Mr Roger Wilkins
Director-General
NSW Cabinet Office
GPO Box 5341
SYDNEY NSW 2001

Dear Mr Wilkins

We are pleased to be able to provide the attached report of our review of the Metropolitan Water Plan. A further report with the results of additional, more detailed analysis will be provided at the conclusion of the review process.

This report reaches some strong conclusions – with substantial implications for the strategy. Several things combine to offer a much more positive outlook than would have been supported even a few months back:

- Recent rains have added substantially to water in storage. Combined with the current investment in accessing deep water, storage is now close to 50 per cent of expanded system capacity.
- Newly identified groundwater reserves offer good prospects for adding an additional and valuable instrument to the measures available for drought response.
- Significant new volumes of recycled water are now in prospect and can be expected to grow, adding to both supply and supply diversity.
- The substantial investment that has been made in establishing a viable desalination strategy has delivered the capability to introduce and use desalination in a deep drought with modest lead times – creating the opportunity to bring desalination in when needed, but in the meantime to avoid substantial costs.
- The investment in water saving by Sydney Water is already saving significant volumes of water. The NSW Government initiatives, including regulatory and pricing measures mean that savings will increase over time.

The analyses we have undertaken, factoring in these developments, lead to a number of important conclusions set out in our report. In particular, we would like to draw your attention to the following:

- Measures already implemented or approved point to a secure supply system – with supplies in excess of demand using no more than the present level 3 restrictions – until at least 2015.
  - This conclusion is crucially dependent on these measures, and the way that some will progressively increase in impact over time – without them, supplies would not be secure.
- Beyond 2015, the water demand-supply balance could change substantially as a result of population growth and decisions your Government has yet to take on river flows, while climate change trends may have an impact on rainfall in the catchment (negative or positive).

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- We have identified a range of measures that could be implemented to meet these needs.
- The right 'package' will depend on the needs that emerge and on earlier decisions taken on matters such as desalination. It is not necessary, and would almost certainly prove costly, to lock into a specific set of responses now.

- This approach to managing the system and system investments adaptively offers scope for large cost savings and for delivering a system better suited to future needs and available technologies.
- In contrast to the past, it is now possible to guarantee supply adequacy through any drought.
  - Access to water supplies that are largely independent of rainfall, such as from recycling, and scope for introducing, and if necessary scaling up, desalination in the event that dams fall to levels that threaten supply, combine to allow this to be done.
  - Importantly, the short lead times that have now been established for the construction of desalination, and the fact that the plant can operate in the middle of a drought, mean that it is not necessary to build the desalination plant yet – and it is unlikely to be necessary for many years.
  - However, it will be essential that the capability to deliver a desalination plant with short lead times, of the order of 2 years, be maintained and this will require some on-going investment.
- The promising groundwater sources could be exploited to further reduce the likelihood of needing desalination in the near term and to lower the overall costs of a drought response strategy.
- Delaying the physical construction of the desalination plant in this way offers very large financial savings.
- We have probed the robustness of these conclusions by simulating successive years of low rainfall much worse and less probable than any events on record and believe the conclusions broadly hold. Key risk factors that would sensibly be monitored and incorporated into the adaptive management of the system include:
  - per capita demands; the available evidence strongly suggests that underlying demand levels are lower than was assumed in the 2004 Metropolitan Water Strategy, but the above conclusions hold even at those levels. Any trend towards higher levels would need to be managed carefully or could trigger significant additional costs.
  - catchment rainfall and inflow patterns, that are the subject of considerable current research that should inform future reviews of the overall strategy;

We trust that this report is of assistance to your Government in this important planning process.

Yours sincerely

Stuart White
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David Campbell
ACIL Tasman

Review of the Metropolitan Water Plan

February 2006

institute for sustainable futures
UNIVERSITY OF TECHNOLOGY SYDNEY

ACIL Tasman
Economics Policy Strategy

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Contents

Executive summary

This report forms part of a review of the Metropolitan Water Plan 2004 and contains findings regarding Sydney's supply-demand balance for water, both in the immediate and longer term. This review was commissioned by the NSW Cabinet Office, and is being undertaken by the Institute for Sustainable Futures at the University of Technology, Sydney and ACIL Tasman with technical advice from SMEC Australia. A further report with the results of additional, more detailed analysis will be provided at the conclusion of the review process.

Key findings

The key findings include the following:

- the immediate drought threat to Sydney's water supply is now manageable, due to the success of currently implemented measures and the development of new approved measures;
- this supply-demand balance is improved by the recent rain in catchment areas which has increased storage levels from a low of 38% in June 2005, to 45% at the present time — with the latest hydrology modelling suggesting a greater than 80% likelihood that storage levels will rise in the next 12 months (by contrast, in mid-2005, projections were that storage levels could be as low as 33% in February 2006);
- uncertainty regarding the immediate to medium term implications of climate change for catchment rainfall patterns must moderate this assessment, and there is inevitable uncertainty associated with hydrological modelling and input assumptions; however, our major conclusions would remain intact even with a much lower chance of improvement, and options exist for managing climate change risk in a way that still ensures supply security;
- the first tranche of investment in accessing previously unavailable water at Warragamba and Nepean storages, due to be available by August this year, will expand dam capacity by about 8% and implies that dam supplies are now effectively close to 50% per cent of this expanded capacity;
- further to this analysis of the current situation, there is adequate supply availability with very high security until at least 2015, based on existing and approved measures to increase supply availability and to reduce the demand for water, many of which have been, or are being, implemented since the 2004 Metropolitan Water Plan;
- it is estimated that the supply availability — the ‘safe’ volume of annual drawdown from the dam system — will be 580 GL/annum[1], while the unrestricted demand is estimated to be less than 560 GL/annum in 2015, due to a range of recycling and water saving initiatives that are in place or have been approved;
- demands on the system, including from growth and from possible changes to environmental flow requirements, could result in a significant increase in demands from 2015; there is a range of options available and sufficient to manage the supply-demand balance in the period 2015 to 2030, with sufficient time to choose the best strategy;

[1] Note that 1 gigalitre per annum (GL/a) is equivalent to 1 billion litres per year

- in addition to the underlying rain-fed system of dams, there is a greatly increased diversity and extent of supply and demand options, including increased demand management, increased effluent recycling, the potential for groundwater extraction and the ability to bring desalination capacity on in a relatively short time (26 months);
- the ability to construct desalination capacity in a short time is the result of the planning, approval and testing processes that are completed or under way, which collectively have reduced the lead-time to construct by at least 12 months. This readiness greatly increases supply security by allowing a plant to be constructed and started in a drought in sufficient time to avoid breaching security requirements;
- as a result of the initiatives that are in place, and recent inflows to storages, there is no requirement to construct the desalination plant at this time, the ability to construct a plant of 125 ML/day upgradeable to 500 ML/day within a 26 month period provides sufficient security;
- even more fundamentally, the substantial investment that has already been made in developing a feasible desalination strategy, alongside the roll-out of substantial recycling, allows a dramatic shift in the way that water supply planning should be undertaken, and drought risks can be managed;
    - in the past, drought risk management has depended overwhelmingly on pre-emptive investment in dam storage *in advance of* any drought —with dam construction during a drought offering little immediate benefit. Extreme droughts have always threatened the need to introduce very strong and potentially costly (Level IV and Level V) restrictions;
    - in the future, there will be scope for effective system augmentation within deep drought conditions, and pre-emptive investment, especially in desalination, would probably involve unnecessary costs with few if any offsetting benefits; access to these new options can fully replace the traditional role of Level IV and Level V restrictions and deliver additional security;
    - the major driver of Sydney's water planning is not the inadequacy of average rainfall, or even frequent droughts, but rather the risk of a rare but prolonged and deep drought. For Sydney, the current drought appears to be the second worst on record, second only to the drought of the 1930s/40s, with the drought in the 1890s being the only other recorded drought of comparable depth;
    - the ability to exploit this rarity, to limit infrastructure costs while still delivering absolute security, is a strength of this new approach to supply and drought planning;
- there is a very low probability of storages reaching the levels required to trigger the building of a desalination plant in the next four years — and even in the next ten to fifteen years.

Key periods of analysis

There are three key periods of analysis in terms of the supply-demand balance. Firstly, the immediate term — that is, the period up to the time when dam levels return to pre-drought levels. Secondly, the medium term, up to 2015, when decisions are to be made on environmental flow releases from Warragamba Dam which are likely to reduce supply availability. Thirdly, the period from 2015 to 2030, which is when this policy decision would have an impact, and the period in which population growth is likely to have a greater impact on demand levels. The key issues associated with these three periods are summarised in the following paragraphs.

Immediate drought response

In addition to water restrictions, there has been considerable progress in the development of drought response measures:

- deep water from Warragamba and Nepean Dams will be accessible in August 2006, providing an impact on supply availability both for the current drought and for the future;
- a site for a desalination plant has been acquired and the approvals process and pilot testing is underway, which will effectively reduce the remaining lead-time to construct to less than 26 months, providing the capacity to construct and to supply water, and even to scale up, in sufficient time should dam storages drop to low levels;
- groundwater sources that could provide 15 GL of water a year in drought have been confirmed, with other sources with good prospects for offering a further 15 GL/annum under investigation; in both cases, access would be subject to environmental assessment. These sources would not offer indefinite supply, but appear likely to be subject to fairly rapid recharge and could push back considerably the time until construction of a desalination plant is needed.

These measures, plus the recent inflows to storages from rain events, means that there is a greater level of security for the water supply system than was the case at the time of the release of the 2004 Metropolitan Water Plan. Specifically, the ability to construct desalination capacity within a 26 month period, will mean that security is assured, even in the very unlikely case that storages fall to levels of less than 25%.

Medium term outlook

In the highly likely event that the storages reach pre-drought levels in the next 2 years, the period until 2015 will be marked by the continued implementation of a recycling strategy that will reduce demand from storages by 17 GL/annum, based on existing and approved projects. Further projects are proposed, which would have the effect of augmenting supply availability by 18 GL/annum.

In addition, a range of water saving measures are in place, including the roll-out of BASIX, the new Water Savings Fund and proposed changes to water pricing. These recycling and demand reduction measures, combined with the impact of Sydney Water's existing water savings program, which is the largest and most successful in Australia, are estimated to reduce demand by over 160 GL/annum in 2015. The demand is expected to be approximately 560 GL/annum, once restrictions are lifted (current demand, with Level III restrictions in place, is 520 GL/annum).

The available supply, including the impact of accessing deep water, but allowing for the environmental flow releases for the Upper Nepean, is expected to be approximately 580 GL/annum. This figure is based on either maintaining the ability to invoke Level IV and V restrictions, as is current policy, or to substitute these restrictions with the capability to construct and operate a desalination plant if dam levels reached very low levels.

Longer term outlook

The period from 2015 to 2030 is when any decision on environmental flow releases from Warragamba Dam would take effect and reduce the supply availability. This would also combine with the impact of increasing population on demand, as the current suite of low cost water saving and recycling measures reach their limit. There is a range of options available to meet the supply-demand balance at that time, including options currently being investigated to increase supplies from the Shoalhaven, as well as increased recycling and possibly desalination as a source of growth water, rather than the immediately envisaged security role. In the low likelihood event that the lack of short-term or medium-term rainfall does trigger a need for investment in a desalination plant, subsequent use of the capacity as a source of growth water may well prove cost effective because the capital costs will then be sunk and unavoidable. Its marginal costs of operation are likely to be competitive with the full costs of introducing new sources of supply.

There is ample time to consider these needs and options in detail and determine the best long-term strategy which meets the needs of the community at the lowest economic, environmental and social cost. There is also an opportunity to ensure that there is an appropriate level of community engagement in the decision making process, commensurate with the importance of these decisions.

1. Introduction

This report forms part of a Review of the Metropolitan Water Plan 2004 (DIPNR, 2004). and the principal factors that have changed since the Plan was released. Section 2 describes in more detail the immediate drought context and response and then Sections 3 and 4 explore the status of water supply and demand respectively. The supply-demand balance in the medium term (2006—2015) and longer term (2015—2030) is then evaluated in Section 5. Section 6 looks in more detail at how desalination might best be integrated into the strategy, before presenting conclusions in Section 7.

The focus of this report is on the supply-demand balance and how this is affected by changes that have occurred since 2004. A further report with the results of additional more detailed analysis will be provided at the conclusion of the review process.

1.1. What has changed since 2004?

Several factors have changed since the Metropolitan Water Plan 2004. These provide the basis for a more optimistic assessment of the ability to meet Sydney's supply-demand balance both now and to 2015.

These factors include:

a) increases in dam levels from a low of 38% in June 2004 to 45% in February 2006 with an 80% likelihood that dam levels will rise in the next 12 months (Sydney Catchment Authority estimate), although there is inevitable uncertainty associated with hydrological modelling and input assumptions. This lowers immediate and medium term risks to supply shortages and extends the time horizon in which decisions can be taken that affect longer term prospects;

b) improved understanding of demand and demand trends (discussed further in Section 4) that suggest underlying per capita demand is likely to be lower than the figure previously used;

c) a range of measures being implemented, in addition to the increasing impact of Sydney Water's demand management programs, that contribute to reducing actual demand including the roll-out of BASIX, the Water Savings Fund, stepped-tariff pricing, Water Savings Action Plans, Water Efficiency Labelling Scheme (WELS) and a range of new water saving initiatives;

d) significant progress in developing and implementing committed and approved recycling schemes which will reduce the demand for potable water by 17 GL/annum (further measures have been proposed that would augment supply availability by 18 GL/annum);

e) better modelling of the supply system including the incorporation of recent drought data;

f) diversification of supply options, including recycled water, groundwater and the capability to construct and operate a desalination plant within a relatively short period which allows for a more flexible approach to planning.

2. Drought context and response

The immediate drought threat has begun to ease due to the increased rainfall in catchment areas and the reduction in demand due to drought restrictions. SCA estimates that there is an 80% chance that dam levels will rise above their current capacity of 45% in the next 12 months.

Assuming that dam levels do now trend towards pre-drought levels, this drought will be remembered as the second worst on record from the perspective of the Sydney catchment. The drought from the mid-1930s to mid-1940s was slightly worse — and would, if repeated recently, have driven dam levels a little lower. The overall pattern of the two droughts is quite similar. The only other drought on record of broadly comparable severity was that of the 1890s.

Access to deep water in the Warragamba and Nepean storages will become available in August 2006. Current supplies inclusive of this deep water are close to 50% of this expanded supply capacity.

Groundwater sources that could be used to provide 15 GL/annum of water during drought have been confirmed, with the potential for an additional 15 GL/annum identified. These cannot be run indefinitely — offering indicative supplies at this rate for up to three years, followed by about 7 years recharge time. However, they are illustrative of a persistent theme through the present review. A gigalitre of water available when supplies from other sources are very low has much greater value — ‘punches above its weight class’ — than does a gigalitre of rain-fed supply. The strategic value of such water, in limiting risks, extending supplies and possibly allowing the deferral of high-cost infrastructure investment can be considerable.

The ability to construct desalination capacity in a short time (26 months) is the result of the planning, approval and testing processes that are almost completed, and which collectively have reduced the lead-time to construct by at least 12 months — to about 26 months. This readiness greatly increases supply security by allowing a plant to be constructed and started late in a deep drought in sufficient time to avoid breaching security requirements. This in turn limits the risks of committing to a high cost construction project, only to have the drought break, with adequate supplies still in storage — effectively resulting in a wasted investment.

These measures, plus the recent inflows to storages from rain events, mean that there is a very substantially greater level of security for the water supply system than was the case at the time of the release of the 2004 Metropolitan Water Plan. Specifically, the ability to construct desalination capacity within a 26 month period, will mean that security is assured, even in the event that storages fall to levels of less than 30% — an event with an extremely low probability based on the latest hydrological modelling, even with an allowance for significant change in risks due to climate change.

It is notable that, probably at the end of the second worst drought on record, dam levels have not fallen below 37.9 per cent of capacity and that methods have been developed that would allow a much deeper drought to be managed. Drought continues to be a serious risk for Sydney, and careful risk management is crucial — but in many respects this recent history, which has not required the imposition of Level IV or Level V restrictions, should be viewed as pointing to the robustness of the established system as well as to the value of sound planning.

3. Supply availability

The supply availability of water is determined by the inflows to dams, the ability to transfer water from neighbouring catchments, the restrictions rules that are employed and the availability of non-rain fed supply options (Erlanger and Neal, 2005).

The supply availability accepted at the time of the development of the Metropolitan Water Plan 2004 was 605 GL/annum. This has since been modified in the following ways:

- the recorded inflows which are used to calibrate the supply availability model (WATHNET) have been extended by 6 years to include the years up to 2004, which has the effect of reducing the modelled supply availability by 25 GL/annum — effectively the frequency of deep drought in the historical time series on which the model is based has been increased;
- a range of other changes to the WATHNET model have been made to model more accurately riparian releases at Tallowa Dam, environmental releases at several smaller storages and hydropower releases. Collectively these changes reduce supply availability by 15 GL/annum;
- the approved environmental flows for the Upper Nepean reduce the supply availability by approximately 25 GL/annum;
- accessing the deep water in Warragamba and Nepean storages increases the supply availability by 40 GL/annum, up from the estimate of 30 GL/annum in the 2004 Metropolitan Water Plan.

All of these changes or initiatives have been implemented or are in the process of being implemented, and their collective impact is to reduce the supply availability to approximately 580 GL/annum. This estimate does not include a number of proposed initiatives that would result in an increase of the available supply, namely:

- the capability to construct and operate a desalination plant in deep drought;
- the potential for increasing transfers from the Shoalhaven by increasing the trigger level for these transfers from 60% of system storage levels to 80%;
- the availability of groundwater resources that have been, and are, currently being investigated;
- the impact of return flows from the proposed Western Sydney Recycled Water Initiative;
- the ability to relax the strict requirements regarding frequency of low level restrictions.

These possibilities are described in more detail below.

This supply availability is based on the application of a set of rules that are defined in the Sydney Water Drought Response Management Plan (Sydney Water, 2003a:29) and includes the very low probability of requiring Level IV and Level V restrictions. This requirement is able to be offset by the capability to construct and operate a desalination plant in deep drought as described in Section 6.

As described in Section 2, groundwater resources offer a source of water that is accessible during drought periods. The more certain groundwater resources (15 GL/annum) in the Upper Nepean, if developed and used during drought periods would have the impact of increasing supply availability by 5 GL/annum. In other words, access to this 'bank' of drought insurance allows normal levels of annual usage from the dam, even outside of drought, to be increased by 5 GL/a without lowering system security. Further groundwater sources which could provide an additional 15 GL/annum during drought are currently under investigation.

The proposed Western Sydney Recycled Water Initiative is a major undertaking in the final stages of development, with an Expression of Interest to be issued in June 2006. One component of this scheme is to provide return flows to substitute for water currently taken from Warragamba Dam for agricultural and river health purposes. In addition to the impact that this proposal has in reducing the demand for water from storages, it would also have the effect of increasing supply availability by 18 GL/annum by 2015.

The planning and preparation for a desalination plant in Sydney changes the supply availability, and increases the security of supply, merely through the ability to construct such a plant during times of deep drought. As was noted earlier, the existing planning and preparation work means that the lead-time for construction has decreased to about 26 months. This means that it is not necessary to trigger the decision to build such a plant until storage levels drop below 30% of the extended storage capacity. There is only an extremely small probability of reaching this trigger level given demand projections to 2015.

While in the short term it is important to ensure that we are able to deal with the current drought situation, once dam levels move back to pre-drought levels, the risks for many years beyond that will drop dramatically.

There are a number of options to increase the available supply beyond these levels. These options include increased transfers from the Shoalhaven, for example, through changes to the operational arrangements – that is, increasing the trigger level for pumping from 60% to 80% of the system storage level. *Further increases* in Shoalhaven transfers will require major capital works to augment Tallowa Dam, and/or to increase the transfer capacity through a pipeline or tunnel. These major infrastructure works could increase the supply availability by up to 115 GL/annum, but at a very high capital cost (approximately $800 million).

In addition, marginally increasing the frequency of low level restrictions (not including the current, Level III, restrictions) is an option that would appear to have strong public support (Taverner Research, 2005; Sydney Water, 2003b) and effectively increases the amount that can be safely drawn from storages. This would represent a relatively easy means of complementing the new operating environment in which there is the capability to construct and operate a desalination plant in the unlikely event that storages should fall to very low levels. Further investigation is required of the impact and cost of restrictions, and improved methods of efficiently achieving demand reduction during drought, including pricing mechanisms (Duke and Ehemann, 2004).

Should short-term conditions trigger the need to invest in desalination (or if a desalination plant is in any case built) then the plant could be ramped up to increase supply and to act as a source of growth water. The relevant costs in weighing whether this makes sense relative to other alternatives would be the operating costs of the desalination plant (inclusive of the costs of any carbon offsets), since the capital costs would by then be sunk costs. Once a desalination plant is built, the economics of alternative supply sources can be expected to change dramatically.

4. Demand for water

This section explores the predicted demand for water and the effect of current and future options on mitigating this demand. There are two components to understanding the actual demand for water:

a) the 'base case' demand, also called 'reference case' demand (this is the underlying demand for water, not including the impact of water efficiency options, recycling schemes and restrictions);

b) the impact of water efficiency options and recycling schemes (which substitute water from storages with an alternate source of water or with a technology that requires less water)

The *actual demand from water storages* is calculated by subtracting the savings which are achieved through demand reduction measures from the base case demand. Each of the two components is discussed in more detail in Sections 4.1 and 4.2 respectively.

4.1. Base case demand

The current approach to calculating the total system demand for water in Sydney, is to estimate the water demand per capita per day and multiply this by the current population to give the total demand.[2] The Metropolitan Water Plan 2004 used a per capita demand estimate for the base case of 426 litres per day. This estimate is considered high and does not rely on analysis of water end-uses and the impact of urban consolidation on per capita demand. Analysis of the appropriate base case demand is currently being undertaken, but the most likely estimate falls between 400 and 426 litres per capita per day by 2015.

To be conservative, the figure of 426 litres per capita per day has been used in analysis in this report. The effect of the base case demand being closer to 400 than to 426 litres per capita per day would be to reduce actual demand by up to 40 GL/annum in 2015.

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[2] This per capita demand includes residential demand, non-residential demand and system losses.

Further details about the individual demand reduction measures are provided in Section 4.2.

4.2. Demand reduction measures

There is a range of current and approved water efficiency options and recycling schemes which reduce the actual demand from the base case. These are summarised in Table 1.

Table 1: Demand reduction measures and their estimated demand reduction by 2015

Option / Scheme	Estimated Reduction by 2015 (GL/a)	Description
BASIX	23	The Building Sustainability Index (BASIX) is an assessment tool that mandates a level of water demand reduction in new and renovated homes.
Sydney Water existing Demand Management Programs	65	Sydney Water's demand management programs include active pressure and leak management, the Every Drop Counts (EDC) business program, retrofitting residential households and rebates for rainwater tanks.
New Demand Management Programs	5	Five new demand management options proposed to enhance the existing programs.
Water Savings Fund	14	This is a DEUS administered program which facilitates water saving projects put forward by businesses, councils or other government agencies, organisations or community groups.
Water Savings Action Plans	5	Water Savings Action Plans are required to be prepared by large water users to identify savings.
Appliance Standards and Labelling	13	This program involves the introduction of mandatory labelling followed by minimum standards for a range of water-using appliances under the Commonwealth Government's Water Efficiency Labelling Scheme (WELS).
Recycling schemes (current and approved)	17	Involves the use of recycled water replacing potable water use in industry (notably BlueScope steel), at sewage treatment plants and in residential houses through dual reticulation.
Stepped tariff for pricing and Outdoor water savings measures	20	Includes the introduction of step pricing as recommended by IPART. The outdoor water saving measures involve the introduction of ongoing low level outdoor water use conditions commencing at the end of the current drought restrictions and supported by ongoing community education.
Recycling schemes (proposed)	20	Additional local recycling schemes and the Western Sydney Recycled Water Initiative.

The demand reduction measures target a diverse market for achieving water savings. Retrofits and rebate programs target existing multi unit and single residential households. BASIX targets new homes built and renovations. SWC's 'Every Drop Counts' program involves working with schools and high water using businesses to achieve reductions in demand. Recycling schemes target industry and residential markets, in part driven by the requirements of BASIX.

Water savings offered by some of these programs, such as recycling, have a relatively high unit cost. However, the rationale for recycling schemes extends well beyond water supply — these schemes can offer significant benefits in reduced costs of wastewater management and/or reduced adverse impacts from nutrient discharge to the environment. Nonetheless, across this range of measures there is likely to be scope for achieving progressive improvements in cost effectiveness through fine tuning of the ‘portfolio’ of measures.

The total potable water savings from water efficiency and recycling schemes in 2015 and 2030 are shown graphically in Figure 1.

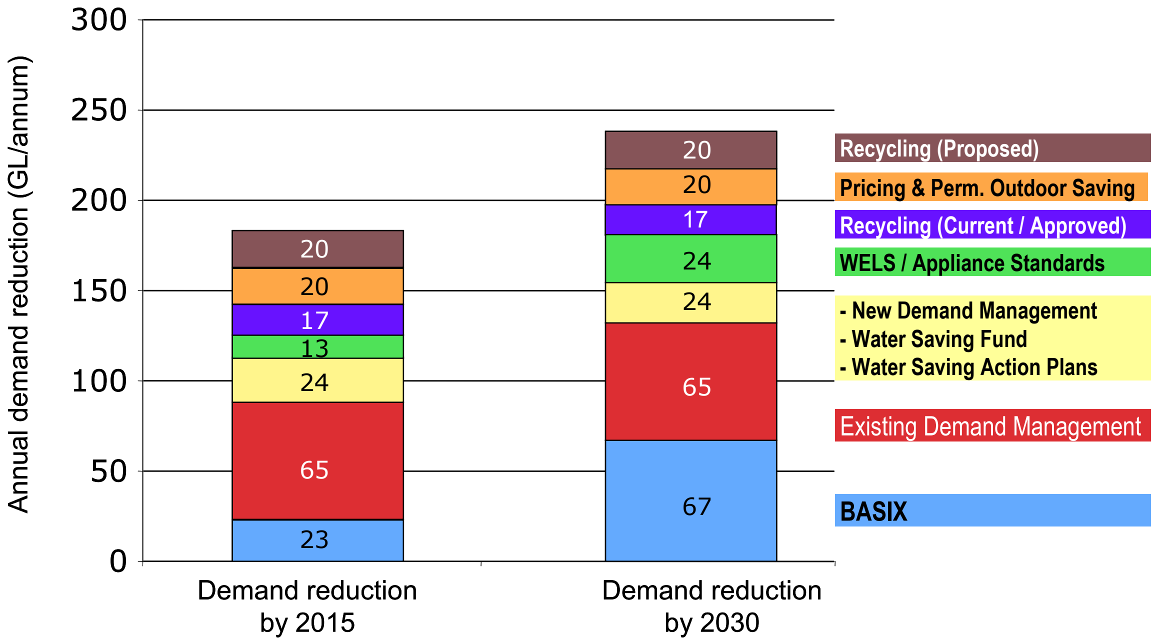

Figure 1: Demand reduction by 2015 and 2030

Figure 1 shows that the majority of savings are attributable to water efficiency options. These estimates are based on current information from the agencies responsible and have been adjusted where necessary to avoid double counting of savings.

5. Supply-demand balance

Sections 3 and 4 have discussed the status of options for supply and demand. This section now evaluates the supply-demand balance at 2015 and 2030 and discusses the implications of these results in the context of an adaptive management planning strategy.

5.1. Medium term (2006–2015)

Actual demand is calculated by subtracting the effect of demand management measures from the base demand. This is shown for the upper and lower cases in

Figure 2 and Figure 3 based respectively on an assumption of per capita demand of 426 litres per person per day and 400 litres per person per day.

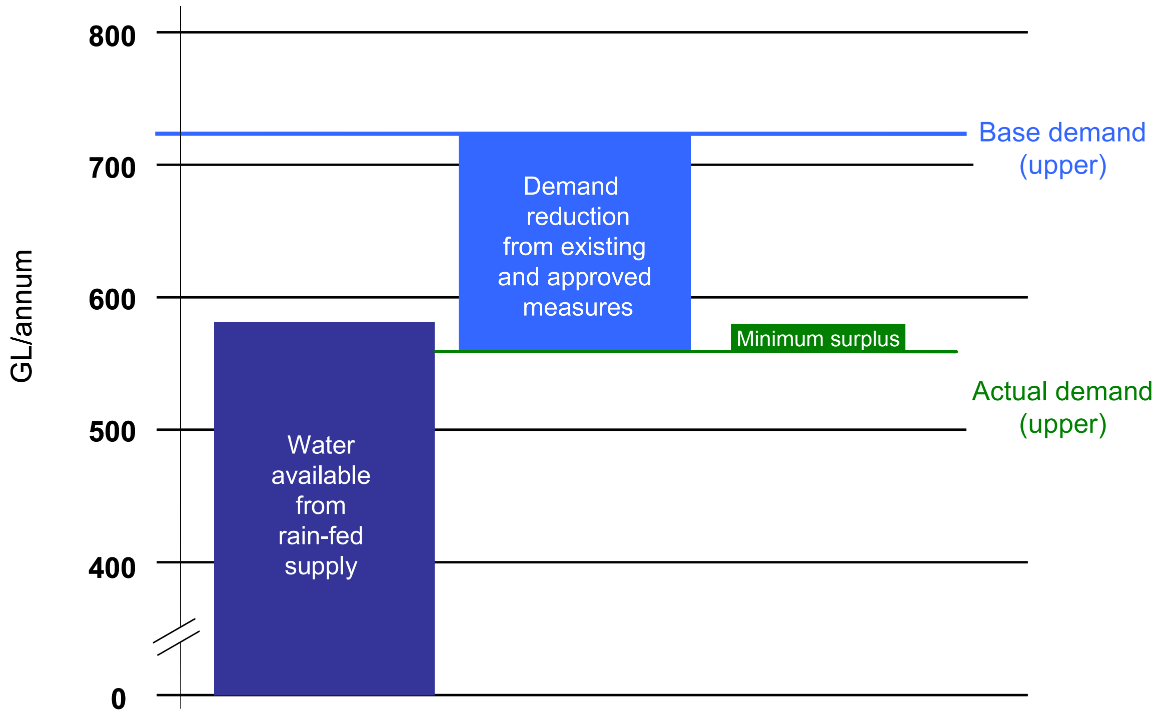

Figure 2: Supply-demand balance for 2015 (upper estimate)

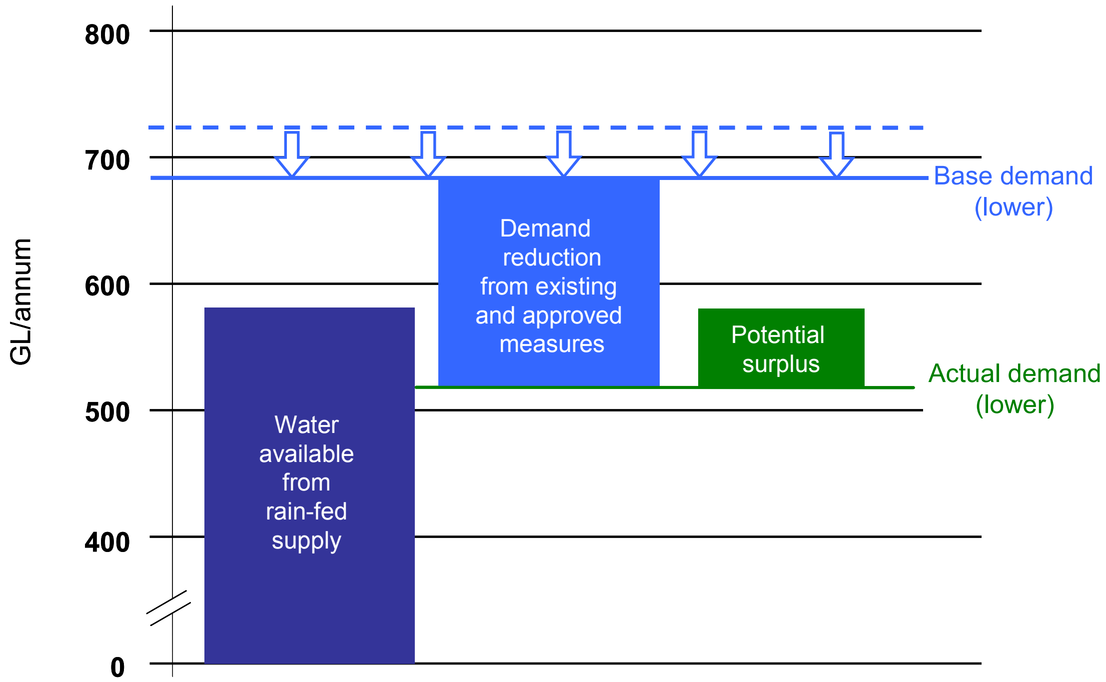

Figure 3: Supply-demand balance for 2015 (lower estimate)

Both the upper and lower demand assumptions imply a surplus, with a substantially larger 'safety margin' with the lower figure.

This indicates that the likely surplus in 2015, is likely to be between 20 GL/annum and 60 GL/annum depending on the assumed base case demand. This does not include the impact of 20 GL/annum of proposed recycling schemes or additional water efficiency options that may be implemented in future, or the increase in water supply availability (18 GL/a) that would be provided by the use of return flows from the Western Sydney Recycled Water Initiative.

5.2. Longer term (2015–2030)

In the longer term, there are two principal issues which will affect the supply-demand balance. First, the proposal to dedicate water for Warragamba environmental flows on which a decision is yet to be made. This would reduce supply availability by approximately 82 GL/annum. Secondly, by this time, population growth may start to drive demand back up as the current suite of low cost water efficiency measures and recycling schemes will have been taken up before 2015.

This could lead to a supply-demand gap on current estimates. However, there are a range of options available to close this gap, including increased transfers from the Shoalhaven.

There is also likely to be further cost effective water efficiency and recycling potential that could in future help to narrow the supply demand gap.

There is sufficient time for planning within an adaptive management framework, and ensuring that there is a level of community engagement in this decision making process that is commensurate with the significance of, and public interest in the decisions.

6. The role of desalination

Reference has been made at several points to the potential role of desalination in relation to future supply security. However, the above discussion of the supply-demand balance was predicated on existing measures, but without formally including desalination. In this section we consider in more detail how it might sensibly fit into the strategy.

Technically, the existing measures underlying the above assessment include the triggering of Level IV restrictions if dams fall below 35 per cent and Level V restrictions if dams fall below 25 per cent. These restrictions have never been invoked.

If Level 5 restrictions ever needed to be triggered, requiring a reduction in demand of 50%, the economic costs would be very high — with substantial implications for industry, employment and production as well as residential usage.

As was noted earlier, the simulation modelling suggests that the likelihood that they would be invoked over the next 10 years is extremely small – a probability of about 2.5% for Level IV restrictions and 1.15% for Level V restrictions; even these figures are 'high' as a result of the initial dam levels used in these simulations — the long run probability of these restrictions is much lower than this, and is required to be so as part of the operating regime. However, the option of implementing Level IV and V restrictions, as an extreme response to an extreme drought, has until now been essential to supporting the safe supply estimates — and is built into the revised availability figure of 580 GL/annum.

Removal of Level IV and V restrictions, without a compensating measure, would reduce water availability by about 65 GL/annum — implying a supply gap by 2015 if demand levels are towards the upper end of the modelled range. The fact that a measure (which the Government has not needed to trigger even in the second worst drought on record) can have this impact on supply availability is further evidence of the way that measures tightly targeted at extreme drought needs can 'punch above their weight class'.

Another measure tightly targeted at extreme drought would be adopting a desalination strategy, whereby a a desalination plant would be built in time to mitigate extreme drought threats — but such commitment would be delayed as late as is safe. Based on the work done to date, the most likely strategy that would offer both total security and reasonable management of costs would be one that involves an initial commitment, once storages reach critical levels, to a 125 ML/day plant, but with inlet and outlet pipes sized to allow later upgrading to as much as 500 ML/day.

A 125 ML/day plant offers a valuable buffer, but cannot guarantee absolute security through the most extreme drought conditions. In a truly extreme drought, it would be possible that an upgrade would need to commence even before the 125 ML/day plant began operation. However, in most cases, commencing with commitment to a 125 ML/day plant could be expected to 'buy' enough extra time to allow the drought to break before there would be a need to trigger the upgrade. Having access to the upgrade would, however, allow the trigger point for even the 125 ML/day plant to be set at a much lower level than would otherwise be needed to deliver adequate security.

As with Level IV and Level V restrictions, a central feature of a cost effective desalination strategy is implementing other measures to ensure that the probability of triggering construction of the plant remains very low. Key elements here include maintaining pressure on other more cost effective measures for limiting demand and/or expanding supplies, and keeping in place the necessary arrangements to allow the desalination plant to be built with a short lead-time. This could be expected to involve some ongoing investment in retaining access to a site along with suitable approvals etc. Provided this is done, construction of the plant before it is actually required to deal with critical dam levels appears to add nothing to system security but would bring forward a large set of infrastructure costs. We estimate that the financial savings that accrue from deferring construction until required are in excess of $950m.

One way of looking at this approach to fitting desalination into the overall strategy is as insurance. Building a desalination plant could be viewed as the up-front premium. This would be costly, but the subsequent 'excess' in the event that the plant is needed would be modest. Alternatively, a modest investment can be made in the premium — in the form of maintaining the capability to roll out a plant with a short lead-time, with a much higher excess in the event that the plant is needed. Given the very low chance of needing the plant for a long time, the low premium/high excess strategy has considerable appeal.

Another feature of delaying the need to build the desalination facility is that it may well allow a lower cost, less energy intensive plant to be built when the need arises. There has been a sustained trend towards increasingly efficient and cost effective desalination technologies for many years now, and this trend is likely to persist.

Finally, it is worth noting that the potential role for a desalination strategy in eliminating the need for Level IV and V restrictions can go further. Logically there is scope for trading the likelihood of Level I to III restrictions against the likelihood of triggering a need to build the desalination plant. The question of fine tuning the mix and frequency of restrictions with the likelihood, and therefore expected costs of desalination being needed, will be discussed in our further report. For now we note that the ability to bring in desalination could be used to revise the frequency of the Level I to III restrictions. The ‘right’ balance will depend on factoring in the community preferences in addition to the economic analysis.

7. Conclusions

The ability to provide supply security, means that the community of Sydney now has considerable flexibility in facing the future of water supply. There is a strong case for now exploiting this flexibility in meeting its long term water needs. This suggests that serious consideration should be given to modifying the form of the more recently announced desalination strategy, and adopting a new approach to securing supply in the 2006 Metropolitan Water Plan.

The ability to defer major capital expenditure also allows for adaptive management in the post-2015 period. In the intervening time, a range of studies will be finalised, including into the impact of climate change on our water supply system and improvements in the demand forecasts. In addition there is scope to take advantage of new information and emerging technologies which can lower costs and energy use to meet the supply-demand balance. Finally, many of the decisions to be made should rightly involve citizens in the decision making process, given their significance, and the additional time will allow this to occur in a robust and considered way.

Based on conservative assumptions, the financial benefits of not needing to proceed immediately with the desalination plant have been assessed as likely to be in excess of $950m in current dollar terms. Achieving these gains will require *maintenance of the capacity* to bring desalination into the system with a short lead-time. Given the low likelihood that this will be necessary for many years, insurance structured this way offer good value for the community.

8. References

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