.)

For the IWSS, the source development schedules are available from the Corporation for a 50 or 100-year horizon. The ordering of sources in the development sequence reflects ascending order of unit costs, locational needs and urgency. For instance, the desalination plant at Kwinana is being built now, not because it is the lowest cost source, but because it can be quickly constructed to provide Perth with the required security of supply.

Since there are a number of moderate cost sources to be developed before a second desalination plant becomes the next lowest cost source, and the Hanke-Turvey methodology is based on changes in present values, it follows that the LRMC is less than the unit cost of a future desalination plant. At the same time, the desalination plant at Kwinana is committed with the result that it is unaffected by a change in the level of demand and therefore is not included in the LRMC.

	4% ($/kL)	6% ($/kL)	8% ($/kL)	10% ($/kL)
Growth water:				
8 year climate scenario	0.82	0.80	0.76	0.71
30 year climate scenario	0.58	0.54	0.50	0.45
Existing water:				
8 year climate scenario	0.76	0.71	0.70	0.72
30 year climate scenario	0.46	0.32	0.23	0.17

Source: Water Corporation with Marsden Jacob Associates analysis

4.1.2 Avoidable Costs for G&AWS – Growth

Approach to analysing avoidable growth costs

The cost of expanded supply to Kalgoorlie-Boulder and beyond should be assessed on a forward-looking basis. This requires:

- the separation of costs relating to using the G&AWS Main Conduit to supply the agricultural districts from those attributable to supplying the demand points beyond Southern Cross;
- the exclusion of costs which have already been expended or "sunk";
- the inclusion of expansion costs at the incremental cost of expansion; and
- recognition of costs which would be avoided if G&AWS supply to Kalgoorlie-Boulder and beyond were to cease.

During the course of the review several different analyses of the costs of extending the G&AWS were put forward. These included the:

- Notional Cost Model employed by the Corporation to set charges for new industrial customers. This model develops engineering solutions and cost estimates for designated changes in average flow capacity of the G&AWS Main Conduit (say 15 or 30 ML/d increments). The resulting unit costs are then applied by the Corporation to set headworks charges for mines and other industrial users. As the last full scale evaluation of this model was in 1994, current unit cost estimates are based on CPI indexation of those earlier costs;
- Corporation's capital program for the G&AWS Main Conduit to 2023-24 plus extrapolation to 2035. This program and the associated cost estimates have been developed by Corporation management, approved by the Board and form part of the Corporation's submissions to the Authority for the purposes of the Inquiry on Urban Water and Wastewater Pricing; and
- "comparator" cost estimate of a "Super-G&AWS" developed by UUA and its consultants under the assumption that it is not possible to expand the G&AWS Main Conduit beyond 45 ML/d without duplicating it completely (see the next section).

Incremental expansion of the G&AWS Main Conduit

As noted in the Draft Report, to assist in comparison of the cost of the options of a) expanding the G&AWS Main Conduit and b) building a desalination plant in Esperance and pipeline to Kalgoorlie-Boulder, UUA had developed its own concept and costing of a G&AWS expansion. For the cost-benefit analyses submitted by UUA, this concept and costing constituted the base case, or "comparator", against which the EKP proposal was assessed by UUA.

The prime feature of the comparator was UUA's assumption that the G&AWS would need to be completely duplicated once the G&AWS Main Conduit was required to be expanded beyond a capacity of 45 ML/d.

The Authority's assessment is that the comparator is unrealistic in assuming it is not economically feasible to extend the G&AWS Main Conduit beyond 45 ML/d. Not only is this inconsistent with the Corporation's planning assumptions and capital program but it is also inconsistent with the analysis undertaken for UUA by ARUP Water.

There is a question, however, of whether there is a cost penalty associated with expanding the G&AWS Main Conduit.

For the purposes of the Draft Report the Authority accepted the Corporation's view that the G&AWS Main Conduit could be incrementally expanded at no significant cost penalty, but invited further submissions on this matter.

While the Corporation provided no independent verification as such, the Authority noted the following matters in the Draft Report:

- the G&AWS Main Conduit has been expanded incrementally in the past;
- incremental expansion is the basis of the Corporation's notional cost model;
- the Notional Cost Model closely aligns with the current capital programme;
- the capital programme is reviewed by the Board and management; and
- the presumption of the ability to make incremental expansions without significant cost penalties is also observed in other pipelines, including gas pipelines.

In response, UUA and its advisors, ARUP Water, met with Corporation engineers to discuss these issues. The Corporation provided ARUP Water with technical specifications and information relating to Zones 5 and 6 of the G&AWS Main Conduit and ARUP Water then estimated the costs associated with incremental expansions of Zone 6.[12]

In terms of the UUA assumption that the G&AWS Main Conduit would need to be duplicated to meet demand beyond 45 ML/d, the ARUP Water advice was that this assumption was not valid:

> Increasing the capacity of G&AWS zone 6 by "incremental extension" is cheaper than any major reconstruction (new main) that provides capacity well ahead of demand…

On the question of cost penalties and their materiality, ARUP Water's analyses explored incremental expansions of Zone 6 of 45 to 60 ML/d, 60 to 75 ML/d, 75 to 90 ML/d and 90 to 105 ML/d. Based on ARUP Water's initial analysis, the costs of each incremental expansion were found to fall for the second expansion, and thereafter to rise. Based on these results, ARUP Water concluded that:

> While "incremental extension can be achieved without significant cost penalty" can be reasonably applied when comparing 'incremental extension' of the G&AWS to any new main replacement, "incremental extension" does come with the penalty of increasing unit costs as capacity increases.

ARUP Water's re-analysis of this data then removed the fall for the second extension and showed a systematic rise.

However, the ARUP Water analysis conflicts with the results of an earlier review by the Corporation.[13]

> The main point of debate would be whose methodology is optimum. UUA have looked at two options in one zone. To optimise properly requires a review of several options and all zones. Without reviewing other alternatives it is not possible to say whether theirs is the optimum model.

[12] The G&AWS Main Conduit is segregated into six operational zones: Zone 1 (Mundaring Weir to Cunderdin Reservoir); Zone 2 (Cunderdin to Merredin Reservoir); Zone 3 (Merredin to Yerbillion Reservoir); Zone 4 (Yerbillion to Ghooli Reservoir); Zone 5 (Ghooli to Dedari Reservoir); Zone 6 (Dedari to Kalgoorlie (Mt Charlotte) Reservoir).

[13] Water Corporation (1998), *G&AWS Main Conduit Long Term Review*, prepared by Infrastructure Planning Branch, IPB Project No. P585, August.

> Although the exact details are now superseded, the long term planning strategy was evaluated by WC in 1998 and the following options examined:
>
> a) Minimising pipe upgrades and duplications by maximising utilisation of pump stations;
>
> b) Minimising number of pump stations which implies significant pipe upgrades; and
>
> c) Utilising seasonal balancing storage to minimise upgrades to pipeline capacity.
>
> Option b) was found to be cheaper than option a) which was 35 percent higher in present value terms. However, option a) was cheaper if operating costs were ignored. Options b) and c) were similar in cost but the cost of option c) had the potential to increase significantly due to water quality issues. Option b) was therefore considered the least cost option. This finding is currently being optimised with new storages being constructed at Kalgoorlie.

There are several reasons why the Authority does not consider it necessary to undertake a more thorough analysis of which approach is optimal. First, the G&AWS Main Conduit has been incrementally expanded over more than a century and the system of pipes, pumps and storages is familiar to both the Corporation and its contractors. Thus, there is ongoing scope for efficiencies from "learning by doing", as has been concluded in the recent broad review of Corporation performance and efficiency by Maunsell:[14]

> Recent innovation has made possible the refurbishment of the Kalgoorlie pipeline at half the annual cost of replacement, which was the previous approach. Approximately 7 kilometres of pipe is refurbished each year.
>
> This ongoing saving is reported to be worth $3.5 million each year, however this needs to be discounted to take into account the shorter life span of refurbished pipe (50 years) compared to replaced pipe (100 years).
>
> Efficiency gains are also being reported on the cost of the refurbishment itself. Costs per metre of refurbished pipe were $466 in 2002/03, $458 in 2003/04 and projected at $413 in 2004/05. The falling costs are attributed to better management and implementation of lessons learned, for example by lengthening the bypass pipe allowing work to proceed more efficiently. This represents an efficiency saving of 1.7 percent in 2003/04 and nearly 12 percent in 2004/05 against the 2002/03 costs.

The Authority has not factored the potential for future cost savings into its analysis and to this extent this may represent an overstatement of the estimate of the avoided costs for the Corporation if the EKP were to proceed.

Second, the Authority notes that if average growth rates for Kalgoorlie-Boulder demand since 1960 are maintained for the next 30 years, then total demand in Kalgoorlie-Boulder will be no more than 50 ML/d. In other words, it might be reasonably expected that Kalgoorlie-Boulder growth will necessitate no more than the first incremental expansion that was considered in ARUP Water's analysis. Even if Kalgoorlie-Boulder's growth were to be 1 percentage point higher than the previous long term average, i.e. around 2.5 percent, then the total demand in Kalgoorlie-Boulder in 30 years would be around 65 ML/d, which is into the first part only of the second incremental expansion assumed by ARUP Water.

Since the suggested higher cost would only be incurred around 25 to 30 years into the future, the present value of any cost penalty would be relatively small.

Reflecting these several issues, the Authority recognises that expansion of the G&AWS will involve increased cost, but would envisage any expansion of the pipeline system to be implemented on an incremental basis in line with increases in demand. Optimisation of the expansion programme would mitigate against any significant cost penalty such as would be incurred if incremental expansion were not possible and complete duplication of the G&AWS Main Conduit were necessary immediately beyond the 45 ML/d capacity level. Accordingly,

[14] Maunsell Australia (June 2005), "Capital Efficiency Measurement and Reporting" internal report for the Water Corporation.

the Authority has assessed the impact of incremental expansion costs of the G&AWS Main Conduit as part of its broader investigation of sensitivities to changes in key parameters.

Comparison of the Corporation's notional cost and capital programme estimates

As discussed below, the Corporation's cost estimates of expanding the G&AWS Main Conduit are stable with no significant difference between the estimates from the Notional Cost Model and the estimates based on the capital program. Since the capital program is based on more recent engineering assessments the Corporation has suggested that this information should replace the earlier cost estimates based on the Notional Cost Model. The Authority concurs with this assessment.

The Corporation initially proposed using the Notional Cost Model to assess the cost of providing for future growth in supply to Kalgoorlie-Boulder, Norseman and Kambalda. During the course of the inquiry this was modified to assessing the costs based on projected capital expenditures as per the Corporation's capital program with extrapolation thereafter using the average capital cost per kL of growth capacity over the period covered by the program.

Table 4.2 shows that this change in cost methodology has had only a minimal impact on the results.[15]

Table 4.2 Comparison of the Corporation's Costing Methodologies

Cost Methodology	Present Value Cost of Augmenting Supply at 6% (real pre-tax) ($ million)
Projected capital expenditure	254.6
Notional Cost Model	266.6

Source: Water Corporation with Marsden Jacob Associates' analysis

Avoidable costs to G&AWS – growth demand

Based on the Corporation's engineering and cost estimates, the main cost items that can be avoided in meeting growth in demand in Kalgoorlie-Boulder are described below.

Capital expenditure to service growth

These costs are based directly on the Corporation's capital program for the period 2006-07 to 2023-24. Corporation engineers and analysts sought to identify those costs which would be avoided and those costs which, although still incurred, would be delayed, if the G&AWS Main Conduit were not to supply Kalgoorlie-Boulder and beyond.

These estimates for the period to 2023-24 were then extrapolated out until 2034-35 by which time demand supplied by the Corporation is expected to have increased from the current

[15] The Notional Cost Model calculates the cost of instantly creating a large increment (15 or 30 ML/d) to the capacity of the G&AWS Main Conduit. Under the implicit assumption that this additional capacity is immediately taken up, the unit cost of this capacity is then derived. The fact that the Notional Cost Model assumes a single large capacity increment is instantly created does not imply that it must be, or that there is a substantial cost penalty in creating that capacity incrementally over a period of years. Indeed, the comparison of the notional cost estimates with the projected capital expenditure suggests that there is no penalty.

30 ML/d to between 37 and 65 ML/d depending on the assumed growth of demand in the Kalgoorlie-Boulder area.

The Authority estimates the costs of the Corporation's capital expenditure to meet growth in demand in Kalgoorlie-Boulder to be $2.93/kL, based on a discount rate of 6 percent (real pre-tax).

The cost of source water for growth

Under the G&AWS option, the scheme would be incrementally expanded to deal with demand growth as it occurs. This growth water would continue to be drawn from the IWSS via Mundaring Weir. The source cost of this water for Kalgoorlie-Boulder is estimated from the Corporation's source development schedules and the LRMC cost models recently developed by the Authority.

The Corporation's source development schedule, by definition, reflects the options included and this may be based on existing firm options only or include options which are well advanced but not finally agreed. Several low cost options currently under consideration and negotiation, include further permanent trades of water from Harvey Water, and possibly a second phase of supply from the South West Yarragadee. These were not included in the source development schedule and LRMC estimates reported in the Authority's Draft Report. Their inclusion reduces the cost of source development and the estimated LRMC for increments in required supply.

Inclusion of further water trades from Harvey Water and a phase two from the South West Yarragadee results in LRMC estimates of $0.80/kL for the 8-year climate scenario and $0.54/kL for the 30-year climate scenario, assuming a real pre-tax discount rate of 6 percent.

The Authority considers these latter estimates to be more realistic and appropriate and has adopted them for this review.

It is noted that since the modelling that was undertaken to estimate LRMC incorporated high loss rates associated with the metropolitan reticulation system, relative to loss rates that would be experienced in the operation of bulk pipeline systems such as the G&AWS or the proposed EKP, the estimates of avoided costs based on the LRMCs used would be conservatively high.

G&AWS operating expenditures to service growth

Avoidable operating expenditure costs to service growth for the G&AWS were estimated at $0.92/kL, at 6 percent discount rate (real pre-tax). These compare with $1.23/kL incorporated in the Notional Cost Model. The lower cost estimate is due to the subtraction of unavoidable fixed costs previously incorporated in the $1.23/kL estimate.

4.1.3 Avoidable Costs for Esperance

Based on the Corporation's engineering and cost assumptions, the main items in the avoidable costs of Esperance supply are set out below.

The costs which relate primarily to the cost of augmenting the borefield and the operation of the borefield would be avoided if the EKP option were to proceed and to supply Esperance.

The capital costs assumed to be avoided in relation to supplying Esperance are based on:

- a new bore and 0.5 km of collector main valued at $0.4 million for every 100 ML increase in consumption above 2.5 GL; and
- expenditure of $0.15 million every five years for increased treatment capacity.

Operating costs are based on a 2004-05 cost of $0.3 million which is escalated at the assumed growth rate for planning purposes of around 3 percent.

These costs were transformed to annualised $/kL estimates for the range of discount rates evaluated and applied to the Low, Medium and High growth scenarios adopted for the analyses.

The annualised unit values of the avoided Esperance costs are shown in Table 4.3.

Table 4.3 Water Corporation Avoided Costs for Esperance (Present Value at 6 Percent Real Pre-Tax)

Cost	$/kL
Capital expenditure	0.12
Operating expenditure	0.13
Total expenditure	**0.25**

Note: Rounding errors may occur

4.1.4 Summary of Water Corporation Avoided Costs

Table 4.4 summarises the costs per kL that would be avoided by the Corporation in the event that the EKP project went ahead, as estimated by the Authority, assuming a discount rate of 6 percent (real pre-tax).

Table 4.4 Summary of Avoided Costs for the Corporation (at 6 Percent Real Pre-Tax)

	Present Value of Costs ($/kL)	
Type of Expenditure	8-Year Climate Scenario	30-Year Climate Scenario
Existing demand		
Maintenance	0.31	0.31
Pumping	0.10	0.10
Source water	0.71	0.32
	1.11	**0.72**
Growth demand		
Capital	2.93	2.93
Operating	0.92	0.92
Source water	0.80	0.54
	4.65	**4.40**
Esperance		
Capital	0.12	0.12
Operating	0.13	0.13
	0.25	**0.25**

Note: Rounding errors may occur

4.2 United Utilities Australia Proposal

The costs of UUA's proposal for the EKP are based on the detailed technical specifications provided to the Authority by UUA.[16] These specifications were reviewed by the Authority's engineering associates, IBL Solutions. The advice is provided in Appendix 4.

As noted, costings showing cash outlays over a 50-year period were developed by UUA for a plant and pipeline delivering initially 60 ML/d rising to 100 ML/d by year 30 and subsequently extended to other scenarios. UUA described these costings as *"conservative, leaving room for profit".*

The UUA proposal involves costs and benefits that do not necessarily flow to UUA itself. Nonetheless, they ought to be included in the assessment of the cost-benefit analysis of the project. For instance, the substitution of potable for hypersaline water may involve the mines incurring additional expenditures in order to bring the water from the proposed pipeline to the mine or processing site. As it happens, the cost of bringing water from the proposed pipeline to a mine or processing site is, on the evidence, unlikely to be material for at least the initial tranche of demand identified by UUA and has therefore not been included in the analysis.

4.2.1 Main Features

The EKP proposal envisages a desalination plant being constructed at Esperance with the water being piped northward from Esperance to Kalgoorlie-Boulder. The town of Esperance would also be supplied with desalinated water, replacing existing supplies sourced from bores operated by the Corporation. In its simplest form the EKP proposal envisages the closure of the G&AWS pipeline at Southern Cross.

The capital expenditure required for the EKP is front-loaded with around 75 percent (in present value terms) occurring in the first two years. This contrasts with the extensions of the G&AWS, which are incremental and spread over time.

Reflecting the energy intensity of the desalination processes and the need to pump water along the 392 km pipeline, operating costs including administration are significant at around $1.00/kL, with energy costs representing around 65 percent of the total operating cost, with these estimates varying slightly between the five output/demand scenarios.

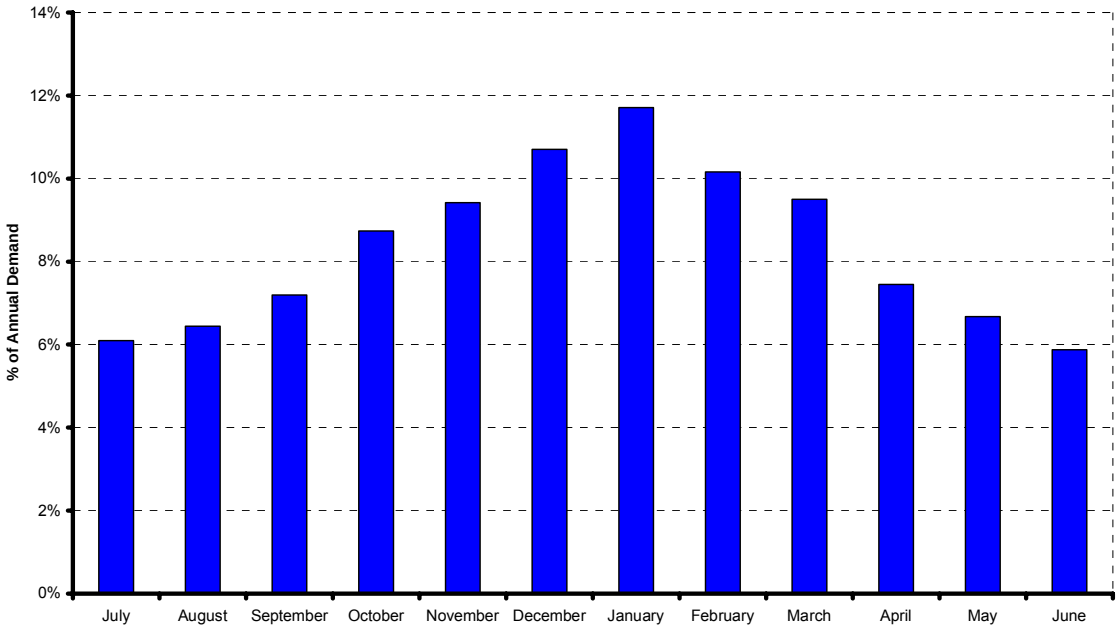
The energy cost estimates have been revised downward from those provided for the Draft Report, following advice from the operator of the Esperance wind farm, who without the EKP would have substantial excess capacity. The Authority has confirmed that the revised energy costs are realistic, and has incorporated them into its models of UUA costs.

4.2.2 Peaking Storage Requirements

A desalination plant utilising reverse osmosis technology, such as envisaged at Esperance, operates at maximum efficiency and lowest cost when operating at full and stable production. However, demand for water in the Goldfields exhibits a strong seasonal swing (Figure 4.1).

[16] United Utilities Australia, *Goldfields Water Supply Esperance-Kalgoorlie Pipeline, Technical Description, 60 ML/day Winter Capacity*, provided to the Authority on 11 March 2005.

Figure 4.1 Average Monthly Demand for Water in Kalgoorlie-Boulder (Percent of Annual Demand)



Source: Water Corporation

A concern has been that the UUA proposal would need to incorporate substantial additional peaking storage. Detailed investigations of this issue by the Authority, the Corporation and UUA were undertaken. Following discussions between the parties, it was concluded that the combination of existing and proposed Esperance and Kalgoorlie-Boulder storage facilities and demand management may be sufficient for UUA to accept the risk of meeting peaking requirements and that no immediate addition to peaking storage facilities would be required.

4.2.3 Summary of UUA Capital and Operating Costs

Table 4.5 summarises the capital and operating costs for the EKP for different demand scenarios, at 6 percent and 8 percent real pre-tax discount rates.

Table 4.5 Summary of EKP Capital and Operating Costs ($ per kL) for Different Demand Scenarios

	EKP Costs (Capital plus Operating), $ per kL				
Discount Rate (Real Pre-Tax)	**60-107 ML/d**	**60-130 ML/d**	**60-100 ML/d**	**60-120 ML/d**	**75-120 ML/d**
6 percent	2.20	2.17	2.16	2.12	2.05
8 percent	2.57	2.53	2.50	2.45	2.35

Source: UUA cost models with MJA analysis

4.2.4 Water Quality and G&AWS Disinfection Strategy

The G&AWS Main Conduit and its extensions are among the most geographically expansive drinking water supply systems in the world. The combination of geography, variable demand and high temperatures (in autumn/spring and summer) presents significant challenges in relation to maintenance of high water quality standards.

The Corporation has a comprehensive set of planning, design and operational strategies to address these challenges.

One of the strategies for maintaining an acceptable water quality along the G&AWS Main Conduit involves en route chloramination, i.e. the addition of both chlorine and ammonia.

The Corporation's modelling indicates that the optimum balance between dosing rate, residual decay and the control of disinfection by-products is achieved by limiting water age to eight days.

Under the scenario where there is zero demand east of Southern Cross (the UUA proposal), control of water quality (i.e. limiting water age to eight days) involves:

- isolating all parallel mains;
- constructing new disinfection facilities at Cunderdin and Nulla Nulla. These are costed at $2 million and $1.5 million respectively; and
- replacing existing pipeline between Yerbillion Pump Station and Ghoolie Pump Station (i.e. Southern Cross) with 72.5 km of smaller diameter pipe to achieve required velocities under conditions where flows are significantly reduced. This is costed at around $12 million.

Detailed discussions between the Corporation and UUA engineers are understood to have agreed that these costs would be warranted. Nonetheless there are other options including:

- keeping the G&AWS pipeline open between Southern Cross and Kalgoorlie-Boulder with either a minimum base flow, emergency supply or periodic supply, particularly in summer; or more radically
- reversing the flow in the G&AWS pipeline between Kalgoorlie-Boulder and Southern Cross and therefore supplying Southern Cross with desalinated water.

In respect of the first option, keeping the G&AWS open would mean that the costs of operating and maintaining the zone between Southern Cross and Kalgoorlie-Boulder would no longer be an avoided cost for the Corporation. In addition, the Corporation indicated concerns over temperature variation in the pipeline resulting from low or static flows in the pipeline which would require the addition of expansion joints to ensure the operational integrity of the pipeline was maintained.

The second of these options (reversing the flow on the G&AWS to Southern Cross) was raised in several submissions. UUA indicated support for the concept, on the grounds that:

> [t]he reduced flows would minimise the need for capital upgrade of the pipeline, but more importantly would avoid significant costs associated with water treatment, rechloramination and pipe replacement required for maintenance of water quality in the G&AWS...
>
> Of additional significance would be the increase in demand through the Esperance-Kalgoorlie Pipeline in the early stages of the project's life which would further reduce unit costs and improve the net benefits for the EKP. (UUA submission, "Technical Matters", p2)

Specialist Water Services submitted that supplying the G&AWS with desalinated water from Esperance would reduce the problems of maintaining water quality on the G&AWS pipeline to Kalgoorlie, particularly in relation to the levels of trihalomethanes (**THMs**). Specialist Water Services submitted that if the Australian guidelines for THM levels (currently 250 µg/L)[17] were reduced to USA guidelines (80 µg/L), this would require advanced water treatment at Mundaring costing an estimated $60-70 million and around $3 million in operating costs.

[17] A microgram (µg) is 0.000001 of a gram.

Advice to the Authority from the Department of Health is that studies into the safe levels of THMs are ongoing, but there are no plans at this stage to reduce the levels of THMs.

Further, there appears to be a substantial net cost to reversing the flow on the G&AWS Main Conduit, and this cost is larger than the cost of upgrading the chloramination disinfection strategy. The Corporation's estimates indicate a net cost of at least $78 million, before taking into account other costs such as the need to adjust pipe sizes on the G&AWS and resizing and/or relocating pump stations.

For the purpose of this report, the Authority has adopted the chloramination disinfection strategy proposed by the Corporation. The capital costs associated with this strategy were transformed to an annualised cost of 8.8 cents per kL.

4.2.5 Cost Offset from Release of Esperance Borefields

Esperance is currently supplied by groundwater from the borefields close to the town. UUA suggested that if the EKP were to proceed, these borefields would no longer be required with the result that the land could be released for prime residential development. UUA suggested that the value of the land so released was around $70 million in present value terms and that this value could accrue to the Treasury as a result.

Several submissions to the Authority noted the potential benefits of the UUA proposal in freeing up the borefield land in Esperance. For example, the Shire of Esperance wrote that:

> The Shire of Esperance also believes the [Authority] should have taken into consideration the fact that the Water Corporation continues to rely on the borefield west of Esperance as its sole source of water for the town. The borefield is in close proximity to town and inhibits the expansion of residential areas into otherwise suitable locations. Esperance suffers from a shortage of suitable land for future urban subdivision due to the close proximity of the RAMSAR listed wetlands. The UUA proposal obviates the need to use the borefield and would make land close to existing residential areas available for development, which is currently restricted as being classified as P2 water priority areas. In saying this, the Shire recognises the need to retain the borefield as a complementary water supply and any future development would need to take this into account in terms of satisfying environmental and statutory requirements. (Shire of Esperance submission, p3)

The Authority's enquiries indicate that the borefield could be shifted progressively at relatively low cost thus releasing the areas currently retained for the purpose of the borefield. Based on progressive release over a 40-year period, the real estate value of this land is estimated at around $1.6 million in present value terms at 6 percent real pre-tax.

A cross-check on this estimate is provided by the value of a recent major sale of similar real estate where 1,238 ha sold for around $2,300/ha. Again, assuming a progressive sale over 40 years gives a value of around $1.5 million at 6 percent real pre-tax.

These gross valuations do not acknowledge the cost of decommissioning but do recognise the likelihood that land sales by government are more likely to occur on a wholesale rather than a retail basis.

For the purpose of this inquiry, the Authority has applied a net present value of $1.6 million to the Esperance borefields land, based on a real pre-tax discount rate of 6 percent.

4.2.6 Mines and Other Industrial Uses

The EKP proposal would make potable water available to a number of mine sites and would obviate the need for these mines to use hypersaline water. The nature and level of the direct

and indirect costs of using hypersaline water have been progressively explored in recent years, particularly in the 2002-03 review and most recently by UUA during 2005.

For the purposes of the Draft Report, the Authority relied upon submissions of UUA and their consultants that, based on the 2002-03 review, the full costs of hypersaline water ranged from around $2.40/kL to around $4.00 and that UUA was interested in supplying mines whose costs were above $3.00/kL. UUA's consultants estimated a mean value of $3.33/kL and then argued that the present value would be around $3.40/kL because the mines that are incurring the highest costs from use of hypersaline water would be the first to purchase potable water.

The Authority noted, however, that, as emphasised by the 2003 review, there are multiple sunk costs so that mines are likely to be slow to transition to the use of potable water and that the assumptions generating the $3.40/kL estimate were speculative.

Following the Draft Report, UUA further investigated the direct and indirect costs of using hypersaline water in the mines and related activities.

UUA's September submission to the Authority suggested that the unit cost of using hypersaline water was well in excess of either $3.33 or $3.40/kL and was around $3.61/kL. This increased estimate reflected a significant rise in the chemical costs necessitated by the use of hypersaline water compared with the August 2003 review.[18]

UUA also provided examples of average commercial values of water for a range of potential customers, which indicated an average cost/kL of hypersaline water for these customers of $3.75/kL.

Based on UUA's assessment of the average of previous research on the avoidable cost of hypersaline water ($3.61/kL) and their September 2005 assessment of "the commercial estimate" of the full value ($3.75/kL), UUA noted that the (unweighted) average is $3.68/kL.

UUA concluded by requesting that the Authority should utilise this "researched figure" of $3.68/kL for the purposes of the inquiry.

In its modelling analyses, the Authority has employed the $3.68/kL estimate. In addition, the Authority has examined the sensitivity of these potentially avoided costs in Section 5.4.

There are some other potential customers for potable water from the EKP apart from mines. Various submissions noted that the agricultural sector would be interested in purchasing water, to supplement existing supplies for drinking water for livestock or chemical spraying of crops, or to develop new high-value agricultural industries (e.g. horticulture, viticulture, floriculture, aquaculture, equine industries, cattle feedlotting, seed potatoes, cereals, vegetables, stock feed).[19] There are also potential new industrial customers, such as industrial parks in Esperance and Kalgoorlie.

The Authority has treated these potential new customers on the same basis as potential new mining demand, on the assumption that they would purchase water from UUA only if it were profitable to do so (i.e. to produce high value outputs, or to avoid high short-run costs due to water shortages). The Authority has therefore applied the $3.68/kL value to demand from potential agricultural and industrial customers. It is important to note that the demand from these customers falls within the EKP demand projections, and is not additional demand.

[18] The 2002-03 review found reagent costs to be in the range of $0.75/kL to $2.30/kL, whereas UUA estimate reagent costs around $2.07/kL.

[19] See submissions by Esperance Port Authority, WAFarmers, Michael Ietto, Tony Ietto, Neil Wandel, and Goldfields Esperance Development Commission.

4.2.7 Water Quality at Esperance

The Corporation advises that expenditure on water quality treatment at Esperance to improve aesthetic qualities is recognised as a long-term need but that it is not incorporated into the short or medium term capital programs.

A potential benefit of the EKP proposal is that the water quality problems currently at Esperance would be dealt with as soon as the desalination plant is commissioned, rather than Esperance residents and businesses having to wait their turn in the sequence of towns awaiting expenditure by the Corporation (and indirectly the general taxpayer) to address aesthetic water quality issues.

Potable supply at Esperance is sourced from the Corporation's borefields. This water meets the health and environmental criteria of the 1996 Australian Drinking Water Guidelines (**ADWG**) but does not meet aesthetic criteria relating to hardness and Total Dissolved Solids.

The hardness of the water has noticeable effects and poses costs to users. Numerous submissions noted the benefit of improved water quality for Esperance if the EKP were to go ahead (see submissions by GEDC, Gregory Hosking, CCI of WA, ANZIS, Shire of Esperance, UUA, Hazeltine Pty Ltd, Esperance CCI, Thorp Realty, The Nationals WA). Dissatisfaction with the current water quality in Esperance was a point that was raised strongly at the public forums attended by the Authority in Esperance.

For example,

> …the town supply is shocking to say the least. The mineral and calcium content in the water is very high and apart from the taste, it is very hard on household appliances and hot water systems that use the town water. Electric hot water systems typically last between three and five years if the water is not put through a water softener prior to entering the hot water system. Compare this with a life of 10 to 15 years and beyond for those hot water systems using rainwater. (Brett Thorp JP, Thorp Realty submission).

The Shire of Esperance noted that improving the water quality in Esperance would result in significant benefits to consumers by:

- increasing the lifespan of domestic appliances such as water heaters, kettles, dishwashers and washing machines…;
- [avoiding] additional costs of treating water by utilising water softening processes. [The Shire estimates the cost to a household of such a process to be around $1,900 in capital costs and $650 in annual running costs];
- removing the additional cost of obtaining alternative sources of drinking water… including the cost of installing rainwater storage tanks, water filtration systems or purchasing bottled water;
- [reducing] calcification of taps, shower fittings, reticulated watering systems and the buildup of calcium residue on buildings, windows and internal wet areas…(Shire of Esperance submission, pp2-3)

The poor water quality in Esperance is also cited as impacting on the tourism industry, for example:

> Visitors to Esperance regularly complain about the quality of water currently available from our borefield water supply. The poor quality of water also adds additional costs to our commercial operations. (Esperance Region Tourism Association)

and also:

> We are moteliers in Esperance and we believe that the poor water quality in this area is found by visitors to be objectionable. On many occasions visitors have complained to us about the water quality and we strongly believe water quality to be a limiting factor to the tourism industry in Esperance. (Gregory Hosking)

To mitigate these impacts some water users at Esperance incur direct costs through water softeners, filters and chemicals, or the installation of rainwater tanks. Such private costs are not unique to Esperance and occur in other towns across the State. One approach to valuing the willingness of customers to pay for water quality improvements is to carry out an extensive study of the private costs incurred by consumers to avoid problems related to water quality. An alternative approach is to estimate the costs that would be incurred by the Corporation to improve the water quality at Esperance.

The Corporation advises that a water quality treatment plant, possibly based on reverse osmosis, may be built to address these issues sometime in the future. Regardless of when the plant were commissioned, these costs would be lower if the plant were used to provide enough treated water to blend with non-treated bore water in order to meet the ADWG.

The Authority therefore sought to estimate the avoided cost to the Corporation commissioning a water quality treatment plant in Esperance. The Corporation provided the Authority with estimates of whole-of-life costs from a supplier for two water treatment plants of varying sizes designed to treat water to comply with the aesthetic guidelines of the ADWG. The weighted average whole-of-life cost of these plants was $0.65/kL, and this value has been used as a basis for the Authority's analysis of the avoided cost for Esperance water quality improvements.

The avoided cost of advancing water treatment has been calculated as the present value cost of implementing the required water treatment from 2008, based on $0.65/kL of demand, less the present value of water treatment implemented some 25 years later. This net cost is estimated to be $25.3 million, or $0.47/kL, at a 6 percent real pre-tax discount rate. The analysis assumes that UUA captures this benefit.

The addition of around $25 million to address water quality at Esperance is material in relation to the Corporation's total programme for service enhancement over the next five years of $167 million. Unless funded by additional Community Service Obligation payments to the Corporation, expenditure on water quality in Esperance could reduce or delay expenditure on water quality improvements in other country towns.

5 COMPARISON OF COSTS AND BENEFITS

5.1 Introduction

As required by the Terms of Reference, the Authority has examined the overall costs and benefits of the EKP proposal. This has been undertaken within a standard cost-benefit framework based on the modelling of real cash flows over a 50 year period.

A standard cost-benefit analysis will identify a base case and examine impacts of alternative "with project" cases. In this review, the base case is defined as continuing to extend the G&AWS incrementally. The alternative "with project" cases relate to a range of demand scenarios under the EKP proposal.

The modelling is undertaken for some 30 individual scenarios. These are based on:

- the five pipeline output/demand scenarios, viz:
  - 60 to 107 ML/d with output increasing over the 50 years;
  - 60 to 130 ML/d with output increasing over the 50 years;
  - 60 to 100 ML/d with output increasing to Year 30 and remaining constant thereafter;
  - 60 to 120 ML/d with output increasing to Year 30 and remaining constant thereafter;
  - 75 to 120 ML/d with output increasing to Year 30 and remaining constant thereafter;
- the Low, Medium and High growth assumptions for Kalgoorlie-Boulder and Esperance; and
- the 8-year and 30-year climate scenarios and related impacts on stream flows and, in turn, source costs for the IWSS.

Each of these scenarios is evaluated at 4, 6, 8 and 10 percent real discount rates. For the purpose of the presentation of the base analyses, the 6 percent discount rate and Medium Growth scenario are employed (the Authority has assumed a real pre-tax WACC of 6 percent, which is the appropriate discount rate to use to identify the Corporation's avoidable costs). However, UUA's discount rate is likely to be higher than 6 percent.

The results are presented in the following order:

- Section 5.2 describes the base results at 6 percent discount rate for each of the five output/demand scenarios and the two climate scenarios.
- Section 5.3 examines and reports on the sensitivities of the results to key parameters including the discount rate and growth scenarios.
- Section 5.4 reports on the results of a number of breakeven analyses, specifically:
  - the percentage change in the Corporation's avoided costs (i.e. the maximum price that might be paid by the Corporation) for the EKP proposal to breakeven at nominated real project returns (discount rates);
  - the breakeven price for industrial water required to achieve nominated real project returns, assuming revenue from the Corporation is based on its avoided costs calculated at a 6 percent real WACC.

5.2 Base Results

The base results for the five output/demand scenarios, assuming the 8-year climate scenario for stream flow conditions, are presented in Table 5.1.

Table 5.1 Present Value of Costs and Benefits for Each Output/Demand Scenarios Assuming the 8-Year Climate Scenario, Medium Growth for Kalgoorlie-Boulder and Esperance and 6 Percent Discount Rate

Benefit Cost Component	EKP Output/Demand Scenario				
	60 to 107 ML/d $M	60 to 130 ML/d $M	60 to 100 ML/d $M	60 to 120 ML/d $M	75 to 120 ML/d $M
Water Corp Avoided Costs					
Growth					
Capex	128.2	128.2	128.2	128.2	128.2
Opex	40.2	40.2	40.2	40.2	40.2
Source	35.0	35.0	35.0	35.0	35.0
	203.4	**203.4**	**203.4**	**203.4**	**203.4**
Existing					
Maintenance	50.5	50.5	50.5	50.5	50.5
Pumping	16.1	16.1	16.1	16.1	16.1
Source	116.7	116.7	116.7	116.7	116.7
	183.3	**183.3**	**183.3**	**183.3**	**183.3**
Esperance					
Capital Costs	6.4	6.4	6.4	6.4	6.4
Operational Costs	6.8	6.8	6.8	6.8	6.8
	13.1	**13.1**	**13.1**	**13.1**	**13.1**
Total Water Corp. Avoided Costs	**399.8**	**399.8**	**399.8**	**399.8**	**399.8**
Avoided Costs to Industry	**353.1**	**449.0**	**493.8**	**650.4**	**776.9**
Esperance Water Quality	**25.3**	**25.3**	**25.3**	**25.3**	**25.3**
Total Avoided Costs	**778.3**	**874.2**	**918.9**	**1,075.5**	**1202.0**
EKP Costs					
Capex	431.4	444.7	446.7	465.4	473.0
Opex	356.5	389.5	408.4	464.0	497.6
GAWS Water Quality	14.5	14.5	16.4	16.4	16.4
Esperance Land Value	-1.6	-1.6	-1.6	-1.6	-1.6
Total Costs	**800.9**	**847.2**	**870.0**	**944.3**	**985.4**
Net Benefit (Cost)	**-22.7**	**26.9**	**48.9**	**131.3**	**216.6**

Note: rounding errors may occur.

The Corporation's avoided cost based on the Medium Growth scenario for Kalgoorlie-Boulder and Esperance are estimated to total around $400 million, comprising the avoided costs for existing demand to Kalgoorlie-Boulder of $183 million, for growth demand to Kalgoorlie-Boulder of $203 million and avoided costs in Esperance of around $13 million (excluding water quality enhancement).

The costs avoided in servicing existing demand in Kalgoorlie-Boulder are dominated by the reduction in demand in water from the IWSS, i.e. the value placed on the source water saved or replaced should the pipeline proceed. These are estimated at around $117 million.

The avoided costs in servicing the growth water for Kalgoorlie-Boulder are dominated by the savings in capital expenditure, comprising $128 million.

Benefits to mines and other industrial users are substantial, varying from $353 million to $777 million. These benefits are dominated by assumed per kL cost savings to mines, which are set in the base analyses at $3.68/kL as suggested by UUA.

A further avoided cost is the cost of an immediate upgrade to water quality or Esperance. This is the cost of advancing Esperance in the sequence for country town water upgrades and is estimated at around $25 million.[20]

Total avoided costs as a result of the EKP project proceeding are estimated to range upwards from $778 million to $1,202 million for the evaluated scenarios. More pessimistic scenarios would obviously result in lower avoided costs and, conversely, more optimistic scenarios in higher avoided costs.

The costs of the EKP project range from $801 million to around $985 million depending on the output/demand scenario. The dominant component of the EKP proposal under all scenarios is the capital expenditure. However, this is relatively insensitive to the level of output assumed indicating the substantial potential economies of scale able to be achieved if there is sufficient demand.

Operating expenditures, however, do vary significantly depending on the output scenario assumed, ranging from $357 million to $498 million in present value terms for the five output scenarios evaluated.

The net benefits of proceeding with the EKP proposal are positive for four of the five scenarios evaluated, ranging from $27 million for the 60 to 130 ML/d scenario to $217 million for the 75 to 120 ML/d scenario. The 60 to 107 ML/d scenario – the lowest demand scenario evaluated – has an estimated net present value of around -$23 million. These net benefits are specific to each scenario and individually make no recognition of the risks and uncertainties involved.

Table 5.2 reports the counterpart results under a 30-year climate scenario for stream flows. The sole difference between the results in Table 5.1 and Table 5.2 relates to the source costs, especially for the existing supply to Kalgoorlie-Boulder. The present value of the avoided source costs for existing supply declines by around $64 million from $117 million for the 8-year climate scenario to $53 million for the 30-year climate scenario.

[20] For the purpose of the analysis, the avoided cost is based on advancing the water treatment upgrade by 25 years. It also assumes that there would be no change in consumer surplus between this proposal and the EKP proposal which only holds true if the Corporation is not capital constrained. If the Corporation is capital constrained, which is likely, then there is likely to be some offsetting reduction in consumer surplus due to other communities missing out or suffering delays in receiving their water quality upgrades.

Table 5.2 Present Value of Costs and Benefits for the Five Output/Demand Scenarios Assuming the 30-Year Climate Scenario, Medium Growth for Kalgoorlie-Boulder and Esperance and 6 Percent Discount Rate

Benefit Cost Component	EKP Output/Demand Scenario				
	60 to 107 ML/d $M	60 to 130 ML/d $M	60 to 100 ML/d $M	60 to 120 ML/d $M	75 to 120 ML/d $M
Water Corp Avoided Costs					
Growth					
Capex	128.2	128.2	128.2	128.2	128.2
Opex	40.2	40.2	40.2	40.2	40.2
Source	23.8	23.8	23.8	23.8	23.8
	192.2	**192.2**	**192.2**	**192.2**	**192.2**
Existing					
Maintenance	50.5	50.5	50.5	50.5	50.5
Pumping	16.1	16.1	16.1	16.1	16.1
Source	53.1	53.1	53.1	53.1	53.1
	119.8	**119.8**	**119.8**	**119.8**	**119.8**
Esperance					
Capital Costs	6.4	6.4	6.4	6.4	6.4
Operational Costs	6.8	6.8	6.8	6.8	6.8
	13.1	**13.1**	**13.1**	**13.1**	**13.1**
Total Water Corp. Avoided Costs	**325.1**	**325.1**	**325.1**	**325.1**	**325.1**
Avoided Costs to Industry	**353.1**	**449.0**	**493.8**	**650.4**	**776.9**
Esperance Water Quality	**25.3**	**25.3**	**25.3**	**25.3**	**25.3**
Total Avoided Costs	**703.5**	**799.4**	**844.2**	**1,000.8**	**1,127.3**
EKP Costs					
Capex	431.4	444.7	446.7	465.4	473.0
Opex	356.5	389.5	408.4	464.0	497.6
GAWS Water Quality	14.5	14.5	16.4	16.4	16.4
Esperance Land Value	-1.6	-1.6	-1.6	-1.6	-1.6
Total Costs	**800.9**	**847.2**	**870.0**	**944.3**	**985.4**
Net Benefit (Cost)	**-97.4**	**-47.8**	**-25.8**	**56.5**	**141.9**

Note: Rounding errors may occur.

The impact of this change is to worsen the case for the EKP proposal. As a result, the net benefits are estimated to range from -$97 million for the 60 to 107 ML/d output/demand scenario to $142 million for the 75 to 120 ML/d scenario.

The results, however, are sensitive to the choice of discount rate, which is discussed in the next section.

5.3 Sensitivity Analyses

The sensitivity of the results to the choice of discount rate and to the different output/demand scenarios is illustrated in Figure 5.1 and Figure 5.2 for the 8-year and 30-year climate scenarios, respectively.

Figure 5.1 Net Present Values for the Five Output/Demand Scenarios - 8-Year Climate Scenario

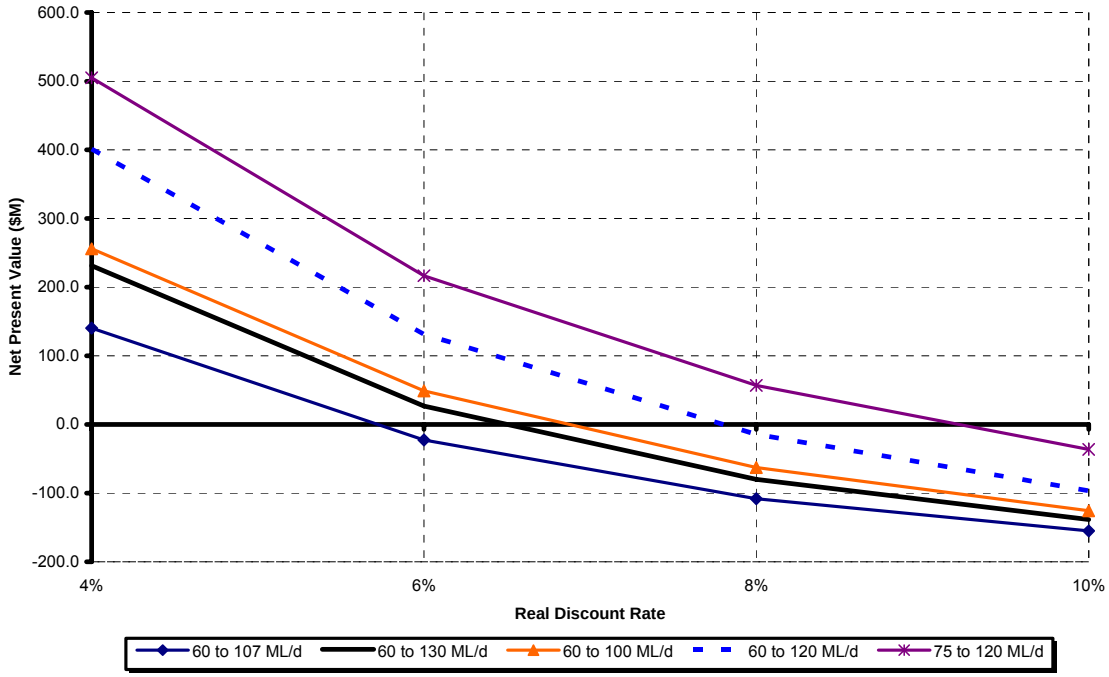
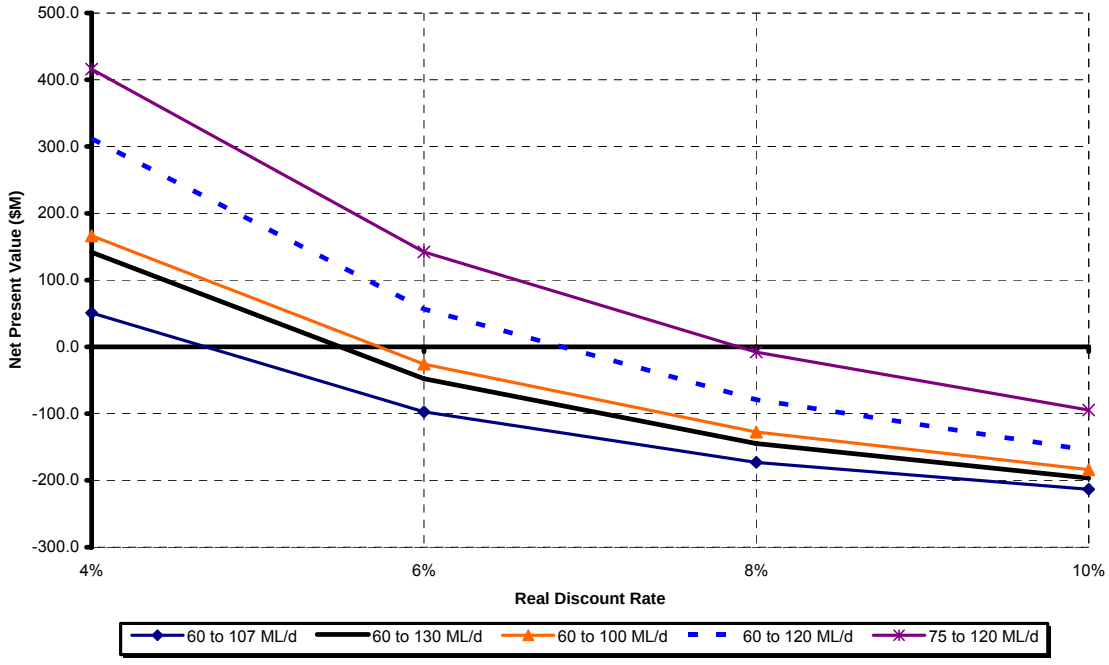


Figure 5.2 Net Present Value for the Five Output/Demand Scenarios - 30-Year Climate Scenario



The first finding for the 8-Year climate scenario (Figure 5.1) is that at the lowest discount rate (i.e. 4 percent) the EKP proposal generates positive net benefits under all demand scenarios.

At the 8 percent discount rate only the highest output/demand scenario – 60 to 120 ML/d – generates net benefits. At the 10 percent discount rate negative net present values are generated for all output/demand scenarios.

When the 30-year climate change scenario is applied (Figure 5.2), the results are less favourable, with only the two highest of the evaluated output/demand scenarios producing positive net benefits at the 6 percent discount rate. At the 8 and 10 percent discount rates all scenarios generate negative net present values.

As noted, the 6 percent discount rate is effectively the Corporation's WACC, which reflects a diversified portfolio of investments, most of which carry substantially lower risk and uncertainty than the EKP proposal.

The sensitivity of the results to changes in assumed levels of growth in Kalgoorlie-Boulder and Esperance are illustrated using the lowest and highest output/demand scenarios, viz the 60 to 107 ML/d and 75 to 120 ML/d scenarios (Figure 5.3 and Figure 5.4 respectively).

Figure 5.3 Sensitivity of Project Net Present Values to Growth Assumptions – 60 to 107 ML/d Output/Demand Scenario

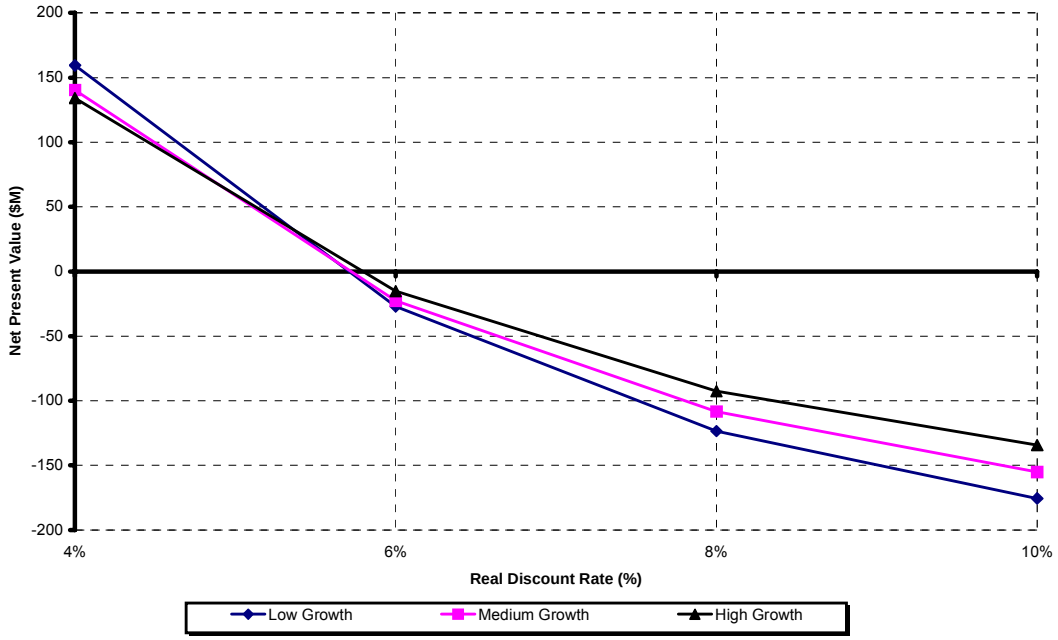
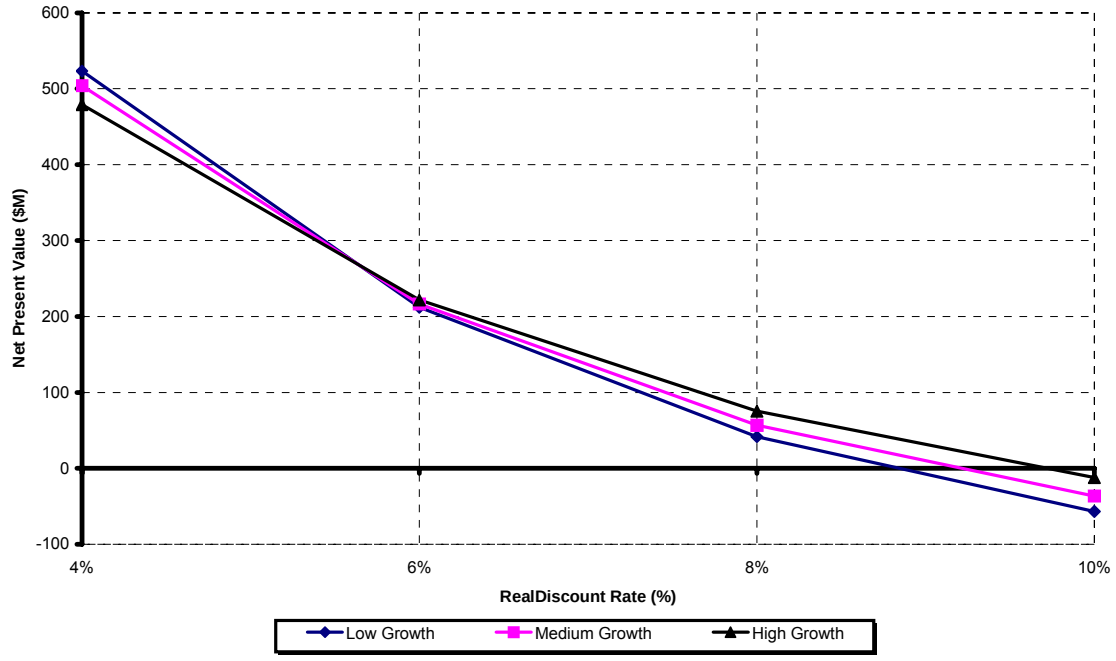


Figure 5.4 Sensitivity of Project Net Present Values to Growth Assumptions – 75 to 120 ML/d Output/Demand Scenario



The main finding is that at a real discount rate of 6 percent, there is little difference in the estimated net present values for the three growth scenarios for Kalgoorlie-Boulder. This is because the effective value of avoided costs for water supplied to Kalgoorlie-Boulder and Esperance (around $3.87 per kL, including the avoided cost of the Esperance water quality upgrade) is similar in magnitude to the assumed value placed on the avoided cost for industrial water (around $3.68 per kL). At higher discount rates, the net present values increase from the Low to High growth scenarios, reflecting the higher value of avoided costs for water supplied to Kalgoorlie-Boulder and Esperance than for water supplied to mines and other industrial customers. Conversely, at lower discount rates, the value of avoided costs of water supplied to industrial customers is higher than the avoided cost for water supplied to Kalgoorlie-Boulder and Esperance.

Importantly, assumptions regarding growth rates for Kalgoorlie-Boulder and Esperance do not have as significant an impact on the net present values as the choice of real discount rate.

5.4 Breakeven Analyses

The Authority has undertaken two additional analyses which examined the EKP project from the proponent's perspective. Effectively, this set of analyses examined the:

- total revenue attributable to the EKP project under varying assumptions regarding prices to be paid for water supplied to mining and industrial customers and prices to be paid for water supplied to the Kalgoorlie-Boulder and Esperance; and

- total capital and operating costs associated with the project.

Using this evaluation framework, the Authority sought to determine:

- the change in the Corporation's avoided costs for existing and growth water (i.e. the prices paid for water supplied to Kalgoorlie-Boulder and Esperance) for the EKP proposal to breakeven at nominated project real discount rates. The breakeven change in avoided costs is conditional on other parameters, particularly the price that could be charged for water sold to mines and other industrial users. Accordingly, the analysis was undertaken assuming prices for water supplied to mining and industrial customers of $3/kL, $4/kL and $5/kL; and
- the change in the price for mining and industrial water for the EKP proposal to breakeven assuming that water supplied to Kalgoorlie-Boulder and Esperance is priced at the Corporation's avoided costs based on a 6 percent WACC.

To illustrate these relationships and sensitivities, the lowest and highest of the output/demand scenarios have been evaluated.

Change in Water Corporation Avoided Costs

Figure 5.5 shows, for the level of demand represented by the 60 to 107 ML/d scenario, the changes in the Corporation's avoided costs that would need to occur to have the project breakeven at different assumed prices to mines and industrial users. The figure shows that if real project returns above 8 percent are required by EKP, then the Corporation's avoided costs would need to increase for any assumed price to mines and industrial users. At a price to mines and industrial users of $4/kL the Corporation's avoided costs would need to increase by around 30 percent.

Figure 5.5 Change in Water Corporation's Avoided Costs to Breakeven at Nominated Real Project Returns – 60 to 107 ML/d Output/Demand Scenario

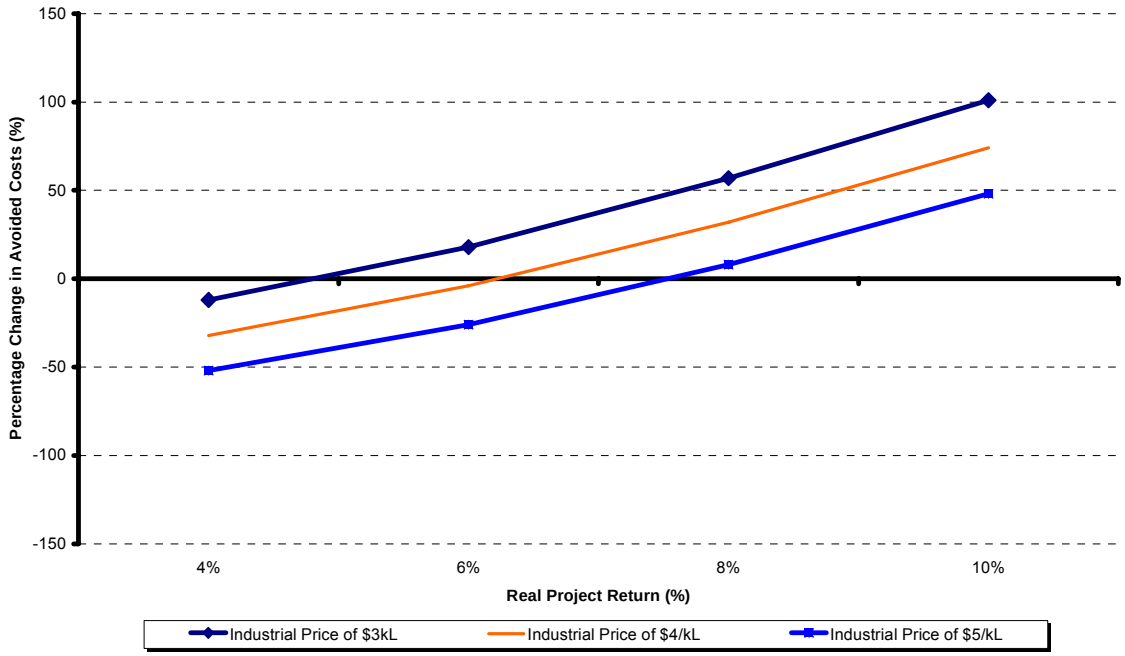
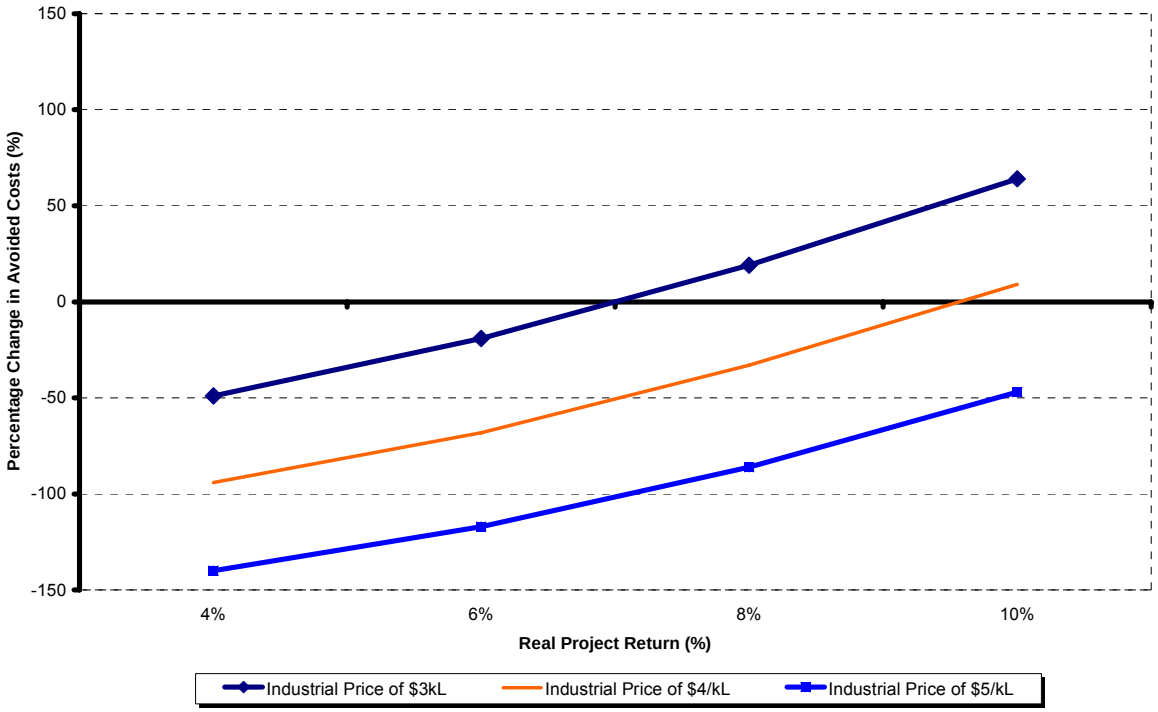


Figure 5.6 provides the same analysis for high levels of output/demand, reflected by the 75 to 120 ML/d scenario. At a price of $4/kL, the breakeven return is around 9.5 percent.

Figure 5.6 Change in Water Corporation's Avoided Costs to Breakeven at Nominated Real Project Returns – 75 to 120 ML/d Output/Demand Scenario



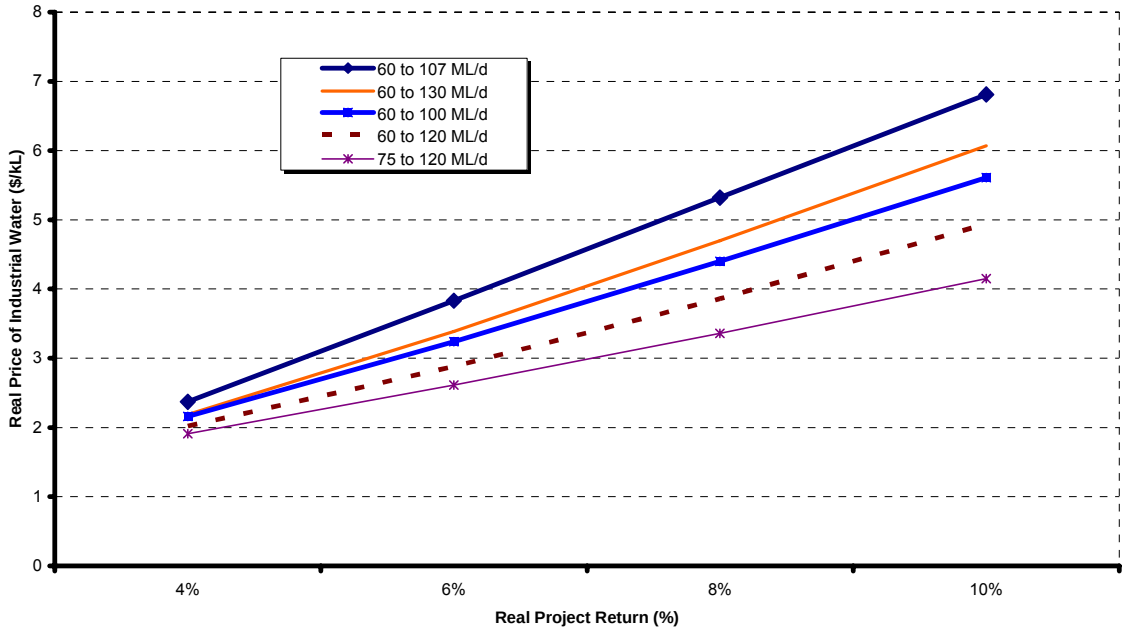
Breakeven Prices for Industrial Water

The Authority has estimated the average price required to be obtained from mining and industrial water customers in order for UUA to achieve nominated real project returns. The analyses assume that water supplied to meet existing and growth demand in Kalgoorlie-Boulder and Esperance is priced at the Corporation's avoided costs based on a 6 percent real WACC, i.e. around $1.11/kL for existing supply and $4.65/kL for growth water supplied to Kalgoorlie-Boulder and a total avoided cost of $0.72/kL for water supplied to Esperance (which includes $0.25/kL capital and operating costs and $0.47/kL to improve the water quality in Esperance).

There is a direct relationship between the required return and the required price for mining and industrial customers. Higher required project returns result in the need for higher prices to be paid for mining and industrial water and conversely lower required returns mean lower prices for mining and industrial water.

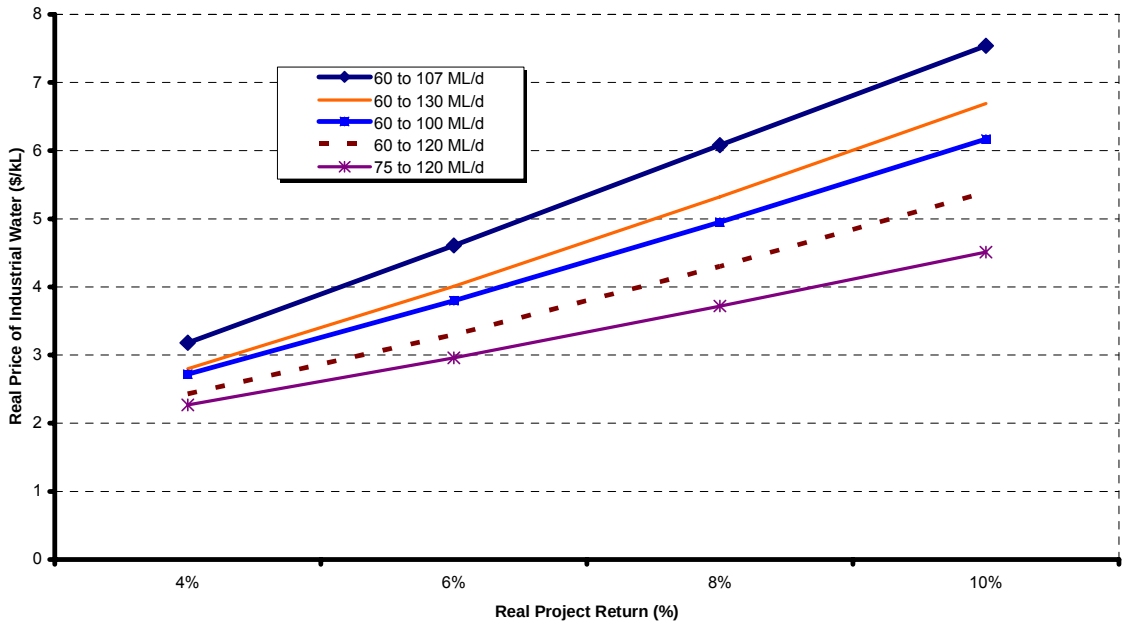
As illustrated in Figure 5.7, if real project returns of above 10 percent are required, then the price for industrial water would need to be at least $4/kL for the high demand (75 to 120 ML/d) scenario. This price increases to just under $7/kL for the low demand (60 to 107 ML/d) scenario.

Figure 5.7 Breakeven Prices for Industrial Water – 8-Year Climate Scenario



The impact of the 30-year climate scenario (Figure 5.8) is to reduce the avoided costs to the Corporation and increase the price for industrial water (by around $0.50/kL) for any given output/demand scenario.

Figure 5.8 Breakeven Prices for Industrial Water – 30-Year Climate Scenario



One broad conclusion can be drawn from the breakeven analysis. If water supplied to mining and industrial users is priced near its assumed avoided cost (i.e. $3.68/kL), and water supplied to Kalgoorlie-Boulder and Esperance at their respective avoided costs, the resultant project return is likely to be around 6 percent for low demand scenarios and up to 8 percent for high demand scenarios.

6 OTHER IMPACTS

The Terms of Reference require advice on the potential of the two options (the EKP proposal or extending the G&AWS) to enhance regional and State economic development, as well as their impacts on end consumers and on State finances. This section addresses these issues, along with other benefits ascribed to the EKP proposal in submissions made to the Authority.

6.1 Comparative Impacts on Regional and State Development

The comparative impacts on regional and State development of the EKP proposal and the extension of the G&AWS include:

- the level of costs and expenditures. Depending on the uptake in demand, the EKP proposal would involve total expenditures of $790 to $970 million in present value terms at a discount rate of 6 percent. In contrast, if the EKP were not to go ahead, then the Corporation is estimated to spend an additional $400 million, also in net present value terms discounted at 6 percent;
- the timing of the expenditures involved in each option. The EKP would involve capital expenditures of around $420 million in the initial construction phase alone. In contrast, the extension of the G&AWS would occur incrementally over the 50-year period;
- the extent of currently unsatisfied demand for potable water in the region that is likely to be satisfied. While neither project would satisfy all potential demand, the EKP would satisfy more demand and over a more extensive area than the G&AWS could achieve;
- the extent to which construction expenditures occur in the region and the associated employment impacts. During the two year construction period, UUA and the contractors would employ around 200 persons with a permanent staff of around 20. UUA advise that around 75% of the total project cost would be sourced or occur within Esperance and Kalgoorlie.

  However, the expenditure by UUA on the EKP needs to be offset against the expenditure by the Corporation on the maintenance and expansion of the G&AWS and Esperance supply system over the same time period. The Corporation employs 30 full-time staff in Kalgoorlie and 10 in Esperance, excluding local contractors. Mechanical and electrical maintenance services are generally sourced outside the region, but maintenance services such as welding and concreting are sourced locally. An example provided to the Authority by the Corporation is the construction of the new reservoir in Kalgoorlie, which will employ around 100 people locally during the construction period.

Many submissions noted the boost to regional employment which would result from the UUA project (e.g. The Nationals WA, ANZIS, Goldfields and Esperance Development Commission, Kalgoorlie-Boulder Chamber of Commerce and Industry). UUA noted that:

> The UUA project would have a direct impact on regional employment and economic activity associated with the construction and operation of the desalination plant and pipeline. UUA estimate that around three quarters of the total project cost of $915 million (in present value terms over 50 years) will be spent in the Esperance and Kalgoorlie regions (71 per cent in Esperance and 3 per cent in Kalgoorlie). (UUA submission “Regional Impacts, pp8-10)

The Nationals WA noted that the project would lead to:

> the creation of 200 jobs during the construction phase of the project; [and] the creation of a permanent workforce of 20 (15 in Esperance and 5 in Kalgoorlie). (The Nationals WA submission, p1)

ANZ Infrastructure Services (ANZIS) notes in its submission that:

> …in addition to direct investments for EKP, the project will generate further investments in the region to develop and construct supporting infrastructure. ANZIS is expecting further investment in [the Esperance Energy Project][21] of $15 million; [and]
>
> other associated benefits from these investments in terms of employment, skills upgrade, development and broadening of industry capabilities…(ANZIS submission, p4).

The Authority notes that satisfying currently unmet demand would make existing mining activities more profitable. This benefit to the mines results from reducing the cost of water or making potable water available for the first time. If this lower cost and increased availability induces an expansion of activity, then there will be other impacts – in addition to construction stimulus – on regional and State development, beyond those due to the G&AWS extension. A key issue, therefore, is the extent to which the benefits to mines and other industrial users, as a result of being able to use potable rather than the hypersaline water, leads to increased mining and industrial activity.

6.1.1 Increase in Value of Mine Production

In addition to allowing the substitution of potable for hypersaline water previously used by the mines, a lowering of the costs of water to the mines could, in principle, induce an expansion of mining activity in the Goldfields over and above the current expansion due to high gold and metal prices. The extent to which water prices are reduced will vary for individual users, depending on the difference between their avoidable costs and the price paid for water from the EKP.

UUA and its consultants, ACIL Tasman, submitted that the increase in the value of mining production was around $3.4 billion per annum and that royalties would increase by around $90 million per annum.[22]

The $3.4 billion estimate by ACIL Tasman is based on the volume of potable water that may be taken up by new mines or expansion of old mines, multiplied by a figure based on the average value of mine production per ML of water used. The Authority has several concerns with this approach:

- first, the relevance of the calculated estimate depends on the extent to which the availability of water is a constraint on the expansion or development of mines. If the new mines and expansions would go ahead without potable water, then the availability of potable water cannot be said to create, or to have allowed, the increase in mine revenues. Given the current mining boom, it should be no surprise that there is new demand for water. However, the issue is what, if any, new mining activity would be induced by improved costs and availability of water;
- second, water is not the only input into new mines and major expansions. Thus, the use of the average level of mine revenue per ML of water overstates the value of mine production created, since it ignores the costs of all other inputs; and

[21] The Esperance Energy Project incorporates the 336 km gas pipeline from Kambalda to Esperance and the 33 MW gas-fired power station at Esperance. ANZIS manages the Energy Infrastructure Trust, which is a 50% investor in the Esperance Energy Project.

[22] ACIL Tasman, "Calculation of regional impacts", supplied to the Authority by UUA on 8 August 2005.

- third, reflecting the current boom in the State's mining sector and the scarcity of skilled resources and critical inputs as evidenced by increases in salaries and other prices, any major expansion in the Goldfields may have some contractionary impact on mine expansions and other construction projects elsewhere in the State, since skilled labour and other resources must be bid away from other projects.

The Authority considers that an assessment of the increase in the value of mine production is not able to be determined at this stage as it relies on the outcomes of commercial negotiations between UUA and the mines and in any case is a commercial matter for the proponents to assess as any benefits can be captured.

6.2 Security of Supply

Submissions to the Authority indicated a wide perception that the EKP project, if it went ahead, would improve the security of water supplies to Kalgoorlie-Boulder. There are two types of risk which underlie the security of supply:

- pipeline risk (failure of the pipeline due to pipe bursts or leakages, or power failures at pump stations and reservoirs); or
- source risk (failure of the water source).

Some submissions expressed a preference for the retention of two pipelines into Kalgoorlie-Boulder (e.g. City of Kalgoorlie-Boulder, GEDC). The City of Kalgoorlie-Boulder emphasised the importance of guaranteeing the long-term security of the City's water supplies, and stated that:

> …the City of Kalgoorlie-Boulder has always been concerned at the vulnerability of a single water source and would therefore consider the most preferable option to be the provision of potable water from two sources. (City of Kalgoorlie-Boulder submission, p1)

Other respondents suggested that the UUA scheme would reduce the source risk to Kalgoorlie-Boulder, as desalination is a climate-independent source of water (e.g. The Nationals WA, Specialist Water Services Pty Ltd, ANZIS). For example:

> In the absence of EKP, or any other desalination plant, the State of Western Australia is placing greater reliance on future water supply from rainfall. We consider that the EKP should be risk adjusted because it diversifies the sources of water for the State. (ANZIS submission, p5)

The Corporation submitted that the source risk to Kalgoorlie-Boulder and Esperance would be increased if the EKP alone were to supply Kalgoorlie-Boulder, and that the G&AWS Main Conduit should be maintained as a back-up to ensure an acceptable security of supply in Kalgoorlie-Boulder.

> It is the Corporation's view that UUA's proposal to terminate the G&AWS and rely on a desalination plant as the sole supply to Kalgoorlie and Esperance represents an overall reduction in the security of supply for customers…[A catastrophic source failure] is more likely to occur with a desalination plant than the existing supply source (Mundaring Weir). Additionally, the Corporation has scheduled works that will make it possible to bypass Mundaring Weir and supply the G&AWS from other sources should this source fail. While the probability of source catastrophic source failure may be low, without the backup of the G&AWS, there would be no alternative supply. It would not be possible to tanker enough water to maintain a supply to a city the size of Kalgoorlie. (Water Corporation submission, p1-2)

UUA's view is that the technology planned for the desalination plant is robust and well-tried, and indicated it is confident that the planned performance can be achieved, using the same

technological approach installed in many successful plants around the world and as planned for the Kwinana desalination plant near Perth.

At commissioning (when the risks to the operation of the desalination plant are likely to be higher than in bedded-down operational mode), the G&AWS Main Conduit would still be operational. This would reduce the consequences of any adverse operational risk in the initial start-up of the desalination plant and pipeline.

A separate issue is the risk of source failure in Esperance and the surrounding region. The UUA proposal was viewed by several stakeholders as improving the security of supply to Esperance; for example:

> The risk to Esperance lies in not having the desalination facility. Funds can be expended to enhance the drinking water but the bore fields are still a limited source in the long run and there are costs involved in purifying the water. (GEDC submission, p8)

The Corporation has informed the Authority that the borefields in Esperance are sufficient to meet all the demands for that community for the next 30-40 years. However, communities between Esperance and Norseman which are not supplied by the G&AWS currently rely on rainfall storage and groundwater resources. The EKP would provide an additional alternative source of water to reduce the risk of inadequate supplies from the existing water sources. Many submissions noted the advantages to farmers in the Esperance region having access to a reliable supply of potable water, to meet water demands during drought periods or to develop new high value agricultural products (for example, WAFarmers, Michael Ietto, Tony Ietto, GEDC).

The Authority considers that there is little difference in the risk of pipeline failure between the G&AWS Main Conduit and the EKP. This is because the G&AWS Main Conduit has been progressively upgraded over the past 30 years, so that the pipeline assets are relatively new. However, if both pipelines were available to supply Kalgoorlie-Boulder, there would be a reduction in pipeline risk to Kalgoorlie-Boulder.

The Authority's assessment of relative source risks is that the desalination plant may involve somewhat higher risks than Mundaring Weir, given that the Corporation is able to draw from multiple sources and in future will be able to bypass Mundaring Weir.

The Authority is of the view that the costs of keeping the G&AWS Main Conduit open can be seen as an insurance premium which the Government may be willing to pay to maintain a desired security of supply for Kalgoorlie-Boulder. The Corporation has estimated the net present value of the costs of keeping the G&AWS Main Conduit open at around $4 million per annum (around $65 million in net present value terms at 6 percent real pre-tax). However, the Authority considers that this premium should not be attributed as a cost of the UUA project.

The Authority accepts that the EKP would offer additional security of supply to those communities between Esperance and Norseman which are not currently supplied by the G&AWS or Esperance borefields.

6.3 Impact of Competition in Reducing Monopoly Inefficiencies

The principle that competition has a role in sharpening incentives to seek markets and cost efficiencies was supported in submissions by UUA and others.

UUA suggested that the EKP proposal would have a major impact on the incentives and behaviour of the Corporation with resulting improvements in cost efficiency and productivity with consequent benefits to the WA State economy.

> The [draft] report fails to recognise the dynamic efficiency implications, for water supply across WA, of a second major supplier entering the market on the back of a major investment in innovation and market research. (UUA submission, ACIL Tasman report "Net Cost Upside", p3)

The Chamber of Commerce and Industry wrote that:

> There is merit in [UUA's] claim that the current system of priority for householders' consumption at subsidised prices introduces a deadweight welfare loss into the current regulated environment in the Kalgoorlie market that would diminish with competition. (CCI submission, p1)

and

> CCI believe that the ERA, as a pro-competition regulator under section 26 of its own Act, should approach its task with a greater presumption in favour of competition. (CCI submission, p2)

The Department of Industry and Resources notes that:

> …there is the opportunity to introduce competition into the supply of bulk potable water, along the same lines that has been achieved by the power procurement process used by Western Power Corporation in Esperance. (DoIR submission, p1)

Mincor Resources NL submitted the following:

> …there is also the issue of competition – of either supplier and/or source. Experience in other areas, and with other utilities, has universally demonstrated the considerable benefits to be produced in introducing some competition to the supply of any commodity. There is every reason to believe that an alternative supplier and/or an alternative source of freshwater could bring great benefits to this vexed issue for the Goldfields. (Mincor Resources NL submission, p2)

UUA drew attention to the review of the impacts on National Competition Policy by the Productivity Commission, which assessed substantial benefits to the Australian economy from productivity gains in the water sector.[23] UUA noted that if even a small, say one percent, proportion of such benefits were induced by UUA undertaking the supply to Kalgoorlie-Boulder, this would result in sizeable additional benefits from the UUA proposal.

UUA estimates a potential benefit for WA due to dynamic efficiency gains of over $25 million in present value terms (at 6% over 50 years). This is based on:

- the Productivity Commission's assessment that competition effects in urban water between 1990-2000 resulted in savings of around 0.35 percent of GDP;
- a WA State Gross Product of $89 billion in 2003-04, equating to $300 million annual gains from competition in urban water; and
- assuming productivity gains of 1 percent of the $300m for WA, with benefits flowing after 10 years.

[23] Productivity Commission, Modelling Impacts of Infrastructure Industry Change over the 1990s, Supplement of Review of National Competition Policy Reforms, Productivity Commission Inquiry Report No. 33, 28 February 2005.

The Authority agrees with the submission by UUA that the Corporation may have a greater incentive to seek markets and cost efficiency gains as a result of UUA's presence in the market, which would represent the largest alternative supply of bulk water in the State.

However, the Productivity Commission's analysis was an economic impact assessment that referred to the impacts of greater competition, largely involving transfers between producers and consumers. Nonetheless, identification of any additional efficiency impacts depends on the net improvement in efficiency, over and above those already anticipated to result from current regulatory processes, including competition by comparison (benchmarking) and the requirement for competition for new developments.

The Authority believes that the general nature of the benefit of alternative large scale water service providers should be acknowledged, but that no value can reasonably be attached to this benefit for incorporation into the cost-benefit analysis for the reasons discussed above.

6.4 Reduced Electricity Costs to Esperance

The EKP project would result in a reduction in the cost of providing electricity to the Esperance community. The proposed desalination plant would represent a new large base-load customer for the local power station, run by Burns Roe Worley, which would reduce the incremental cost of electricity production and introduce other benefits for the power supply to Esperance. The Chamber of Commerce and Industry notes that:

> [T]he extra energy demand will trigger a re-negotiation of the gas tariff which will reduce Western Power's tariff equalisation payment, and a lower tariff to the Esperance Port Authority. In addition, some consideration should be given to the increased demand for baseload generation on the stability of power distribution of the Esperance system. (CCI submission, p2)

The Esperance Port Authority noted:

> The Port Authority currently spends more than $3 million annually on power, an amount that is continuing to grow as new exports come on line. Even a modest reduction in power costs will result in significant cost savings to the Port and, therefore, its customers. (Esperance Port Authority submission, p2)

The magnitude of the price reduction for Western Power is substantial and is estimated at up to $2.5 million per annum,[24] or around $35 million in present value terms at 6 percent. Discussions with the Esperance Port Authority indicated that the magnitude of their potential price reduction is around $7 million in present value terms at 6 percent.

Another source of cost reductions would derive from the increased utilisation of the wind farm, which is understood to be switched off at night due to insufficient demand.

The Authority has accepted UUA's estimates of lower energy tariffs and has incorporated these into the EKP cost estimates. Other third party benefits (such as the reduced tariffs for Western Power and the Esperance Port Authority) are private in nature, and could potentially be captured by UUA as part of commercial negotiations. In addition, to the extent that costs and hence prices are reduced through economies of scale, this is likely to increase demand for the affected services and increase net benefits to consumers. However, for the purposes of this inquiry these benefits could not be calculated and therefore have not been included in the cost-benefit analysis.

The impact of the reduced tariffs on State finances is discussed in Section 6.8 below.

[24] Advice from Western Power, 14 September 2005.

6.5 Amenity Value to Regional Communities

A number of submissions, particularly from communities along the EKP pipeline route, noted the importance of increasing amenity values in regional communities due to access to greater and more reliable supplies of water (see submissions by the Shire of Esperance, Esperance Regional Tourism Association, Senator Ruth Webber, Grass Patch Development Association, GEDC, Tony Ietto). For example,

> A freshwater pipeline through our region would have social benefits for the farming families as well as towns along its length where water is often in short supply or of poor quality for domestic use. Limited water supply means poor quality facilities in outlying communities for amenities such as school sporting fields or parks and gardens. In particular, Salmon Gums has always suffered from water shortages, with the major part of its water supply coming from a disused quarry. A water pipeline would go some way towards drought-proofing these areas. (Shire of Esperance submission, p3)

Towns between Esperance and Kalgoorlie, such as Gibson, Scaddan, Grass Patch and Salmon Gums, are supplied by town dams, and water supplies are often insufficient to maintain school sports ovals (see submissions by the Grass Patch Community Development Association and Tony Ietto). There is also insufficient water for beautifying the townsite and maintaining the local caravan park and Pioneer Memorial garden in Grass Patch, which:

> …leaves the townsite looking very ugly and unattractive to not only the local but visitors. (Grass Patch Development Association submission)

A comment made to the Authority at the public forum in Esperance emphasised that improving amenities such as parks, gardens and ovals raised the quality of life in regional communities, encouraging people (such as doctors and school teachers) to stay in those communities.

The Authority accepts that the amenity values of such communities (i.e. those that are currently not supplied by the G&AWS or by the Esperance borefields) could be enhanced by the availability of large supplies of potable water. Under the uniform tariff policy, the prices paid for water by customers using up to 350 kL per year would not change. However, the uniform tariff policy does not extend to usage above 350 kL or for commercial purposes, which would include activities such as the watering of ovals, parks and municipal gardens. The availability of water from the EKP to these towns would therefore depend on the commercial price of that water and the amount that the communities are willing to pay.

A separate issue is that of the availability of groundwater in Esperance. The Esperance Region Tourism Association submitted that improved amenities would provide the impetus for tourism development.

> Water is in such short supply that Esperance can not currently develop the type of quality tourism facility such as resort and golf courses that other destinations take for granted. (Esperance Region Tourism Association submission, p1)

The Corporation has informed the Authority that there are no restrictions on water usage in Esperance. Large water users, such as golf courses, would be free to purchase water from the Corporation at standard commercial tariffs (for Esperance, $1.50/kL to $2.85/kL for usage above 300 kL/annum). Thus, the availability of supplies of potable water from a project such as the EKP would not benefit such customers unless the price of that water was at a level that they would be willing to pay.

Another benefit to communities along the route of the EKP is the potential for increased gas reticulation to those communities.

> The pumping stations along the EKP pipeline will be powered by gas turbines which means there will be local pressure reduction stations to take gas from the main which could in turn allow for gas reticulation at those locations. (ANZIS submission, p5)

6.6 Environmental Benefits

Some respondents submitted that there would be environmental benefits of eliminating hypersaline water use by mines. For example,

> …we would expect that some allowance be made for the environmental benefits flowing from the replacement of super-saline water with potable water. (ANZIS submission, p5)

The substitution of potable water for hypersaline groundwater would reduce the levels of abstractions from the palaeoaquifers in the region. Concern about the levels of abstraction from the palaeoaquifers was a major trigger for the Government's initiation of the exploration of alternative water sources from 1990 onwards. The Authority understands, however, that with better understandings of the palaeoaquifers, following the studies undertaken as part of the Goldfields Esperance Water Supply Strategy in 2002/03, this matter is no longer a major concern.[25]

Thus, Chamber of Minerals and Energy WA Eastern Regional Council chairman Adam Wright recently commented that there was no danger to the environment of hypersaline water by the mining industry in the Goldfields:

> The water is used in an environmentally responsible manner in accordance with regulations and licence conditions and does not pose a threat to the environment. (Alana Buckley-Carr, *Kalgoorlie Miner*, 10 September 2005, p5)

A further environmental benefit of the EKP derives from the increased use of the wind farm due to the introduction of a large baseload customer such as a desalination plant. The Chamber of Commerce and Industry wrote that:

> Greater baseload demand would yield greater utilisation of the Esperance wind farm, particularly during very low load demand conditions overnight when it is not possible to draw unrestricted wind power. (CCI submission, p2)

Increased use of the wind farm would reduce carbon emissions in Esperance and would generate additional renewable energy credits. As noted in Section 6.4, better utilisation of the wind farm would also contribute to the reduction in power costs to UUA and the Esperance community.

6.7 Impacts on End Users

Residential customers in the Goldfields would pay the same price for water under either option, since residential tariffs for water use up to 350 kL per annum is set by the State's uniform pricing policy. Any reduction in the cost of incremental supply would merely lower the amount of the Community Service Obligation (**CSO**) payment.

Residential customers in Esperance would benefit from the EKP proposal since it would improve the quality of water which does not currently meet the aesthetic standards set in relation to hardness and Total Dissolved Solids. The nature of this benefit is that it would advance Esperance's place in the sequence/queue of WA towns waiting for future upgrades of aesthetic water quality.

[25] See ACIL Consulting, "Palaeochannel Study Final Draft Report", in *Goldfields Esperance Water Supply, Background Papers, Draft Water Supply Strategy*, Government of Western Australia.

6.8 Impacts on State Finances

The Terms of Reference for the review request an assessment of the impact of each option (G&AWS scheme or EKP proposal) on the State Government's finances, including borrowings and capital expenditure, tax equivalent and dividend revenue and CSO payments (Terms of Reference s.4). The key issue being addressed is the extent to which these key payments to/from government are affected if the EKP proposal proceeds.

This section investigates the potential impacts on State finances from the perspective of:

- the financial interrelationship between the Corporation and the State Budget, including tax equivalent and dividend payments and CSO payments; and
- other possible budgetary impacts associated with private sector financing lowering State borrowing requirements, the extent to which any royalties and other tax receipts are affected and any other indirect flow-on impacts such as dividend streams of Western Power and the Esperance Port Authority.

6.8.1 Tax Equivalent Payments, Dividends and CSO Payments Between the Corporation and Government

CSOs are paid to the Corporation to recover the costs of schemes or services that would not otherwise be commercially viable. The CSO payment to the Corporation is based on the difference between customer revenue and the cost of providing these services (measured as the sum of the operating cost, replacement cost, depreciation and a real rate of return on the written down value of assets).

Since the price for water services paid for by residential and some existing business customers in the Goldfields region is set by the State's uniform pricing policy, the total revenue raised for any particular quantity of demand is essentially fixed. Therefore, it is the extent to which adopting the EKP proposal affects the operating and capital costs associated with service provision in the Goldfields region (compared to the costs associated with the G&AWS scheme) that will affect the magnitude of the shortfall associated with service provision and hence the extent to which the associated CSO payment to the Corporation changes.

In other words, the level of the CSO payment (for a given quantity of water) only changes due to an underlying change in avoidable costs associated with the change in the source of supply for that quantity of water. Hence, a decline in the level of the CSO payment will only occur in the event that the EKP proposal leads to a reduction in the Corporation's avoidable costs.

Any change in the cost of providing a service subject to a CSO payment directly impacts the State Budget via the CSO payment and the Corporation's tax equivalent and dividend payments. However, the magnitude of this impact on the State Budget is affected by the interrelationship between these two payment flows.

Table 6.1 shows projected payments from and to the Corporation, as reflected in the Budget papers for the 2005-06 year.

Table 6.1 Payments Between the Budget and the Corporation, 2005-06

Payments	$ million
Tax equivalent (income) payments	171.6
Tax equivalent (indirect) payments	2.9
Dividend payments	321.6
Total payments to Government	**496.1**
Less CSO payments received	- 356.1
Net payments from the Corporation to Government	**140.0**

Source: Budget Paper No. 3, Appendix 7, Tables 1 and 2

Like other Government Trading Enterprises, the Corporation is liable for income tax equivalent, local government rate equivalent and dividend payments to ensure competitive neutrality (i.e. a level playing field) between significant government business activities and private sector businesses. The tax equivalent payments to the State Government are made at the company tax rate of 30 percent of profits. On the remaining profit after tax, the current dividend payout ratio for the Corporation of 85 percent is applied.

This effectively means that 89.5 percent of the Corporation's profits are returned to State Government in the form of tax equivalent or dividend payments. Since CSO payments represent a payment to compensate for a revenue shortfall after operating and capital expenses are incurred, the full amount of the CSO payment is reflected in the Corporation's operating balance (i.e. profit before tax), and hence 89.5 percent of each dollar of CSO payment is returned to the State Budget.

Hence, any reduction in the requisite CSO payment to compensate for a revenue shortfall when underlying (or avoidable) costs are reduced will have a corollary impact on the Corporation's profits, with a subsequent effect on payments to government to a similar degree (albeit 89.5 percent in absolute dollar terms).

In any case, in this analysis it is assumed that UUA is paid the Corporation's avoidable costs and therefore there would be no change in CSOs.

Figure 6.1 presents further information regarding CSO payments, as provided by the Corporation.

Figure 6.1 Background of Corporation's CSO Payment

CSOs (Community Service Obligations) are paid to the Corporation to recover the costs of schemes or services that would not otherwise be commercially viable.

The Corporation's CSO payment for the provision of country water, sewerage, drainage and irrigation services is based on the difference between customer revenue and the cost of providing these services. Costs are measured as the sum of the operating cost, replacement cost, depreciation and a real rate of return on the written down value of assets.

This CSO payment is rebased every four years to the actual loss incurred. In the interim period, the payment is based on a formula that adjusts the actual loss at the last rebase for growth, changes in prices and an efficiency target. Asset write-offs, however, are included each year as a wash-up item.[1]

An additional payment is made for any new CSO service approved by Cabinet, or any improvement to the service levels of existing CSO services. CSO payments for improvement in service levels are either approved by the Minister or by Cabinet if the project exceeds $5 million.

Any change in the cost of providing country services directly impacts the State Budget either via the CSO payment or the Corporation's tax equivalent and dividend payments. Changes to the cost of providing services to Kalgoorlie-Boulder are reflected in the CSO payment at the time of the rebase. In the interim years they impact the Corporation's bottom line,[2] and are reflected in the tax equivalent and dividend payments to Government.

A significant once-off change, such as the purchase of water from United Utilities, would be subject to a Cabinet decision. In this case changes would be immediately reflected in the CSO payment.

CSOs for schemes are calculated based on operating and capital costs (depreciation and a Return on Assets) less total revenue raised. The Return on Assets has been set at 4 percent of Written Down Replacement Cost for assets constructed prior to 1996 and 6 percent for assets constructed thereafter. The calculation of CSOs is rolled forward each year based on growth and inflation, and is then reduced by a factor for efficiency.

The CSO is calculated for each town based on a "nodal" costing model, where operating and capital costs are distributed based on demand and location.

The CSO budget for Kalgoorlie-Boulder was $26.8 million in 2005/06. In addition, the Corporation received CSOs totalling $6.5 million for Kambalda, Coolgardie, Norseman and Ora Banda.

CSOs represent a recovery of operating costs and past investments and are not intended to reflect forward looking or avoidable costs.

Source: Water Corporation
[1] Item for which an explicit adjustment is made in end-of-year accounts
[2] Or operating balance (profit and loss statement)

6.8.2 Other Potential Budgetary Impacts

Compared to the existing arrangements, a viable EKP scheme could have several other differential impacts on State finances. These include:

- a reduction in the magnitude and cost of State borrowings. In terms of magnitude, rather than the Corporation expending several hundred million dollars on capital investment in the future on service provision in the Goldfields region, UUA and its financiers would supply these funds for its water source project. This could lead to an improved budgetary position in terms of servicing a lower amount of State debt, notwithstanding the likelihood that this private sector interest bill would be implicitly recognised within supply contracts, etc.

  In terms of the cost of State borrowings, unlike other forms of public-private partnerships, UUA's investment in the EKP proposal arises as a private initiative rather than a government initiative seeking private funding and participation. It therefore appears possible that it might be assessed differently by the credit ratings

agencies (such as Standard & Poor's) to other public-private financing initiatives which are often taken into account in and assessment of the level of State Government net debt.

Hence, this could have a flow-on impact in terms of leading to an improved credit rating (or counteracting a potential deterioration in the credit rating) for the State, and hence leading to an otherwise lower cost of debt for the State. On the other hand, the credit ratings agencies would also look carefully at the supply contracts and any guarantees provided or inferred by the State (for example, any "take or pay" requirements) during any consideration of this issue in the context of an assessment of State Government net debt;

- since mining royalties are based on throughput rather than on profit, budget receipts from royalties from existing mines would be unaffected irrespective of whether mining sector profits increased as a result of cost savings arising from the ability to use potable rather than hypersaline water. However, an increase in mining profits may encourage increased exploration activity, the opening of new mines and/or increased production from existing mines.

  In the event increased mining activity was encouraged as a result of the EKP proposal proceeding, budget receipts from royalties could therefore rise. However, the net impact on the State Budget would be lessened due to the likely impact that higher royalty receipts would have on Commonwealth Grants Commission payments;[26]

- a reduction in the unit cost of gas and the consequent reduction in the costs of electricity to Western Power and the Esperance Port Authority, which could result in an increase in net dividend flows to (or reduced outflows from) the Treasury.

  The increase in electricity consumption in Esperance as a result of the EKP desalination plant would result in a significant increase in the flow in the gas pipeline from Kambalda to Esperance in order to satisfy the additional electricity generation requirement (see Section 6.4 above). This would result in the realisation of substantial economies of scale in gas transportation through the pipeline, and hence in reduced electricity generation costs.[27] The benefits of the economies of scale would be shared by Western Power and the Esperance Port Authority as "foundation customer benefits" under the terms of their respective Power Purchase Agreements with Burns and Row Worley Developments, the owners and operators of the Esperance power station;

  Since Western Power is a Government Trading Enterprise, the resulting reduction in costs will reduce the loss on Esperance operations (affecting the CSO payments to Western Power) and/or increase dividends from Western Power to the Treasury. The magnitude of the price reduction for Western Power is substantial and is estimated at

[26] Western Australia would expect to effectively lose about 90 percent of any increased royalties (basically keeping our 10 percent population share) through a reduction in our share of GST grants as recommended by the Commonwealth Grants Commission. The 90 percent varies depending on whether Western Australia levies royalties at above or below the standard rate. In the case of gold and nickel , Western Australia's royalty rates are marginally below the national average rate for value based minerals (the category they are classified to by the Grants Commission) so Western Australia would expect to lose more than 90 percent.

[27] It does not represent a reduction in the total cost of incremental gas demand but represents a sharing and averaging of the previously higher (now sunk) costs and the lower incremental costs. For any gas pipeline, the increment to capacity achieved by compression is very low cost compared with the cost of initial capacity achieved by building the (uncompressed) pipeline. Whereas the initial capacity requires the construction of the pipeline itself, the final level of capacity achieved by the first and second stages of compression may be, say, around four times higher for no more than a doubling of capital costs. Foundation customers such as Western Power therefore typically negotiate the right to re-open their contract in order to strike a new price once compression is required. These rights to re-set the price in order to share the benefits of economies of scale are referred to as "foundation customer benefits".

up to $2.5 million per annum,[28] or around $35 million in present value terms at 6 percent.

Similarly, the sharing of electricity cost reductions with the Port Authority under foundation customer benefit provisions in the supply contract could lead to a reduction in flows from State Treasury to the Port Authority (or alternatively an increase in dividends and other payments from the Port Authority to the Treasury). Discussions with the Esperance Port Authority indicated that the magnitude of this improvement in State finances is around $7 million in present value terms at 6 percent.

These benefits to Western Power and the Esperance Port Authority (and any subsequent effect on payments to or from government) depend on the extent to which they are retained within the enterprises, passed on to customers in the form of lower tariffs, or potentially captured by UUA as part of commercial negotiations.

- any contribution by the State in recognition of the higher quality water benefits to Esperance. UUA could negotiate arrangements to capture the Esperance water quality benefits, potentially through a contribution from the State Government in the form of a CSO payment to the Corporation commensurate with a higher price being paid to UUA for the higher quality water than currently provided to the Esperance community. This additional CSO payment would have a corresponding impact on the State budget. The Authority has assumed that UUA captures this benefit.

[28] Advice from Western Power, 14 September 2005.

7 CONCLUSION

In accordance with the Terms of Reference, the Authority has analysed two options to provide bulk potable water to Kalgoorlie-Boulder and surrounding regions. These are: the expansion of existing supplies along the G&AWS; and an alternative proposal by UUA to desalinate seawater in Esperance and pipe the potable water to Kalgoorlie-Boulder. Other options that may be available have not been considered.

The Authority has estimated the prices at which the Corporation is expected to be neutral between continuing to supply using its own sources and purchasing bulk water from a third party. This would be the case if the Corporation's avoided costs – the costs that it would avoid incurring if it entered into arrangements with UUA – were equal to the costs to the Corporation of purchasing bulk water from UUA. The Corporation's avoided costs for supplying Kalgoorlie-Boulder (in particular, the costs of source water from Perth) depend on assumptions about climate trends: the "8-Year Climate Scenario" assumes lower streamflows into Perth's dams (and higher source water costs) than the "30-Year Climate Scenario".

The Authority estimates the Corporation's per unit avoided costs of delivering bulk potable water, in 2005/06 dollars and based on a weighted average cost of capital of 6 percent real pre-tax,[29] to be in the order of:

Avoided Cost to Water Corporation	8-Year Climate Scenario	30-Year Climate Scenario
Existing supply to Kalgoorlie-Boulder	$1.11/kL	$0.72/kL
Growth demand in Kalgoorlie-Boulder	$4.65/kL	$4.40/kL
Esperance demand	$0.25/kL	$0.25/kL

By comparison, it is estimated that the per unit cost of water from the UUA project, also at a 6 percent real pre-tax rate of return, is between $2.05/kL and $2.20/kL, depending on the uptake of demand. However, given the uncertainty and risks associated with the sales to mines and industrial users, it is likely that UUA would require a return higher than 6 percent, which would result in higher prices. As the Corporation's costs of meeting new demand in the Kalgoorlie-Boulder region are significantly higher than UUA's costs, it follows that there is a level of demand at which it would be less costly to source water from the desalination plant in Esperance.

Current demand for water in the Kalgoorlie-Boulder and Esperance region is around 38 ML/d and, based on a medium growth scenario, could be expected to expand at 1.5 percent per annum and 2 percent per annum respectively. The demand scenarios that have been evaluated as part of this inquiry are based on an initial increase in current demand to 60 ML/d further increasing to between 100 ML/d and 130ML/d over a period of up to 50 years. The higher levels of demand that would be required for the proposed desalination plant to be viable would involve supplying potable water to existing and new mining and other industrial customers that either currently use hypersaline water or whose demand for water is not currently met.

Given the significant increases in the amount of water needed for the desalination plant to be viable, there is clearly uncertainty as to whether such levels of demand will eventuate. This is a commercial decision facing UUA as the proponent of the desalination plant. An

[29] All rates of return quoted in this report are real and pre-tax.

important factor in this decision is the price that existing and new mining and other industrial customers are able to pay for desalinated water. Based on information provided by UUA, for the purposes of this inquiry, it has been assumed that existing and new mining and other industrial customers would pay $3.68/kL and that there is a substantial increase in demand at the time the UUA project commences.

The Authority's analysis has shown that, based on a 6 percent discount rate (real pre-tax), the UUA project produces net benefits at nearly all of the demand scenarios evaluated. However, as indicated above, given the uncertainty and risks associated with the sales to mines and industrial users, it is likely that UUA would require a return higher than 6 percent. If water supplied to mining and industrial users is priced at its assumed avoided cost (i.e. $3.68/kL), water supplied to Kalgoorlie-Boulder and Esperance is priced at their respective avoided costs, and UUA is paid for the benefits associated with improving the quality of water in Esperance and releasing the borefield land in Esperance for development, the resultant project return is likely to be around 6 percent for the lower demand scenarios evaluated and up to 8 percent for the higher demand scenarios.

An important factor relating to future demand in the areas to be serviced by the desalination plant is that in order to be successful, UUA would need to develop the market for desalinated water. It is anticipated that this would involve a departure from the approach taken by the Corporation, including the manner of charging, often involving high up-front headworks charges which can have the effect of depressing demand.

UUA may be able to reduce the uncertainty by investing in further market research to prove-up the initial demand. However, it will be difficult to form a clear view on growth in demand from existing and potential new mines given the uncertainties involved.

The Authority accepts that the Corporation can incrementally expand the G&AWS in line with increases in demand for water in the region served by this system. In these circumstances, it would be inappropriate for the Corporation to assume risks associated with growth rates in demand for water in the Kalgoorlie-Boulder and Esperance regions. Alternatively, if the Corporation is to accept higher risks than at present, it could expect prices lower than those indicated above.

The private benefits of this project include:

- improvements in water quality at Esperance, which are valued at around $0.47/kL;
- greater utilisation of the Wind Farm, which is understood to be off-line at night due to insufficient demand;
- benefits to Western Power and the Esperance Port Authority, which would accrue from the renegotiation of their tariffs that would be triggered by the extra energy demanded by the desalination plant; and
- an amount associated with the Esperance borefield land that would be available for development if the desalination project were to proceed.

It is possible that UUA could commercially negotiate arrangements to gain all of the private benefits attributable to the project and for the purposes of this analysis the Authority has assumed that they do, other than in the case of the benefits to Western Power and the Esperance Port Authority, which the Authority has been unable to quantify but which can be captured in commercial negotiations.

The possible impact of another major water provider in the Kalgoorlie-Boulder region on the Corporation is in the nature of a public benefit that cannot be captured by UUA through commercial negotiation. In particular, the Corporation may be encouraged to seek and develop new markets and cost efficiency gains as a result of a demonstration that another supplier of bulk potable water to Western Australia would provide.

In conclusion, the Authority has been able to publish independent information on the Corporation's avoidable costs and to identify any benefits that are of a public nature that cannot be captured by the parties through commercial negotiation. With the exception of greater competitive pressure on the Corporation from the potential for new entrants into the market, the benefits associated with the proposal are private in nature and are capable of being internalised through commercial negotiation by UUA if the projected demand for potable water necessary for a commercial project can be realised.

UUA has indicated that it is not seeking Government financial support to make the project commercially viable. However, UUA has suggested to the Authority that, given the Corporation's dominant role in the water industry, there may be a role for Government during any commercial negotiations that any proponent might have in the future with the Corporation. The Authority concurs with this view.

APPENDIX 1: TERMS OF REFERENCE

INQUIRY ON THE COST OF SUPPLYING BULK POTABLE WATER TO KALGOORLIE-BOULDER

Terms of Reference

I, ERIC RIPPER, Treasurer, and pursuant to section 32(1) of the *Economic Regulation Authority Act 2003* (the ERA Act), request that the Economic Regulation Authority (the Authority) undertake an inquiry into the cost of supplying bulk potable water to Kalgoorlie-Boulder and surrounding regions.

In conducting its investigations the Authority is to report on the following matters:

1. The current cost to the Water Corporation of providing a bulk potable water supply to Kalgoorlie-Boulder and surrounding regions. This should clearly identify the cost to the State Government through its community service obligation (CSO) payments to the Water Corporation.

2. The cost that United Utilities Australia, through its proposed desalinated seawater pipeline from Esperance to Kalgoorlie-Boulder, could provide bulk potable water to Kalgoorlie-Boulder and surrounding regions, over the next 25 years.

3. The cost saving to the Water Corporation for the next 25 years if United Utilities Australia did provide Kalgoorlie-Boulder and the surrounding regions with bulk potable water through its proposed desalinated seawater pipeline.

4. The impact of each option (points 2 and 3) on the State Government's finances, including borrowings and capital expenditure, tax equivalent and dividend revenue and CSO payments.

5. The overall costs and benefits of each option, including the impact on the end consumer and the potential to enhance regional economic development in Kalgoorlie-Boulder and the State in general.

A draft report is to be made available by 6 May 2005. Consultation for this inquiry will be on the basis of the draft report, through invitations for written submissions from industry, government and all other stakeholder groups, including the general community.

A final report is to be completed by no later than 4 July 2005.

ERIC RIPPER MLA
DEPUTY PREMIER; TREASURER;
MINISTER FOR ENERGY

Economic Regulation Authority Act 2003

Economic Regulation Authority (Cost of Supplying Bulk Potable Water to Kalgoorlie-Boulder Reference) Notice (No. 3) 2005

Given by the Economic Regulation Authority under section 34(1) of the *Economic Regulation Authority Act 2003*.

1. Citation

This notice is the *Economic Regulation Authority (Cost of Supplying Bulk Potable Water to Kalgoorlie-Boulder Reference) Notice (No. 3) 2005*.

2. Reference amended

(1) Under section 33 of the *Economic Regulation Authority Act 2003*, the Treasurer has amended the reference for the inquiry into the cost of supplying bulk potable water to Kalgoorlie-Boulder and surrounding regions.

(2) The particulars of the amendment are set out in Schedule 1.

Schedule 1 — Particulars of amendment

[cl. 2(2)]

NOTICE OF AMENDMENT TO REFERENCE FOR INQUIRY INTO COST OF SUPPLYING BULK WATER TO KALGOORLIE-BOULDER

I, Eric Ripper, under section 33 of the *Economic Regulation Authority Act 2003*, amend the reference for the inquiry into the cost of supplying bulk potable water to Kalgoorlie-Boulder and surrounding regions* so that the final report is to be completed by no later than 14 October 2005 instead of 16 September 2005.

[**Notice of the reference was published in Gazette 8 February 2005, p. 664-6. Notice of amendments to the reference was published in Gazette 6 May 2005, p. 2026-7.*]

Eric Ripper MLA
Treasurer

Chairman
Economic Regulation Authority

APPENDIX 2: LIST OF SUBMISSIONS

ANZ Infrastructure Services (ANZIS)

ArupWater

Chamber of Commerce and Industry of Western Australia

City of Kalgoorlie-Boulder

Department of Industry and Resources

Esperance Chamber of Commerce and Industry

Esperance Port Authority

Esperance Region Tourism Association

Gold Fields Australia Pty Ltd

Goldfields Esperance Development Commission

Grass Patch Community Development Association

Gregory Hosking

Hazeltine Pty Ltd

Kalgoorlie Nickel Smelter

Kalgoorlie-Boulder Chamber of Commerce and Industry

Michael Ietto

Mincor

Neil Wandel

S.L.S. Technology Pty Ltd

Senator Ruth Webber

Shire of Dundas

Shire of Esperance

Specialist Water Services Pty Ltd

The Nationals WA

The Western Australian Farmers Federation

Thorp Realty Pty Ltd

Tony Ietto

United Utilities Australia

Water Corporation

WorleyParsons

APPENDIX 3: RATE OF RETURN

The rate of return represents the return expected by investors for investments of a given level of risk. The rate of return is that which provides a stream of income from the investment of funds that would be sufficient to attract and retain that investment.

The most commonly used and widely understood model for estimating the rate of return is the Capital Asset Pricing Model (CAPM). There is a substantial amount of information available that can be drawn upon to assist in the application of the CAPM, which is not generally the case for other models of asset returns.

This model specifies the parameters that are needed for an organisation to estimate its weighted average cost of capital (WACC), which is calculated by adding the cost of equity funds (weighted by the proportion of equity funds to total assets) to the cost of its debt (weighted by the proportion of debt to total assets). The WACC recognises that providers of both debt and equity require different rates of return due to the different risks they face. The WACC reflects the opportunity cost of capital, meaning that the return should be commensurate with the returns that an investor could expect to earn from other investment opportunities in the market, after adjustment for differences in risk.

An estimate of the WACC may be made in real (adjusted for inflation) or nominal terms. The choice to use a real or nominal WACC depends upon the choice of whether to model costs and returns in real or nominal terms. The cost-benefit modelling of this inquiry uses financial modelling in real terms.

Furthermore, the CAPM and WACC models generally deliver an estimate of the required after-tax (or “post-tax”) WACC. To achieve consistency with cost forecasts that are typically made in pre-tax terms, calculations require assumptions about the expected taxation liabilities of the service provider and corrections to either the rate of return or the cost forecasts to reflect these liabilities.

In deriving a rate of return under the CAPM framework, a number of parameters are estimated as follows:

- the risk-free rate;
- the equity beta;
- the equity or market-risk premium;
- the benchmark financing structure;
- the benchmark debt margin; and
- the value of dividend imputation.

The risk-free rate represents a rate of return on an asset with zero default risk. Australian regulators have adopted similar approaches to deriving a proxy measure of the risk-free rate of return by observing the yields on Commonwealth bonds − the generally accepted asset with a default risk nearest to zero.

The equity beta reflects the level of non-diversifiable risk associated with a particular asset, relative to the (non-diversifiable) risk associated with a well-diversified portfolio of assets. It measures the market risk associated with its assets and the financial risk borne by shareholders due to an entity’s use of debt financing.

A well-diversified portfolio of assets has a beta of one. A beta of less than one implies that the entity under consideration has less non-diversifiable risk than the market average, and vice versa with a beta greater than one.

Estimating a beta requires information regarding the economic returns on individual assets (comprising the value of the returns plus the change in the market value of the asset) as well as the economic return on the well-diversified portfolio of assets.

The market risk (or equity) premium is measured as the difference between the expected return on a well-diversified portfolio of stocks and the risk free rate. It represents the reward that investors require to accept the uncertain outcomes associated with equity investments relative to the return provided by the risk free rate.

Capital structure refers to the proportion of debt to total capital (i.e. debt plus equity) employed by an entity. Often referred to as an entity's level of "gearing", the measurement represents the proportion of regulatory asset value that is assumed to have been financed by debt and include all decisions related to the financing of the asset, including the amount that an entity pays for an asset and the level and form of debt finance employed.

Capital structure affects the level of financial risk and return to equity holders. The higher the level of debt, the higher the equity beta (see discussion of equity beta above) and the higher the corresponding cost of equity.

The cost of debt is the return that the entity's debt holders demand on new borrowings. The cost of debt will vary depending on the default risk of the borrower, which in turn will be affected by the gearing of the company (high gearing means a high level of debt relative to cash flows and consequently a higher risk of default), the volatility of its cash flows and long term security of revenue.

Under the dividend imputation tax system, Australian resident taxpayers who receive dividends from Australian resident companies can claim a credit for tax that has already been paid by those companies in respect of that dividend income. Ignoring timing impacts, an Australian resident taxpayer can therefore be compensated for the incidence of company tax (but not personal tax).

APPENDIX 4: CONSULTANT'S OPINION ON UUA'S TECHNICAL PROPOSAL

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June 7, 2005

Dr John Marsden
Marsden Jacobs
Level 3, 683 Burke Road
CAMBERWELL VIC 3124

Dear John,

WA ERA Kalgoorlie-Boulder Project

Marsden Jacobs' request for me to carry out a 'high level' technical review of United Utilities Australia's (UUA's) Technical Proposal, and its Cost Model, for providing a drinking water supply to the Kalgoorlie-Boulder area in WA., refers.

I confirm that the process train developed in the Technical Proposal is technically appropriate and should be well able of producing the desired volume and quality of drinking water identified. In addition, apart from a few operational costs that are identified and further elaborated upon below, I confirm that the costs developed in the UUA Cost Model are adequate for this stage of project development.

The technical items that I considered required some clarification are:

1. Use of a relatively unknown form of ultrafiltration (UF) pre-treatment ahead of the reverse osmosis (RO) plant; supplied by Hydranautics who also supply the RO membranes and are responsible for the conceptual design of the UF/RO desalination plant;

2. Apparent lack of a balance or surge tank between the UF and RO process units;

3. Basis for the ultraviolet irradiation (UV) dose, as I would have expected it to be higher, thus possibly having implications for the magnitude of the power supply to this unit;

4. Use of 8 RO elements in each pressure vessel, in lieu of the 'normal' 6 or 7;

5. Clarification of the anti-scalant dose ahead of the RO system;

6. Membrane life in the RO system is stated as 7 years, with this value being used in generating the membrane replacement costs that appear in UUA's Cost Model. I accept 7 years fro the first pass but am concerned with 7 years for the second pass given that this latter unit will be operating with a high recovery;

7. How is variation in water demand accommodated ?

8. How is the 'supply risk' addressed – given that the product drinking water is produced in only one treatment plant ?

9. Appropriateness of basing the costs for chemically cleaning the RO membranes on a *single* annual clean, noting that this assumption has been made with only one sample of seawater having been taken and analysed ?

I confirm that the above technical and in some case, costing issues, were discussed with Neil Palmer of UUA and Keith Anders of Hydranautics on the 15th April 2005.

Satisfactory responses were provided for Items 1, 2, 4, 5, 7 and 8. However, Responses to Items 3 (basis for UV dose) and 9 (frequency of chemical cleaning of the RO membranes) were not resolved and UUA was to provide more feedback/clarification. In addition, while it is not necessary to take any further action at this stage, Item 6 (appropriate membrane life) must be addressed in more detail should the project ever move to the design stage.

I trust that the above suits your needs in compiling the report for ERA, but please do not hesitate to contact me should you require any further details or feedback.

Yours faithfully

Ian B Law

APPENDIX 5: GLOSSARY

Act	*Economic Regulation Authority Act 2003*
ADWG	Australian Drinking Water Guidelines (1996)
Authority	Economic Regulation Authority
Consumer surplus	The difference between the maximum amount consumers would be willing to pay for a good or service and what they actually pay for the good or service.
Corporation	Water Corporation
CSO	Community Service Obligation
Draft Report	The Draft Report for this inquiry, published by the Authority on 30 June 2005
Economies of scale	A reduction in the average cost per unit of output as the scale of output increases (e.g. a reduction in unit costs of water delivered as pipeline size increases)
EKP	Esperance-Kalgoorlie Pipeline
G&AWS	Goldfields and Agricultural Water Supply scheme
G&AWS Main Conduit	The 549 km main pipeline of the G&AWS, extending from Mundaring Weir to Kalgoorlie's Mt Charlotte Reservoir.
GL	Gigalitres, which is 1,000 ML or equivalent to 667 Olympic-sized swimming pools
Headworks	Major capital investments required to accommodate step increases in demand (e.g. an increased load from a large industrial customer)
IWSS	Integrated Water Supply Scheme
kL	Kilolitres, which is 1,000 litres
LRMC	Long Run Marginal Cost, which is the forward-looking cost of supplying an additional unit of water to meet increases in projected demand, through new source development and demand management programmes
MJA	Marsden Jacob Associates
ML	Megalitres, which is 1,000 kilolitres

Producer Surplus	The difference between the minimum amount producers would be willing to charge for a good or service and what they actually charge for that good or service.
RO	Reverse Osmosis
THMs	Trihalomethanes
UUA	United Utilities Australia