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Water price restructuring and the role of Sydney's wholesale water price

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Contents

Executive summary **i**

1 Introduction **1**

The water resource scarcity problem facing Sydney: the dimensions 2

Market failure and absence of market based opportunities for valuing urban water 3

2 Mechanisms for achieving demand supply balance **6**

The existing price structure and demand supply imbalance 7

The role of price in closing the gap 10

3 Costs as drivers of water prices **13**

The different kinds of cost of achieving balance between demand and supply 13

Costs to water users — incremental costs 'at the tap' 14

Long run marginal costs — a key concept 15

4 Possible roles for the wholesale prices **21**

Wholesale pricing to recover costs or signal scarcity? 22

The wholesale price as a means of implementing a cap on extractions 24

5 Links between wholesale and retail prices, non price measures and the cap **32**

Retail price restructuring 32

6 Conclusions **35**

References **39**

Boxes, charts and tables

2.1 **Price responsiveness and the supply gap** 9

3.1 **LRMC average incremental cost approach for a 'twin track' supply/demand balance program** 18

Executive summary

THE RATE AT WHICH WATER supplies can be reliably extracted from Sydney's catchments on a permanent basis without worsening the in-stream environment is known as the sustainable yield. It is difficult to estimate with precision. However, there is widespread concern that recent extraction levels exceed this sustainable rate — that an excess demand has emerged.

The body responsible for catchment–based supplies — the Sydney Catchment Authority (SCA) — is in danger of violating the reliability requirements of its operating licence if required to continue to supply the retailer — Sydney Water Corporation (SWC) — at existing rates of growth without recourse to additional sources.

It is in this environment that the Independent Pricing and Regulatory Tribunal of New South Wales (IPART) has been asked to review the structure of wholesale and retail water prices.

A high level of uncertainty hangs over the immediate prospects for restoring water demand–supply balance in the Sydney region. Among the critical uncertain elements are:

- the additional environmental needs of the Hawkesbury-Nepean system;
- the appropriate size of any cap on extractions that might be introduced as a means of asserting and delivering these needs;
- the likely water savings achievable from demand management measures which rely on consumer behaviour, and from price increases, which also depend on consumer responsiveness;
- the costs per kilolitre of water saving or capacity augmentation / supply substitution — particularly when costs of such alternatives as recycling using 'third pipe' systems or desalination vary with the scale on which they are adopted; and

- future supply side responses to changes in SCA bulk water prices by third parties wishing to offer recycled water as a substitute for water sourced from SCA.

These uncertainties influence the most appropriate role for wholesale prices (the price at which SCA sells to SWC and others) in the short term and their link, if any, to restructured retail prices (the SWC prices to final water users).

Both wholesale (bulk) water and retail (reticulated) supplies are sold at administered prices whose maximum level is determined by the regulator, IPART. They are not *market* prices. They have been the means of covering the costs of both SCA and SWC on a 'user pays' basis.

Retail water prices can have an important role to play in communicating forward looking costs of water supply to customers and thereby influencing water use. These costs should reflect the most efficient means by which water agencies can balance demand and supply — through supply options and demand management.

Wholesale prices have different potential roles. As both the SCA and SWC point out in submissions to the review of price structures, the wholesale price can be interpreted as a market signal to other potential suppliers, or it can be used purely as a regulatory device to moderate the retailer's profits and reduce incentives to sell water above a predetermined cap. A step price is one means of doing this.

There are risks in using the wholesale price, whether on all water sold or on sales to SWC above the cap, to express the estimated 'scarcity costs' of future bulk water supplies for Sydney. The risks are that with a single dominant buyer of bulk water, SWC, alternative suppliers might take the wholesale price, and the step price in particular, as an indicator of the price at which they will be able wholesale *their* product in future. These risks are greatest if a step price includes estimates of any of the future incremental costs of supply options *beyond the Sydney Catchment Authority's mandated area of responsibility*. The costs of large scale recycling or desalination are examples. It is not certain who will incur these supply augmentation/substitution costs and their magnitude and timing are speculative. Reliable estimates may be commercial in confidence.

On the other hand, the regulator IPART, other planners (and possibly other potential suppliers) are entitled to know what enhancement costs are involved for SCA in playing its part in closing the demand–supply gap. There may be merit in incorporating SCA's future augmentation costs explicitly in the *volumetric* wholesale price — signalling what SCA can

efficiently achieve within its catchments through investing to augment existing supplies, inter valley transfers etc. This signal, along with the other costs of achieving demand-supply balance through demand management, would be passed through to consumers as part of the retail usage price. It would however, make SCA's revenue more volatile as the fixed component of wholesale charges may have to fall to ensure no over recovery of costs by SCA.

A higher *level* of wholesale charges will be readily justified on compliance grounds alone if proposed changes to environmental flows go ahead. SCA will need to make modifications to its dams to accommodate these. But under current pricing arrangements the wholesale price is purely a cost recovery vehicle with an arbitrary 50-50 reliance on fixed and variable charges to recover those costs. If there is a view that it should also be used as a regulatory mechanism to help implement a cap on extractions by influencing Sydney Water's behaviour, a different *structure* of charges will be needed.

There are legitimate concerns that SWC currently faces incentives to sell more water as the profit margin increases with increased sales. If the intention is to use a *second tier* wholesale price to simply remove all profit elements for SWC from any sales above a cap level, then an arbitrary wholesale volumetric step price must be calculated (rising with increased sales) and set by the regulator, with the retail price already determined. The wholesale price structure applied to sales *below* the cap could be chosen independently, but would preferably aim to recover all of SCA's costs via sales up to the cap – it would not be reliant on sales that violate the cap. This approach would generate a fund of uncertain size from above cap sales revenue which could be hypothecated to water saving projects or environmental work or revert to consolidated revenue.

The same broad mechanism could be used to apply a penalty wholesale price for above cap sales, imposing losses on SWC on any such sales. If SWC were required to pay a price equal to long run social marginal cost for this water, as some have advocated, in spite of SWC employing a demand management program agreed to through an integrated planning approach, this would have several shortcomings:

- It would penalise SWC for outcomes beyond its control and/or overstimulate demand management expenditure by SWC. The appropriateness of penalising the supplier in these circumstances is questionable. So is its usefulness.
- The wholesale price signal sent out through the penalty step price would overstate the *operator* long run marginal cost, as it would include

costs borne exclusively by customers as well as the costs of the water agencies, and would run the risk of encouraging high cost substitute supplies prematurely.

An alternative to a wholesale step price as a means of implementing a cap on extractions is the use of a sales review and subsequent retail price adjustment mechanism. Wholesale prices could be set on their present basis (but raised to reflect SCA's future investment requirements). The price regulator would adjust the *fixed charge* component of the *retail* price of water in the subsequent regulatory period to neutralise any profits from above cap sales in the current period. This option has the advantage that it avoids any misplaced interpretation of stepped wholesale prices by would-be suppliers. It does not constrain how wholesale or retail prices are set. Its disadvantage is that it introduces additional regulatory uncertainty and the concern that Sydney Water will feel unconstrained by the prospect of reduced revenues in a future regulatory period.

Two tier (increasing block) retail tariffs are used in some other urban centres in Australia and elsewhere. There have been calls for its adoption for Sydney. The adoption of a wholesale step price of any type is not easily aligned with increasing block tariffs at the retail level. *All* consumption contributes to a breach of the cap when this occurs. There may be an equity argument that large residential water users should bear the costs of above cap consumption through a higher usage price on water consumed above a threshold. But there are practical difficulties in aligning that retail threshold with the wholesale cap when aggregate consumption varies significantly from year to year. For practical purposes the retail threshold would need to be fixed for the regulatory period, or be adjusted in a systematic way through that period (eg through a pre announced lowering of the threshold in each year).

The use of 'operator long run marginal costs' effectively Sydney Water's long run costs of balancing demand and supply) as a reference path for setting retail usage prices has the advantage of providing a relevant resource scarcity signal to water users. It can also provide a signal to future alternative suppliers. The longer the view, the less certain the costs of alternative measures. Nevertheless, that signal is clearest if there is a single tier usage price.

In summary

The wholesale price is an *administered* price. It is not market determined and it is only one instrument. It cannot be relied on exclusively to simultaneously remove perverse incentives for Sydney Water to sell above

sustainable levels, recover the revenue needs of Sydney Catchment Authority, place a scarcity value on Sydney's bulk supplies, provide an accurate signal to other would-be suppliers, and link to proposed two tiered retail tariffs. There is a danger that some advocates of a wholesale step price expect it to do all these things.

1 Introduction

CONCERNS ABOUT SCARCITY OF HARVESTABLE SUPPLIES of water from catchments serving the Sydney metropolitan areas have emerged in recent years, with annual extractions exceeding estimated long term sustainable yields by 25 000 megalitres[1] in 2001-02. The consumptive use of water at these levels does not present a threat to safe supplies if it is only temporary. Inflows to the system also rise and fall about the long term safe yield figure. However, if it persists in the absence of alternative supplies, the bulk water supplier, the Sydney Catchment Authority (SCA) would be unable to meet its licence obligations on the reliability of water supplies. There would be an inability to address environmental damage to the Hawkesbury-Nepean system through increased environmental flow releases which have been called for by the Hawkesbury-Nepean Forum. With population growth and no change to the current path of per capita consumption, total extractions would rise and environmental costs would likely increase — an indication of increasing scarcity.

In competitive, market-based situations increased relative scarcity is dealt with through *price adjustments* brought about through the market. Sydney's urban water supplies do not fit that category.

Prices for the bulk water provided at the wholesale level (principally for subsequent treatment and distribution) and at the retail level (to residential, commercial and industrial users) are regulated by the NSW Pricing and Regulatory Tribunal (IPART). Prices are regulated because of the particular features that govern ownership of water resources and supply of water and waste water services.

Wholesale supplies of raw bulk water are provided by a single statutory authority — the Sydney Catchment Authority — from its five catchment systems and the twenty one major dams which it maintains. The water itself is owned by the Crown. The stored water is sold at regulated prices. The SCA also manages environmental releases from the storages. The bulk

[1] 1 megalitre (ML) equals 1 million litres or 1000 kilolitres (kL). 1 gigalitre (GL) equals 1000 megalitres.

water for eventual industrial commercial and industrial use is sold to the sole retailer, Sydney Water Corporation (SWC) which pays for it to be treated under contract before transporting it for delivery and sale at regulated prices. SWC also sells relatively small quantities of its treated effluent for industrial and outdoor use.

With the prospect of further mandatory measures to curb water consumption facing Sydney residents if consumption is not aligned with sustainable yield, the price setting authority faces the question of how changes to the *structure* of prices might help.

IPART (2003) has raised a series of issues that it considers relevant in making any recommendations for change.

This discussion paper addresses a number of these issues in further detail. It takes up the appropriate role for the pricing of bulk water extracted by the Sydney Catchment Authority for sale to the retailer, Sydney Water, and the appropriate relationship between the wholesale and retail price.

The water resource scarcity problem facing Sydney: the dimensions

Recent population growth in Sydney has outstripped forecasts. Population projections established on the basis of the 1991 and 1995 censuses show that the population served by the Sydney Catchment Authority was projected to be 3 973 200 in 2001.[2] The estimated residential population of the same area in 2001 was in fact 4 101 611. This difference has placed pressures on available supplies that were not fully anticipated a decade ago.

At the same time, while price signals and expenditure by SWC to encourage efficient use and address its own supply losses has had some impact on per capita consumption, reducing it from 506 lpd (litres per day) in 1991 to 416 currently, this has not been a big enough response to prevent a supply-demand imbalance emerging.

Current retail demands are driving a wholesale demand (625 GL per annum in 2002, lower in 2004) with low level compulsory restriction in place to accommodate growth in the face of drought conditions. The estimated current available yield of the catchments serving Sydney is 600 GL. This imbalance arises after allowing for *current* environmental flow requirements (which some argue should be substantially increased) and

[2] Based on the ABS medium series.

supplementation by Shoalhaven transfers by pumping from the neighbouring Shoalhaven catchment in drought periods (the current practice, which is also under challenge on environmental and equity grounds). The Shoalhaven is the major supplier of Nowra and other centres on the South Coast.

SWC has estimated in its response to the Tribunal's Issues Paper, (Sydney Water 2004) that under a 'business as usual' scenario — with no change to existing demand management and price path settings — retail demands would grow to 720GL per annum by 2015. If population growth rates equal to the 1.1 per cent average of the period 1991 to 2001 are sustained, Sydney requires consumption reducing measures that will save almost 7GL per annum, rising annually, just to maintain the status quo total consumption.

An implicit judgement has been made by government that the environmental and social costs of a major new storage dam at Welcome Reef in the Shoalhaven catchment outweigh any benefits, ruling out this as a future supply option. No formal benefit cost analysis of that option has been undertaken.

If allowed to continue, and given environmental flow requirements, growth in total draw on the catchment would force SCA into non compliance on the reliability of supply condition of its (current) licence operating. There is therefore an incompatibility emerging between the SCA licence condition to supply SWC demands and to simultaneously observe reliability constraints and environmental flow constraints.

This situation has emerged despite

- changes to the structure and level of retail water prices approved by IPART whereby the usage charge for water has increased from \$0.69 per kL in 1995-96 to \$0.98 in 2003-04 while the fixed charge has been reduced slightly from \$80 to \$76.55; and
- demand management measures implemented by SWC which since 1998 which have cost \$44 million (a figure put in perspective by the annual revenue figure for SWC of approximately \$1300 million).

Market failure and absence of market based opportunities for valuing urban water

Where their use is feasible, *market determined* prices are usually favoured as a mechanism for allocating resources. They are favoured on the presumption that voluntary responses to market based prices will achieve

that allocation more efficiently than through arbitrary rationing or some other non price mechanism. Market based allocation allows water to be taken up by its highest value uses. The SCA response to IPART's Issues Paper on price structures makes the point that the foundations for allowing market based values for water to emerge, and with them a reflection of its relative scarcity, are not present for urban water in Sydney (SCA 2004).

For market based scarcity values to be established, *property rights* to the water would have to be allocated and traded. While this is happening for bulk supplies in some rural areas of NSW dominated by irrigation use, it is not a feature of the Sydney area. It is not practical to allocate water property rights to individual urban end users[3].

Even if property rights to the water could be assigned there would still be problems of market failure. These would arise because:

- natural monopoly features are present in the transportation system for Sydney's water, necessitating price regulation; and
- externalities, particularly environmental damage from extractive use, would not be priced under a market mechanism.

Regulation and regulatory pressures

To deal with the market failures that typify urban water systems, governments in New South Wales have adopted an approach that combines *regulated maximum prices* for wholesale and retail water, with operating licence obligations on SWC. Price paths for the two agencies are set by IPART. The licence conditions on SWC require demand management effort on the part of SWC targeting reduced per capita consumption. This approach has not, however resulted in levels of supply and demand for

[3] In theory, it would be possible to allocate entitlements as shares of the available catchment supplies to, say, local governments and allow them to trade in these rights on a temporary or permanent basis, with part of the allocation being subject to purchase in the market place. Local governments would then have an incentive to recognise the water resource constraint in development approvals. There would, however, be major complexities in allocating initial shares given the varying levels of development across council areas and the role of the state government in granting development approval. One method would be to allocate amounts to individual councils based on longer term population projections for each area and per capita consumption amounts that would be set low enough to be somewhat below projected available supplies from sustainable catchment yield. Councils could then bid for the remaining unallocated water, recovering costs of these revealed scarcity rents through periodic charges administered on their behalf by Sydney Water and through Section 94 contributions. Unnecessary 'water hoarding' is one of a number of difficulties with such a scheme.

water from the Hawkesbury-Nepean and related systems that are, on recent trends and under current extraction arrangements, sustainable. Furthermore, both SCA and SWC face incompatible pressures.

SCA currently faces incompatible regulatory pressures. SCA is obliged to meet rising total SWC demands without reducing the reliability with which it can do so. It is required to do this in the face of access to harvestable quantities which may be further diminished by reassessment of the sustainable yield of the catchment for extraction purposes if recommendations for increased environmental flows are followed.

SWC faces conflicting commercial incentives and regulatory pressure. It is required to operate as a profitable business whose primary function is to sell treated water to its customers and to remove treat and dispose of waste water. At the same time its operating licence imposes reductions in per capita consumption targets which it is not currently meeting. SWC has been criticised for 'under supply' of demand management effort in the interest of making profitable water sales.

Concerns that the combination of retail price and demand management effort have failed to reduce demand to sustainable supply levels have prompted proposals for

- use of a modified wholesale price to (a) deal with SWC profit driven incentives to sell more water rather than less from SCA sources (b) increase incentives for greater demand management effort by SWC;
- implementation of a formal cap on extractions from the Hawkesbury-Nepean system while recognising that SCA cannot just 'turn off the tap' when demands from SWC exceed the sustainable yield; and
- possible combinations of the above.

2 *Mechanisms for achieving demand supply balance*

WHAT ARE THE MEANS of reconciling total water demand and potable supplies that are consistent with not exceeding the sustainable yield of the Hawkesbury-Nepean system? They fall into the following four categories.

- Augmentation of supplies through infrastructure investment (other than another dam) by suppliers including:
  - increased transfers from the neighbouring Shoalhaven catchment;
  - recycling of effluent for non potable use (residential outdoor, industrial and open space, and as a replacement for environmental flows), stormwater harvesting etc; and
  - desalination.
- Decreased reliability — increased frequency of restrictions – amounting to a deterioration in the quality of the service, but one which stretches the available supplies.
- Increased *discretionary* demand management effort, either by SWC or others, covering:
  - SWC's leakage reduction and pressure reduction programs;
  - retrofitting of water efficient bathroom and toilet fittings;
  - rainwater tank rebates (which amount to part funding a supply augmentation measure taken by individual households); and
  - water efficient house and landscape design.
- Mandatory measures including:
  - permanent low level restrictions on outdoor use similar to those imposed through 2003-04;
  - mandated sale / use of water efficient appliances;
  - design requirements for new developments which mandate a minimum level of water saving against a benchmark — the government's BASIX program for water and energy efficient new development being an example of this; and

  - possibly mandating actions or expenditure by SWC.
- Pricing measures — wholesale and retail price adjustments and possibly restructuring of those prices.

The existing price structure and demand supply imbalance

Usage based retail pricing of water was introduced in Sydney more than a decade ago. A two part tariff made up of a fixed charge and a usage charge was introduced. It had an identifiable effect on per capita consumption and in changing the growth path of total consumption. Cost reflective pricing was acknowledged as a desirable feature, although the initial balance between the volumetric component and the fixed charge was not based on any attempt to closely target particular costs with the two components. Subsequent adjustments to the usage and 'access' components of the price have had the effect of moving a greater burden of cost recovery to the usage component which has moved up as the scarcity of Sydney's bulk supplies has become evident.

More recently, on the creation of the SCA in 1999, a wholesale price structure was introduced with SWC paying SCA a (current) price of 11 cents per kL and a fixed charge which together recover (roughly equally) the costs of SCA, which are largely fixed in nature. (They are dominated by the costs related to the existing storage infrastructure.) Because SWC's costs also include a very large fixed component, its profit margin increases on every additional kilolitre sold

The current pricing structure has two notable features. As it stands the wholesale price contains no explicit 'scarcity' price signal to the main purchaser, SWC. And the usage component of the retail price, currently 98 cents per kilolitre, cannot be compared with the long run costs of satisfying water demand as these have not been published.

The main sources of uncertainty in striving for balance

Price restructuring, both wholesale and retail may be helpful in dealing with these apparent demand-supply imbalances.

However, decisions about future appropriate pricing structures for wholesale and retail water in the area served by supplies from the SCA are having to be made in the presence of significant uncertainty on both the demand and supply side. There is:

- demand side uncertainty about;

  - future population growth, influenced by planning decisions and to some extent by infrastructure including water supply services availability;
  - per capita consumption, influenced by future demand management effort and responsiveness to that effort in terms of water savings, and any mandatory restrictions on water use but also influenced by responses to future level and structure of *retail* water tariffs;
  - costs of mandatory measures and the division of those costs between customers and agencies; and
  - large variations within and between years in water use in response to weather conditions.

- supply side uncertainty about
  - effect on available catchment supplies of future increased allocations for environmental flows in the Hawkesbury-Nepean with decisions yet to be taken;
  - the costs to SCA of modifying its off takes and any other infrastructure to accommodate these altered flows;
  - the environmental impacts of enhanced transfers from the Shoalhaven, which have not been fully assessed;
  - the announcement of a formal cap on extractions from the system, the size of the cap and the method and timing of implementation;
  - the feasibility and acceptability of various 'substitution' proposals involving the use of recycled treated waste water for either environmental flows or non potable domestic use;
  - the capital and operating costs of substitution and augmentation options which are highly scale dependent and subject to change through technology change (desalination costs are a case in point); and
  - the efficient *sequence* for adoption of water saving and augmenting measures — a problem created because of uncertainty over costs and over responsiveness of consumers and potential suppliers to price signals and regulations.

Reflecting some of these uncertainties the difference in available annual supply for extractions from the system could be as much as 200GL putting it in the range 450 to 650 GL[4] In the context of a system which supplied

[4] At the optimistic end, if only a further 50GL were found necessary for additional environmental flows and extended transfers from the Shoalhaven were approved, providing an additional 100GL, available supplies would rise to 650

around 625 GL in 2002, this range, and uncertainty about it, has important implications for least cost planning and the appropriate related pricing strategy for both bulk water and water to consumers.

An indication of the difficulties created by these uncertainties is given by table 1.1 below.

1.1 **Price responsiveness and the supply gap**

Supply gap	*Elasticity assumptions*		
	0.1	0.25	0.40
25GL	$0.39	$0.25	$0.10
50GL	$0.78	$0.49	$0.19
75GL	$1.18	$0.74	$0.29

Source: CIE calculations.

This illustrates the possible range of retail price changes that could be required if the water price alone were used to attempt to close gaps between demand and sustainable supply. These gaps have been set at three different possible levels — 25 GL, 50 GL and 75 GL — reflecting the prevailing uncertainty over what might be mandated by way of increasing environmental flows. Similarly, there is no settled view on the likely price responsiveness to a price change. A range of elasticities — from 0.1 to 0.4 covers most of the estimates thought to be applicable to Sydney.

Thus if responsiveness to a further price increase is very low (an elasticity of 0.1 means a 10 per cent rise in price will only drive a 1 per cent demand reduction) and water savings of 75 GL were required just to re-establish balance between sustainable yields and demand, and price were the only instrument available, a price *rise* of $1.18 per kL would be required. On the other hand, if a relatively small 'excess demand' exists and customers are more price responsive, a rise of as little as 10 cents per kL would be required.

While this is merely illustrative and a range of measures as well as price are being brought to bear to effect water savings, these do not help to increase the precision with which price can be used to address Sydney's demand supply imbalance.

It is within this highly uncertain environment that the Tribunal has to set maximum wholesale and retail prices and price paths. It is an environment where price regulation is needed because of market failure but one in which price signals alone are unlikely to efficiently achieve supply-demand balance consistent with sustainable system yield.

GL. Pessimistically, much larger environmental flows, no transfers and allowance for greenhouse change could reduce that value to 450GL.

The role of price in closing the gap

Water price has a part to play in all but those measures which involve mandated restrictions on household use. In its Issues Paper the Tribunal has spelt out some possible retail pricing scenarios which illustrate how different retail prices and price structures would impact on residential customers' bills and on likely water consumption levels.

SWC has nominated pricing reform as the 'next least cost action' to reduce demand, pointing out that without it, price will increase (anyway) to fund extra demand - supply balancing actionsPrice can be allowed to drive demand change:

- by *restructuring* the water tariff as a response to emergent scarcity, using the usage component to signal that scarcity; and
- by *passing through* the costs of responding to scarcity and restoring demand supply balance consistent with sustainable yield.

Augmentation — a supply response — will involve capital expenditure by suppliers.

- If that capital expenditure is by the SCA to make increased transfers possible, it will need to be recovered through the wholesale water price which in turn would be passed on to customers.
- If SWC or others build recycling or desalination capacity, recovery might be directly through the retail potable price (if for instance SWC builds desalination capacity).
- Recovery could be through the wholesale price and further pass through (if for instance a private recycling initiative provided water in lieu of environmental flows to the SCA and the SCA were allowed to pass those purchase costs through to SWC who in turn passes them on to customers).
- Recovery could be through a combination of retail potable and non potable prices (if for instance SWC or others provide reticulated water for non potable use and higher charges for potable use are needed to help cover costs).

Revenue neutraÞ retail price restructuring can make some contribution to closing the gap, even in the short term — somewhere between 1 and 35 GL per annum in *residential* consumption savings, based on IPART estimates, depending on what elasticity of demand is representative of behaviour, whether the per kL tariff increases above some threshold and whether

average or marginal prices[6] affect consumption decisions. (Estimates provided by SWC for comparable options are broadly consistent with those provided by the Tribunal — see Sydney Water submission (2004, p. 28).) Demand management measures and any investment in augmentation/substitution that increase cost and are allowed to flow through to prices will compound this effect.

But revenue neutral tariff rebalancing should itself have some reference basis. Complete elimination of the fixed component of retail prices could easily lead to a retail price for water use which overstates the impact of increased consumption on costs, including the costs of dealing with 'excess' demands. There are large fixed costs of refurbishing the existing system. Sydney's aging pipe system is having to be progressively renewed. These costs are already being recovered in significant measure from the volumetric component of the charge, which recovers much more than just the short run operating costs and water purchase costs of SWC, the costs that vary most directly with variations in the amount of water sold.

Feedback effects from price changes need to be taken into account

The pass through of any cost as a change in retail price has the potential to influence the effectiveness of other non price measures where a voluntary response is relied upon. Most particularly, the response to voluntary retrofit programs could be significantly different under higher volumetric retail prices created as the result of passing through other cost-driven changes or as a result of restructuring the retail price to place more weight on cost recovery from the usage charge. Pronounced increases in the usage price could drive more household uptake of efficient fittings but also create a price-cost-price loop if SWC bears some of the costs of these programs.

Similarly, mandatory restrictions can diminish the responsiveness of water use to price change. When consumers have already modified outdoor consumption in response to restrictions, by changing their garden needs and altering their water use habits, their further response to any price increase is likely to be muted.

Then there is the effect of price changes on total consumption paths which are the basis for calculating the best sequence and extent of costly demand-supply balance measures. In calculating future costs of achieving balance it

[6] The marginal price is the price charged for each additional kL used. The average price is the customer's total water bill (fixed and usage components) divided by their total water consumption. Responses to changes in the marginal price are generally observed to be greater than to changes in the average price.

is prudent to make some allowance for the feedback effect of the pass through of costs onto prices and of price changes back onto consumption behaviour.

Pricing measures cannot be taken in isolation. Augmentation of supplies and demand management activities both generate costs. Costs generate revenue needs. Restrictions amount to a reduced quality of service — an implicit cost to consumers — and affect the willingness to pay for water and the acceptability of price increases.

Given these possible responses to managing the demand-supply balance, what principles should guide the setting of prices? And what costs are relevant to any consideration of a possible restructuring of water prices? Whose costs should be taken into consideration and in what way?

3 Costs as drivers of water prices

The different kinds of cost of achieving balance between demand and supply

If Sydney is to achieve long term demand and supply balance there will be incremental costs at a number of levels. *All* of these costs are appropriate to take into account in choosing between solutions. *Some* of the costs are relevant when regulating future prices.

Different approaches to 'closing the gap' impose different costs potentially borne by different parties. There are costs 'at the dam wall' 'at the meter' and 'at the tap'.

Incremental costs of the SCA — 'at the dam wall'

The incremental costs 'at the dam wall' include any augmentation costs that SCA would encounter in meeting SWC demands while at the same time meeting altered environmental flow release requirements. These costs could include any modification to dams to enable releases of water at acceptable temperatures and at times and in volumes when in stream needs are best met. As such they represent the internalisation of environmental costs. They could also include any incremental piping and storage infrastructure needed to facilitate intervalley transfers which could expand the sustainable yield, and any operating costs such as pumping in making transfers. Estimates put this additional capacity at as much as 100 to 150 GL if accompanied by a small reduction in SCA's licensed reliability requirements.

If SCA can meet its environmental flow commitments more cheaply by other means – for instance through purchase of recycled effluent treated to such a high standard that it is suitable for release 'below the dam wall' — then this *could* be a component of the incremental costs facing SCA. Ultimately this is likely to depend on a decision by government rather than being a commercial choice for SCA. This highlights the important point that, from an *agency* perspective, there will be a least cost means of meeting

changed demands. Whether this delivers the greatest net benefit to the community as a whole is another matter.

Unless SCA is also seen as the body responsible for all bulk water supplies (other than supplies sourced from recycling SWC own effluent) to satisfy SWC demands, future options such as desalination would not be part of SCA's future incremental costs. These issues are discussed further below.

Incremental costs to SWC — incremental costs 'at the customer's meter'

To meet consumer demands while drawing on supplies from SCA that are limited in future to sustainable yield, SWC will incur incremental costs. These will include any increased wholesale water costs from SCA allowed for pass through by the Tribunal in the form of increased wholesale prices. They will also include the costs of enhanced demand management effort undertaken by SWC as a component of the demand supply balancing task. The costs of leakage control and pressure reduction have been mentioned. Further subsidisation of efficient appliance retrofits and rainwater tanks could be included These forward looking costs could also include any future recycling or desalination costs *if these are part of an efficient sequence of measures as seen by SWC and those responsible for water planning.*

It is in the community's interest to ensure that the series of measures SWC and SCA take to bring demand and supply into balance – *given what actions others are taking or are likely to take* — is at least cost. This means taking measures that yield relatively large water savings cheaply first — whether they are demand management or augmentation measures — and postponing high cost-per-ML schemes. One of the challenges for price setting is to ensure to the extent possible that water prices support efficient investment and demand management measures that are compatible with the commercial interests of the two agencies while not 'shifting' costs to consumers.

Costs to water users — incremental costs 'at the tap'

The water users who purchase water from the retailer, SWC, will face any pass through of incremental wholesale and retail costs in the form of higher water prices. They will also be impacted by any mandatory or voluntary changes that require more efficient but more expensive water appliances and home or industrial design net of any savings in water bills brought about by these appliances. Some of these costs are the customer side of costs partly borne by SWC in carrying out its demand management

program. For instance, where SWC subsidises a retrofit the consumer picks up part of the cost and SWC the other part.

The efficiencies produced by consumers bearing these costs can help to lower per capita water consumption and contribute to achieving demand-supply balance. There are further implicit costs borne by water users if the mechanism for maintaining balance involves some form of rationing. These costs can be estimated if there is sufficient information about customers' willingness to pay for water (their 'demand functions').

Long run marginal costs — a key concept

All of the costs mentioned are relevant from the point of view of finding a *package and sequence of measures* that will allow Sydney's demands to be satisfied at minimum net social cost while preventing demands on the Hawkesbury-Nepean system (and any transfers into it) from exceeding sustainable yield of the catchments. Only some of the costs are, however relevant for price regulation purposes.

The role of social costs

In its original inquiry into urban water pricing in 1993 IPART recognised the interrelated and interchangeable nature of demand side and supply side management. The Tribunal recognised that demand side management, involving both price and non price tools, could be used as alternatives to supply side measures to achieve equivalent service outcomes. It advocated *integrated least cost planning* and recommended that 'water suppliers develop a methodology for evaluating least cost planning options which incorporates both demand-side and supply-side options'[7].

This approach recognises the need to take into account the *full* implementation costs and benefits (water saving / augmenting and other benefits) of any option being considered by publicly owned water authorities and planning authorities. That is, it takes into account costs from the catchment to the tap.

This benefit–cost based approach takes into account the fact that water saving investments:

[7] IPART (1993).

- have a time profile that is important — costs that can be delayed are lower in present value terms, but some water saving *benefits* also take time to emerge — in response to education for example; or
- have an *incidence* that needs to be considered — some of the social costs, particularly of mandatory measures, are hidden because they are borne implicitly by water users; and
- may involve components with other benefits such as reduced environmental costs of effluent disposal which may not be accounted for unless this social benefit–cost framework is adopted.

From an integrated planning perspective there would need to be a comparison of the incremental (or *marginal*) social costs of alternative programs for balancing demand and supply and the program with the highest present value of *net benefits* would be preferred. This would involve formulating expenditure profiles for SCA, SWC and water users. The associated costs of this program, expressed in present value terms, and allowing for the variable timing and amounts of water savings/ augmentation from each of the measures, would give the *long run social marginal costs* of achieving water balance efficiently. They are what the Department of Environment and Conservation (DEC 2004) in its response to the Tribunal's Issues Paper described as the *long run social marginal costs of a sustainable water plan.*

This approach can be used as a guide for publicly owned agencies in avoiding untimely expensive projects and in signalling, through long run marginal social cost estimates, the forward looking costs to the whole community of maintaining water balance. However, its implementation would depend on a coordinated approach involving the decisions of both agencies, consumers and other potential players in the highly regulated water 'market'.

In principle, a profile or 'envelope' of long run social marginal costs, involving the optimal sizing and sequence of measures, could be developed. It would be subject to year to year change as information changes about component effectiveness and likely future costs.

Formulation of the equivalent cost for a whole of system approach where twenty or more separate measures involving SWC, SCA, industrial customers, developers, and individual households is complex and the confidence that can be placed in the results depends on the precision with which each of the component costs and water savings/augmentations can be estimated.

Some of the ingredients for constructing such an envelope for Sydney are provided in the information presented by the Water CEOs Taskforce report (2004) provided by the EPA in response to the current review of pricing structures. Each measure costed there is essentially treated as a stand alone contribution to water saving or increased capacity, with estimates of the present value of costs divided by the present value of consumption savings / to give a per ML cost of increased capacity or, equivalently, water saving. All but the recycling and desalination options are costed as though they are to be initiated in the immediate future (by 2006). The Taskforce does recognise the interdependence of measures but does not attempt to quantify this interdependence. *The time path of expected water savings from each measure and the time path of outlays is needed before the least cost envelope can be constructed.*

Furthermore, both water savings and cost estimates are highly uncertain for a number of the measures, so any cost envelope constructed on the basis of these measures reflects only *expected* costs. Selection of an optimal sequence of measures for planning purposes would have to adopt highly conservative estimates for water savings from any measure based on discretionary responses and demonstrate the sensitivity of the solution to the range of costs within which the true cost of any measure is expected to lie.

Nevertheless, the Taskforce approach does give both a ranking of present value costs per ML of different measures and the expected water savings by 2031 from each package of measures. What is needed beyond this is *the least cost sequence of measures that will produce expected demand and supply adjustments consistent with sustainable yield (effectively an extraction cap) in the near future and consistent with maintaining that cap to the planning horizon.*

The Taskforce estimates hint at such a profile, bundling together, (in increasing order of present value cost) 'existing programs,' water efficiency measures, SCA options and supply augmentation / substitution.

However, these long run *social* marginal costs are not the immediately relevant costs for the *regulation of prices.* The costs that should underpin prices are the costs of the water operators, SWC and SCA. that form part of this future cost profile.

Operator long run marginal costs

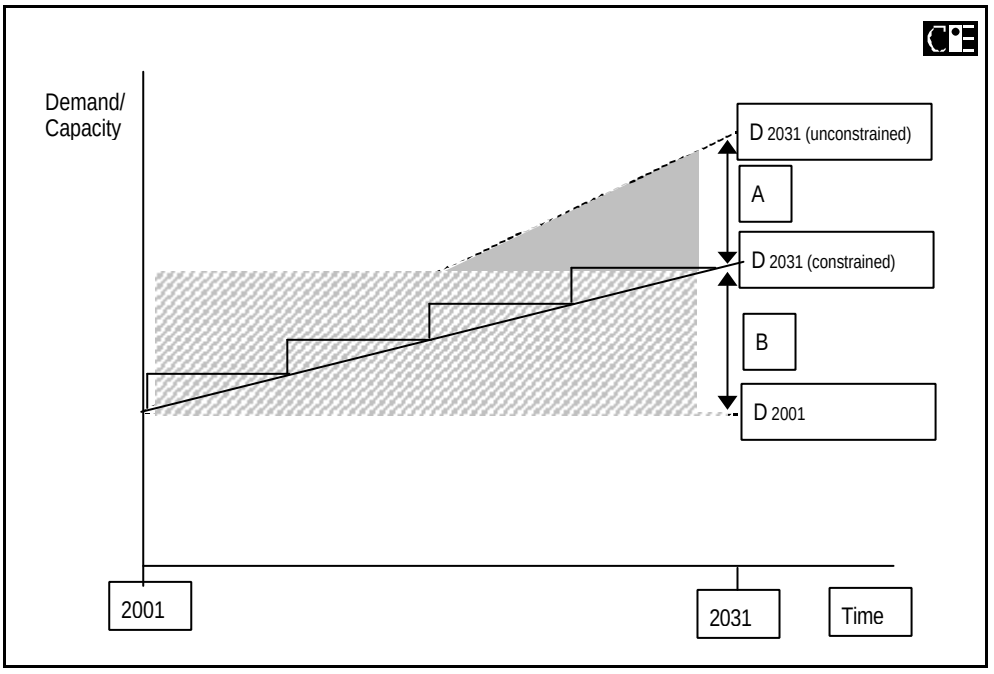
In line with Council of Australian Governments (COAG) agreement reached in 1994, prices for water should cover the full cost of supply in urban systems. This gives both wholesale and retail prices *a revenue*

generating task. The price paths set by IPART have to be sufficient for both SCA and SWC to recover their efficient costs, preferably over the course of the regulatory period, including any predetermined return on the capital stock used to supply their respective customers.

The prices also have a *signalling* task in conveying to water users the costs *to the agencies* of accommodating changes in demand and inducing changes in demand to achieve balance with available supplies. The relevant concept here for guiding price setting is *agency or operator long run marginal cost*. The LRMC schedule will be a view of costs of adjustment stretching out into the future.

The use of long run marginal cost *of the operator* as a guide for setting water prices is now well established in some jurisdictions. In the UK for example the regulator (Ofwat) requires individual water companies to submit estimates of their LRMC for price determination purposes. These estimates are required to include the costs of demand management measures as well as the costs of any augmentation. (See chart 3.1 which illustrates the costs from a 'twin track' approach will comprise the costs of reducing demand by the light shaded area and increasing capacity in blocks by enough to ensure there is always sufficient 'headroom' while demand management measures are lowering the baseline demand profile.)

1.1 **LRMC average incremental cost approach for a 'twin track' supply/demand balance program**



Data source: Ofwat (2001, Report C).

These long run operator marginal costs reflect the timing and sequence of a series of measures that an individual utility considers optimal in balancing water demand and supply in its market area over a given time horizon – typically 30 years. In that sense they are the least cost solution *for the individual supplier*.

There are a variety of methods for estimating the long run marginal cost schedule of a water supply operator. Under the so called average incremental cost method, LRMC would be estimated as 'the present value of the costs of the operator's schemes required to close, and keep closed, the supply deficit, divided by the present value of the schemes' contribution (in ML each year) to supply / demand balance'.

Viewed in this way long run marginal cost involves not only any costs of capacity expansion to meet total demand but also investment in demand management.

This means that SWC would formulate an efficient investment schedule for achieving supply–demand balance over a twenty or thirty year period and include efficient demand management costs where they form part of that schedule. In SWC's case they will certainly do so because of the relatively cheap water savings to be made from leak and pressure reduction measures over the next few years, according to Water CEOs estimates. This investment schedule might include future investments in recycling if these form part of the least cost schedule for satisfying future demands, in this case demands for water for outdoor and some industrial use.

These operator long run marginal costs do not include the costs that water users themselves bear in adopting water saving technologies or designs. To include them when formulating prices would be to cause users to 'pay twice'. They do include the marginal costs of transportation and local storage and reticulation to cater for growth in consumption in some areas. And they do include the discounted (present value) costs of future demand management and supply augmentation.

Efficient price signals will be sent out to water consumers if marginal cost pricing is the basis for the usage component of the retail price. Operator long run marginal costs are the appropriate guide for that signal.

Whose costs? The role of the wholesaler and long run marginal costs

For an integrated water agency which is responsible for its own bulk supplies (as was SWC prior to the formation of the separate SCA in 1999) the estimate of LRMC would include its best estimates of the cheapest

future sources of bulk water, subject to any constraints imposed on it by government. (eg no further dam, no raising existing dam heights etc). It would include any feasible and cost efficient augmentation of what are now SCA-provided supplies.

With the separation of SCA from SWC a somewhat artificial distinction has been created when it comes to possible supply augmentation components of long run marginal costs. As discussed above, SCA as (current sole) supplier to SWC will have to formulate its own least cost investment schedule. It will face its own costs of adjustment and these costs include any measures it can take, *within the catchments* for which it has responsibility, to extend supplies, again subject to constraints imposed by government. (These constraints could include restrictions on pumping from the Shoalhaven in low flow periods, for instance.) These future costs could form the LRMC for SCA. But what of costs 'below the dam wall'? How should IPART view SCA's costs beyond the period when it has done what it can to efficiently modify and add to infrastructure in the catchments under its control?

SWC pays SCA a wholesale price for the raw water supplied by the SCA. That wholesale price is adjusted by IPART through the regulatory process. When opportunities for efficient works in the catchments are exhausted SWC as a commercial operator must source additional water and water savings at least cost. If SCA is given the opportunity or responsibility to offer augmented supplies to SWC through investing in alternative technologies or purchasing substitutes for environmental flow releases, its future costs could become part of wholesale prices for pass through to SWC *if they represent part of the least cost solution for SWC in achieving supply demand balance.*

The long run marginal costs of *bulk water* form part of the long run marginal costs of SWC's operations. The scarcity of bulk water needs to be conveyed to *end users* but as part of a *retail* price that that reflects the LRMC 'at the meter' and involves both demand management and bulk water augmentation costs. The latter will ideally include expected long run wholesale costs from the most efficient source. Whether or not SCA is the provider of future supply increments beyond its catchments depends on what role is assigned to it by government and the sourcing freedoms of SWC. But the price at which it sells water to SWC should ideally reflect the cheapest price at which SWC could expect to source that additional water from SCA or elsewhere.

This poses a number of problems for IPART as the price regulator.

4 Possible roles for the wholesale prices

IN SYSTEMS WHERE WATER is available in catchments in such quantities relative to current and future demand that no foreseeable scarcity issues arise, the price of the bulk water need not carry any scarcity pricing signal. The bulk water price should simply cover the costs of impounding and releasing it for use in an environmentally sustainable way.

The wholesale price 'at the dam wall' could then be set at or around marginal cost of 'production' — short run marginal cost -with a fixed charge being used to recover other costs and ensure financial viability. In SCA's case, variable costs are minimal but the volumetric tariff has been set at 11 cents per ML. Roughly 50 per cent of assessed revenue needs of SCA are currently recovered through this price applied to bulk water sales, principally to SWC. The remainder is recovered through a fixed charge. The assets have to be maintained but these costs do not vary much in response to changes in consumption.

With the reappraisal of the environmental requirements of the Hawkesbury-Nepean system, and higher than forecast population growth, it has become clear that existing levels of extractions of bulk water, when combined with adverse impacts of discharges into the system, have an environmental cost which the government may view as unacceptable. It is likely to be addressed through a modified regulatory approach that both allocates increased water to the river systems and caps extractions rather than relying exclusively on price signals, mandatory efficiency measures in new buildings and discretionary non price demand management largely conducted by Sydney Water to meet reduced per capita targets.

What is the role of the wholesale price in this environment? Should it remain a cost recovery tool reflecting the need to recover capital and operating costs of the existing SCA system? Is it the appropriate instrument for addressing market failure? Is it part of the price signalling arrangements to signal scarcity? To drive increased demand management effort?

To provide incentives for reductions in potable use? To collect a 'resource rent' return in the presence of this scarcity?

Wholesale pricing to recover costs or signal scarcity?

The wholesale price as a means of recovering environmental costs

Additional *compliance capital costs* for SCA are a likely result of the government acting on recommendations for enhanced environmental flows Recovery of these compliance costs would be subject to the normal IPART process and could be expected to be passed through to SWC and on to consumers in the normal way. Under current arrangements it is immaterial from the consumer perspective as to whether they are charged as volumetric or fixed charge increases, as *all* SCA charges to SWC are recovered through the SWC volumetric charge.

The community as a whole is the beneficiary of an improved Hawkesbury-Nepean in-stream environment. The extractive users — dominated by SWC customers — are the impactors giving rise to compliance expenditures by SCA. Cost pass through of increased compliance costs as part of an increase in both the wholesale price and the volumetric component of the retail price would be consistent with an impactor pays approach.

The use of increased wholesale prices, fully passed through to final users, would be an appropriate way to 'internalise' external costs of water extraction and so help correct a market failure. But should they have an expanded role?

The wholesale price as an indicator of bulk water scarcity

Increased minimum environmental flows also require that the SCA have the water *available* to make these releases and to satisfy SWC's demands It is not able to simply 'turn off the tap' to SWC. It must augment its supplies, if permitted, through transfers or, if permitted substitute treated effluent for releases. In either case, additional costs will be borne by SCA. From one perspective these are another form of compliance cost that reflect the decision to rectify environmental damage, and supply increased environmental goods in the form of in-stream water. But they are also part of the costs of achieving demand-supply balance, provided they are part of the least cost sequence of measures from a whole of system point of view. They form part of the long run marginal costs of the SCA and, passed through, would form part of the LRMC of SWC.

When looked at as a whole, and setting aside the fact that SCA and SWC are separate entities, the least cost response to achieving demand-supply balance may well include investment to enhance inter valley transfers. Preliminary estimates of the costs of increased pipe infrastructure and storage have been established. These incremental costs, expressed in present value or 'levelised' terms[8] are an indicator of the scarcity of bulk water. Marginal cost pricing suggests that water sold to SWC (and to others) by SCA should be charged at a wholesale volumetric price that incorporates these incremental costs. The next question is should *all* units sold reflect these marginal costs?.

A practical issue would be whether the current volumetric wholesale price of 11 cents per kL is higher or lower than that 'marginal cost' price. The presumption would be that it is lower.

If the wholesale price on *all* sales is adjusted upwards to reflect bulk water marginal costs, a 'scarcity rent' component will be captured in the value of wholesale sales as all bulk water is being valued and sold at the cost of augmenting supplies, not just the 'additional' water made available.

The revenue needs of SCA would be met through this adjusted volumetric charge (which would be set as part of a price path) and through the fixed charge, which could be adjusted (downwards if necessary) to ensure that SCA expected revenues do not exceed its full costs.

This raises a fundamental question for governments on whether they wish to treat water potentially as a scarce (but renewable) natural resource for revenue raising purposes, or focus only on cost recovery. It also raises the question of how forward looking wholesale prices should be, given the uncertainty of costs associated with future non catchment based supplies.

Eventually, population growth and adverse climate change may mean that additional demand management effort and 'within catchment' measures no longer offer cost effective means of maintaining balancing supply demand balance. When SCA has exhausted cost effective works within its catchments and the cost of these have been passed through ('washed out' of) the LRMC profile does this mean that SCA's long run marginal costs will fall away and with them the appropriate scarcity signal incorporated in the SCA wholesale price? The answer is, in principle, 'no'. SCA's costs of further augmenting supplies become effectively whatever the next cheapest option is — again from a whole of system point of view- outside the use of

[8] 'Levelised costs' are calculated as the present value of future costs divided by the present value of the water savings/increased capacity resulting from that expenditure.

the catchment-based harvesting of resources. This is, in principle, the appropriate cost to incorporate *as a scarcity signal* in the ongoing regulated wholesale price for all water sold, even if SCA is not the body that ultimately provides that capacity. What to do with the revenue that it generates is a separate issue.

The main practical difficulties in implementing this approach are common to a number of the other proposed roles for the wholesale price. Least cost augmentation or water substitution options have future costs that are imprecise and highly uncertain. The use of a 'high' wholesale price that puts out signals which are interpreted as the price at which SWC will buy wholesale supplies or at which SCA can supply SWC has the risk of encouraging private sector investments and demands for access to SWC's waste water that may turn out to be costly and premature augmentations.

This problem is also present if the wholesale price is used as tool for implementing an overall cap on extractions of water from the system.

The wholesale price as a means of implementing a cap on extractions

A formal cap on extractions from the Hawkesbury-Nepean system would be one indirect means of delivering established environmental entitlements. It is a means of establishing how much water has to be saved or sourced by other means if SWC and other minor extractive users are to comply with these entitlements. But how would it be implemented?

One means would be to introduce an interim target of, say, 570 GL to be reached in three years and a tighter cap of say 550 GL in six years , with water consumed above the cap charged out to SWC at prices 'reflecting scarcity'.

This is broadly in line with the proposal contained in the DEC submission to the IPART review. There are also suggestions that an immediate cap, somewhat looser, could be applied and gradually tightened to the level consistent with chosen environmental flows and sustainable yield estimates.

The wholesale price is first and foremost a cost to SWC and other (minor) bulk users. What incentive effects it has for SWC, and what impact it has on either the level and growth of retail demand, or on the efficiency with which that demand is met, depends on its relationship to the retail price.

If a formal cap is imposed, there are issues as to how pricing, and wholesale pricing of catchment supplies in particular, can best assist:

- *transition* to that cap; and
- long term *compliance* with the cap at minimum cost.

The wholesale price as a means of removing the incentive for SWC to make purchases from SCA that exceed the cap.

In its Issues Paper the Tribunal canvassed the idea of a wholesale *step* price as a neutralising device for removing the incentive for SWC to sell water beyond a given volume. That volume could be the cap or some value set relative to the cap. If SWC were able only to retain revenues on sales beyond the cap sufficient to break even on the cost of making those sales, the incentive to make them would be removed. This could be done by raising the wholesale price on those 'above cap' sales, but not allowing its pass through to customers. Unlike some other proposals, pitching a wholesale price at this level will not provide any additional incentive for SWC to increase demand management effort.

This is not a strong incentive mechanism for avoiding breaches of the cap. It does however recognise the realities that SWC has only limited control over the level of demand. It entails 'revenue adequacy' problems for SWC (and, therefore, for the price regulator IPART) given fluctuations in sales driven by weather conditions.

The profit margin increases with sales. This would mean that the wholesale step price would need to vary with volumes sold above the cap if it were to exactly neutralise these profits.

There is the further issue of what price to charge for bulk water *up to the step* point. By one argument the SCA can continue to supply water up to sustainable yield indefinitely without augmentation and water should be priced up to that point at *short run marginal cost* with fixed charges to recover costs on existing capital. This would exclude longer term SCA adjustment costs and the costs of its role in a least cost solution to the demand supply balance problem. However, if these forward looking costs — the incremental costs faced by SCA that are incurred as part of a least cost strategy to balance demands and supplies — are to be recognised in the wholesale price, there is an argument that they should be passed through in the wholesale price of *all* water sold to SWC and others. This treats water at the bulk level in a symmetrical way to the pricing of water at the retail level if long run marginal costs of the operator are the basis for setting usage prices.

The wholesale price as a penalty price for SWC

Both DEC and the Hawkesbury-Nepean Forum advocate:

- charging a wholesale price to Sydney Water which reflects SCA costs (including compliance costs) up to the cap or target extraction level, and at long run *social* marginal cost price above that, with no provision for recovery of the higher cost of 'above cap' water in the retail price;[9] and
- payment of proceeds from the penalty price into a fund for which there could be bidding by those with implementable water saving proposals.

Consistency of penalty prices with an integrated planning approach?

Used as a penalty price to SWC, the social LRMC price on purchases above the cap would stimulate expenditure on demand management and or augmentation /substitution investment up to the point where these were more profitable options for meeting demand by SWC than buying bulk water at penalty rates. Its nature as a penalty price would mean that it would have no *direct* impact on retail customers. However, the stronger the penalty the more 'insurance' SWC would wish to take out through other measures.

Under the DEC proposal, *efficient* SWC expenditures on demand management measures are themselves part of an integrated planning (sustainable water plan) approach. If *all* the demand management measures put in place by SWC are part of an agreed integrated planning approach they will be efficient by definition. Failure to meet cap extraction levels would then be a result of factors beyond SWC control, provided the agreed measures are implemented. Penalty prices would have no useful role under this scenario.

Only if SWC demand management measures are partly or fully discretionary can the step or penalty wholesale price perform as a regulatory incentive. How useful a tool is it likely to be?

If the wholesale price for 'above cap' sales is set at social LRMC it will reduce SWC profits whenever the cap is violated and will stimulate SWC demand management effort. The question is will it stimulate an optimal amount and sequence of such effort, viewed from a whole of community perspective? There are dangers of over stimulation, especially given the

[9] However, under this proposal, the *retail* price on *all* water would be adjusted upwards to reflect increased SCA compliance costs and increased demand management costs.

other demand limiting influences that will be at work through the retail price over time. There is the further uncertainty of what any water savings might result from the funding, when these might occur and how these could be incorporated in the integrated planning approach that underpins the scheme.

The use of revenues from 'excess' sales

The revenues generated through penalty pricing could be used under this approach to subsidise other water saving initiatives proposed by a variety of parties, or to address damage to the Hawkesbury-Nepean. However, the revenues will be uncertain and variable and the more successful the measure the lower will be the proceeds.

Step wholesale prices and financial viability.

There is also a question of financial viability for SWC and SCA. The regulated level of the *retail* price has implications for the effect of any such step on SWC. If the retail price is set to cover fixed and variable costs (including the cost of bulk water purchases) forecast to be *at the level of the cap,* in low water sales years (exceptionally wet years or drought years) SWC will sell less than this and incur losses which could not be recovered through above average sales in more favourable years. The revenue skimming arrangement of either a 'neutral' or penalty step price would prevent any such recovery. Financial viability would therefore require the retail price to be set above a level that recovered fixed and variable costs at volumes that used the cap as the forecast average.

Because of the nature of SWC costs, its average costs fall as it sells more water and so the profit margin on large volumes is higher than that on low. This is part of the perverse incentive facing SWC that some form of modified wholesale pricing is supposed to address.

If the regulator were to set retail prices to allow full cost recovery on forecast (average) sales that are *lower* than the cap (implying the need for a higher margin per kL) this would also require an adjustment to the wholesale step price needed to strip out any profit when sales *exceed* the cap. This would add another layer of complexity to the regulatory task. But if successfully managed it need not impact on SWC financial viability.

However, if a penalty price were applied in the form of a wholesale price at social LRMC for above cap sales, thereby imposing losses on SWC for above cap sales, risks to financial viability of SWC would be introduced

through any recurring breaches of the cap could not be readily addressed. Indeed the whole purpose of a penalty wholesale price would be to eliminate above cap sales through their adverse impact on profitability and dividends.

Financial viability of SCA

The question of financial viability for SCA under any two tier wholesale pricing arrangement is also at stake. SCA has no effective influence on the demands which it must satisfy under its licence. The principles of efficient risk bearing would be violated if SCA's ability to meet its costs were made more uncertain by making them dependent on sales above the cap. This suggests that the existing fixed and variable components of SCA's price should be set so as to generate sufficient revenue *from capped sales* to cover expected costs. The levels of the fixed and variable components of the charge would need to be adjusted to reflect its increased forward looking costs in the per kL charge. Revenue from above cap sales would not revert to the SCA under this arrangement.

Other incentive mechanisms for delivering demand management effort and helping to implement the cap on extractions

A sales review-price adjustment approach?

Over the period of a price determination, prices would be set to recover expected costs on a sales volume 'forecast' equal to the cap. This would allow for a 'loose' cap whereby above cap sales in some periods would be allowed to cancel out with below cap sales in others. Provided the cumulative total of gigalitres sold over the determination period was at or below the cumulative volume permitted by the cap, no further adjustment would be required. Thus if a cap were set at 600 GL per year and tightened by 10 GL in successive years, sales of 2900 GL over five years would be allowable for revenue retention purposes. Only in the event that total sales exceeded this would some adjustment be required. This approach allows the business some 'insurance' against under-recovery in any *individual* year, given that it has the prospect of recouping that in later years.

This adjustment could take the form of a reduction in the fixed component of the retail price at the start of the *next* price determination period. (Use of the fixed component would be likely to have less undesirable signalling effects for consumers. If the usage price were reduced this would weaken

its desirable role in communicating scarcity costs. It would also have an uncertain impact on revenue.)

There is still the problem of at what level to set the retail price for the forthcoming determination period such that SWC can be expected to recover its costs. In this respect the sales review and price adjustment method faces the same difficulties as the step wholesale price mechanism previously discussed. SWC will need to make its sales at prices to customers that allow it to cover costs without relying on above cap sales. If the usage price component is set with reference to long run marginal cost ('at the meter'), this means that the fixed component will have to be large enough for SWC to expect to recover its costs from sales at or below the cap. If unpredictable effects drive sales volumes below the cap for one or more periods and the regulator has set prices based on capped sales, under recovery will result. If IPART set prices based on 'expected' sales somewhat below the cap and actual sales turn out to be at or above the cap in each period, some over recovery of costs may result.

If sales reviews and adjustments were used by the regulator to retrospectively remove *all* revenues from sales above the cumulative cap on quantities — and not just the gross margin element — this would not leave SWC indifferent to any such sales as it would effectively lose profits in the *next* determination period as a result of them. This penalty element may discourage any tendency on SWC's part to be lax about sales above the cap.

A sales review and price adjustment approach which worked through adjustment to retail prices in *future* regulatory periods would leave *wholesale* prices without a regulatory role. It would not necessarily mean that some change to the structure of wholesale prices could not, or should not, occur. It would leave open the question of whether the per unit volumetric wholesale price should be raised to signal scarcity and scarcity related costs.

A rewards and sanctions approach

SWC, in its submission to the price restructuring review (Sydney Water 2004) has canvassed the idea that a more effective and equitable mechanism for inducing increased demand management effort than a step wholesale price would be to reward any *over achievement* of targeted sales reduction quantities. In the context of a cap this would mean annual adjustments to the *retail price* through a 'D-factor' This would require the following according to SWC:

> Sydney Water would be penalised for every unit of water sold in excess of its cap. The penalty would be effected through adjusting (retail) prices in the

> following year such that Sydney Water's forecast revenue was below that required to earn the forecast return. It would therefore lose financially in this situation. By contrast, it would receive bonus revenues for every GL less than the cap… (Sydney Water 2004, p. 57)

The danger with this is that it could again lead to a level of demand management expenditure which is not optimal. With cost pass through of demand management costs available to SWC, the Tribunal would then have the difficult task of deciding what comprised prudent demand management expenditure. But prudent expenditure would be that estimated to lead to targeted savings, not overkill. Any better-than-target outcomes would therefore be, in a sense, windfall and the case for rewarding them dubious.

This approach also introduces potential retail price instability which can have adverse effects on customers. Unlike the revenue capping approach discussed above, this adjustment of retail prices is proposed on a year to year basis.

Forecasts and risk

Regulators of utility businesses such as urban water and energy typically rely on forecasts of consumption provided by the agencies to anchor maximum prices or to set a revenue cap which is intended to recover expected costs based around that level of sales. The agencies are usually the best placed to formulate these forecasts.

In the absence of a cap on gigalitres sold there is an incentive for the retailer to *underestimate* sales and enjoy the additional profits from 'larger than expected' sales when they occur. The business bears the risk when prices are fixed and volumes are variable. Downside risk (the risk to both revenue and profit of the business from lower than expected sales) is increased *relative* to expected returns to the business if sales (for revenue purposes) are capped from above. That same increase in relative downside risk would accompany the imposition of wholesale step prices designed to remove the incentive to sell above the cap. These influences may encourage the retailer to further understate forecast sales as a mechanism for increasing profit margins to compensate for risk.

Increased *price* risk is imposed on *consumers* if the regulator instead decides to adjust *retail* prices within the regulatory period to smooth out retailer revenues and remove 'above cap' sales revenue benefits while compensating for below 'target' sales. This risk of retail price instability is

still present but dampened if retail prices are adjusted only at the next regulatory period.

The level of profit risk is a consideration when deciding on what expected rate of return businesses like SWC and SCA should be allowed to target on their invested assets. If that risk increases with a change in regulated pricing structure, the businesses will seek to have this reflected in the allowable rate of return that forms part of the cost 'building blocks' when IPART is considering their revenue needs. A higher rate of return, other things equal, means a higher price structure.

Any increased likelihood of more frequently imposed restrictions (a form of regulatory risk), greater reliance on new demand management measures and changes to urban planning parameters (less reliance on infill, more on new housing areas) can arguably change the profit risk face by SWC.

Therefore, SWC can be expected to seek prices which boost its returns on each kilolitre sold below an imposed cap to:

- recover costs off a lower sales base that would otherwise generate smaller gross margins; and
- accommodate increased profit risk in a quantity capped environment.

5 *Links between wholesale and retail prices, non price measures and the cap*

Retail price restructuring

A single usage based retail price?

Pass through of any stepped wholesale price at the retail level affects both the incentives facing SWC from any such arrangement and the possible impacts on and reactions from customers.

Arguments for further restructuring of the retail price have been mounted both in the context of wholesale step prices and in their own right.

DEC (2004 op cit) has called for a single tiered one part tariff for water, removing the fixed charge component and replacing it with a per kL charge that reflected LRMC of implementing a sustainable water plan and was sufficient to meet the full costs of SWC, excluding any purchases of bulk water above the cap. Presumably the LRMC would have to exclude consumer based costs otherwise the price would involve double charging. The removal of any fixed element from the retail charge would expose SWC to some greater revenue risk and profit risk, the latter being the more relevant. This could in turn trigger arguments for an increased rate of return component in the price.

Usage prices at the retail level are the best available vehicle for signalling to customers the opportunity costs of increased water use, including the future costs of matching future demand with supply. They do this best when they do not contain other cost components. A single usage charge (with no accompanying fixed charge) that has to do the job of recovering all of the water services costs, including returns on existing capital, is less able

to do this as clearly as a usage component that just targets LRMC[10]. This same problem of mixed messages arises with multi tiered usage prices.

A two-tier usage price (inclining block tariff) at the retail level

The Tribunal in its issues paper has raised the question of a two tier usage price at the retail level, both in the context of two tier wholesale pricing and in its own right. As an example the current charge of 98 cents might apply (with future increases to address increased costs) up to say 300kL per year with the customer then paying a higher rate for all consumption above that. Price structure of this kind are used in the ACT and in South Australia.

The arguments against two tier retail pricing in its own right fall into three broad areas.

- It is more complex administratively (applying the threshold for other than residential use by single dwellings creates difficulty) and less easily understood than what we have now.
- It may impose inequitable burdens on large families.
- It cannot easily target operator long run marginal costs. If the first tier price targets this then all those consuming above the threshold are paying more than the true scarcity cost of water. If the higher tier is set at LRMC then the majority of users who (typically consume below the threshold unless it is set very low) will not face the 'efficient' price.

In its favour is the ability to penalise 'water wasting' and to send a general conservation signal and to impose one interpretation of equitable pricing – that those who consume more should pay *disproportionately* more. Increasing block pricing can be used to cushion the impact of recovery of any increase in water service costs for the majority of users by increasing the gap between first and second tier prices.

A retail step will be a mechanism for implementing one view of equitable imposition of scarcity induced price changes. There is no efficiency based argument for precisely determining the location of such a step. There may be some efficiency based grounds for using the step to target the most discretionary and elastic use and, therefore, getting the most out of the price instrument in an equitable way.

[10] If LRMC is sufficiently high, however, a usage price pitched at that level may automatically recover rate of return, depreciation and other cost elements without the need for any fixed charge. It may turn out that, on calculation of current LRMC, Sydney Water is approaching that position.

Aligning wholesale and retail steps

If a wholesale step price were introduced at the level of the cap, is there merit in trying to align a retail price step with this?

If the cap is to have its desired effect and be largely binding, then SWC would only exceed this level of sales periodically or during a transition period in which further demand management / augmentation measures are being put in place. The proportion of total consumption exceeding the cap would vary in those years in which violation did occur. There would be a difficulty in trying to assign a fixed step retail quantity to 'match' excess consumption. It would be a formidable regulatory task to try to adjust the location of the retail step to penalty price a segment of the population whose aggregate 'excess' consumption matched the aggregate above cap demand of SWC.[11]

Furthermore, to try to do so would introduce a further layer of price variability and complexity within any regulatory period. The step would need to be fixed for the regulatory period.

Such an approach would provide a temporary match between the (immediate past) average excess bulk consumption and a threshold for the step retail price. The (price) level at which to set the second tier retail tariff is a separate issue, as discussed above.

A two tier retail price would also complicate the task of imposing the wholesale step price as a means of neutralising any profits for SWC from above cap sales. This mechanism relies on knowing the retail price and the profit margin it creates on sales above the cap. When there is a single retail usage price, water volumes and sales revenue move in proportion to each other and the 'required' wholesale step price can be determined. However when some sales occur at 'tier two 'prices there is no single retail price with which to make this calculation.

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[11] One possible mechanism would be to do the following:

- once the wholesale cap has been determined (eg 600GL), estimate the average excess bulk consumption for the past three years (eg 20 GL);
- choose an arbitrary retail threshold for residential consumers (eg 400kL) and calculate the average 'excess' consumption (ie the amount above 400kL) for members of this group;
- calculate the total excess residential consumption by consumers using 400kL or more; and
- compare that with total above cap consumption and readjust the retail threshold (from 400kL) until a match is achieved.

6 Conclusions

PROPOSALS TO CHANGE THE STRUCTURE of the wholesale price of water sold by Sydney Catchment Authority — by introducing a step price — carry inherent dangers. And they may not be the most efficient way to achieve longer run balance between water demand and supply in the Sydney region.

The use of a step price as a penalty price on Sydney Water for purchases above a cap related to catchment sustainable yield is hard to reconcile with an integrated planning approach to balancing demand and supply. That approach relies on water operators adopting measures which are part of an agreed, communitywide, least cost *sequence* of measures aimed at achieving and maintaining balance.

The long run *social* marginal cost of water, which includes costs of water saving investments by consumers, as well as future costs to operators, is an indicator of future scarcity. But it is not an appropriate target for either a wholesale step price or a retail price. Used as a retail price, it would result in some consumers paying twice. Used as a penalty step wholesale price, it could induce Sydney Water to engage in strategic behaviour. If forced to buy its 'excess' supplies at a price based on an estimate of social LRMC, Sydney Water may be induced to engage in excessive demand management expenditure or invest in relatively high cost alternative technology, pre-empting access and recycling initiatives by others.

That same penalty wholesale price, if sufficiently high, could indeed act as a signal to others to invest in large scale works to offer substitute supplies at that price. In the medium term, a combination of demand management and 'within catchment' measures to augment supplies may be more efficient.

IPART sets water prices in the absence of an active market for urban bulk water. In doing so, it has to be careful that the signals sent by those prices do not bring forward investment in solutions which, if deferred by some years, might be available at lower cost, on a different scale and, possibly in combination with other emergent supply alternatives. A step wholesale

price, based on estimates of social long run marginal cost, would carry that risk.

This does not mean that wholesale water prices have no role to play in signalling the costs of addressing any demand–supply imbalance. Nor does it mean that it is desirable that Sydney Water should continue to experience its current profit-based incentives to sell SCA water at volumes that exceed estimated sustainable yields. A wholesale step price can be used to neutralise that incentive. But this requires a predetermined retail price and possibly difficult-to-estimate year to year adjustments to the wholesale price. A review of sales volumes at the end of a regulatory period of several years may be a simpler alternative. A subsequent adjustment to the fixed component of the retail price could be made to reduce future SWC earnings in the event of total sales over those years exceeding total 'allowable' (capped) sales.

IPART faces a challenge to set cost–reflective wholesale prices for SCA that are also forward looking. To do so, it needs reliable estimates of the future efficient costs of implementing compliance with environmental flow requirements and augmenting supplies through intervalley transfers.

SCA's augmentation costs should be able to be estimated with some confidence. But other augmentation costs 'below the dam wall' are considerably more speculative and strategic behaviour by potential suppliers can make them more difficult to estimate. It seems likely that intervalley transfer costs are among the most cost efficient measures for achieving and sustaining balance in the medium term.

As such, the present value of these wholesale water costs could be part of an appropriate price signal to feed through to SWC and in turn to consumers. This can be done by including these costs in the volumetric wholesale price for all water sold by SCA. Compensating changes to the fixed price component may be needed to ensure there is no over-recovery of SCA's revenue needs.

The inclusion in current wholesale water prices of other expected future augmentation costs — costs which will not necessarily be incurred by SCA — is more problematic. Such costs form part of a twenty or thirty year view of bulk water costs. But in considering them for inclusion in current SCA wholesale prices, IPART would need information on the likely cost *range* of each option. Where this is very broad and the estimate of long run marginal cost of bulk water includes these components, LRMC estimates could vary widely. IPART faces a trade off if it decides to link water prices to LRMC. The longer the view it takes the less informative the price signal.

Whilst wholesale prices influence investment decisions by suppliers, the retail prices set by IPART are the prices that influence water *use*. Long run marginal costs 'at the meter' are a desirable benchmark to use when setting the usage component of the retail tariff. But they too become increasingly uncertain as more distant, potentially high cost, measures are added to the costings of current SWC programs for leakage reduction, pressure reduction etc. IPART faces the same problem of choosing between a longer horizon and greater precision in linking retail prices to long run marginal costs.

Stepped wholesale prices are not easily aligned with retail prices. And if a *two tier retail price* is considered desirable for equity reasons or to send a reinforced conservation signal to consumers, it may be impractical to link this to the wholesale cap on extractions. Advocates of increasing block tariffs should accept that IPART may be faced with setting a second tier retail price at a usage threshold that is arbitrarily determined, rather than being linked to any wholesale extraction cap.

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