Richard Clark and Associates

WATER PLANNING FOR A SUSTAINABLE FUTURE

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SUBMISSION TO ESCOSA ON SA WATER PRICING AND EXTERNALITIES.

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Author's CV

Richard Clark was the Senior Hydrologist in the EWS Department for 15 years from 1976. As early as 1990 he authored the landmark paper *Asset Replacement – Can We Get It Right?* published in the Australian Water Association journal *Water*. In this he argued the need for institutional reform of the traditional water authorities and for fundamental changes to the traditional water systems if costs were to be reduced and the challenges of Ecological Sustainable Development (ESD) met. (Reference 1). **These insights are still highly relevant.**

On the corporatisation of SA Water he became a hydrologist/water systems researcher within DENR, as the State's (then) major water planning agency.

In 1991 he won the open competition for the design of the MFP trial 60 house New Haven Village water system. He was seconded to the CSIRO and extended the New Haven design to the follow-up 5000 house Mawson Lakes project. During this time he initiated and co-developed the WaterCress model for the investigation and design of integrated urban water systems. This was used for the design of the Mawson Lakes water system and subsequently for the design of the majority of the stormwater capture systems established by Local Councils and private developers in Adelaide. During this time he also teamed up with staff from the (then) Department of Mines in the trialling of Aquifer Storage and Recovery (ASR) as a vital component of low cost stormwater capture schemes in Adelaide.

His analysis of the relative costs and benefits of alternative urban water systems lead him to be active in speaking and writing widely on the need for and benefits of change. Reference 2 written in 1993 warns of the likely rising costs for the replacement of underfunded ageing water assets from the period about 2030 to 2060 and the risk of further rising costs for the majority if the few, but much larger industrial/commercial customers, departed the centralised communal system for lower cost alternative systems.

In 1995 he undertook a $300,000 team project for the Federal Government "Building Better Cities" program. This investigated the Adelaide total water balance situation and the feasibility, costs and benefits of utilising stormwater and wastewater for water supplies. This approach utilises the sustainability concepts of Integrated Urban Water Management (IUWM), as had also been adopted at Mawson Lakes.

In 1997 he left DENR in disgust at the lack of interest in urban water the Department was showing in the face of the increasing water demand, the likely impact of climate change and the obvious rapidly emerging non-sustainability of the Adelaide water systems.

Richard Clark and Associates has continued to use and develop the WaterCress model in numerous applications in water systems modelling, including for DEWNR, SA Water and Local Councils. He is a past president of the Stormwater Industries Association and a member of the Water Industry Alliance and the SA Hydrological Society.

Since leaving the Public Service Richard Clark has continued to publish articles and give public talks on the need for adoption of integrated urban water planning, particularly as applicable to the Adelaide water situation.

OVERVIEW OF SUBMISSION

This submission is made in response to the ESCOSA request for public comment on matters related to SA Water's pricing for drinking water supplies, sewerage disposal and recycling.

In respect to the aspects of pricing identified by ESCOSA, this submission directly addresses:

1. the lack of customer choice for alternate lower cost water services.
2. the under-utilisation and inefficient use and deployment of existing water infrastructures.
3. externality costs of SA Water's water systems and operations.
4. the lack of Government activity and accountability in planning for lower cost water services.

However, it is suggested that pricing reform cannot, by itself, correct the fundamental large inefficiencies that the SA public has inherited in respect to;

- the layout of its present water systems and
- the arrangements for analysis and planning of improvements to their layout.

Thus, while improved pricing policies over the short term may assist, experience over the past 2 decades indicates that little change in respect to fundamentally reduced costs can come about until the Government:

- formally recognises the need to adopt a new paradigm for urban water systems based on the nationally and internationally endorsed concept and implications of Integrated Urban Water Management (IUWM) and
- makes changes to the arrangements for water planning to ensure that the investigations, re-design and progressive replacements of the present water systems can be carried out in a manner compatible with the concepts of IUWM and the interests of the communities dependant on them .

Without these changes the costs of water to SA Water customers is likely to continue to rise as existing under-funded ageing assets wear out and need to be replaced and high cost desalinated seawater makes up increasing proportions of the supply mix. If the changes are made and new water systems are brought on line as the ageing assets expire, there appears to be scope for significant cost reductions.

It is trusted that ESCOSA will take these longer term considerations into account in making its recommendations.

Appendix 1 gives a short summary of IUWM.

1. **LACK OF CUSTOMER CHOICE**

The customers of SA Water require water to be supplied for many purposes. These require water of different qualities. It is well established that water for activities such as toilet flushing and garden watering, which make up 70% of water demand, do not require drinking water quality standards. Suitable lower quality water is widely available in the form of stormwater and wastewater which, with appropriate planning, could be supplied to all new developments (and progressively retro-fitted to existing developments) at significantly lower costs to the consumers, as has been demonstrated at Mawson Lakes and many other locations and situations.

Unfortunately, SA Water, on behalf of its customers, has inherited a water system which, with very minor exceptions, only has the capability of delivering a single quality of water. This quality has been chosen as drinking quality. The quality standard for 'drinking' water has also been rising under public health pressures. The obvious inefficiency of this 'gold-plating' choice is now becoming apparent. What is more, as a panic move brought about by years of poor or inadequate planning, SA Water has recently invested in a seawater desalination plant which has the stand-alone capacity to produce more than half of the present total water demand for Adelaide, but at a quality which is even higher than required for drinking, at a cost far higher than could be have been provided from stormwater (utilising aquifer drought storage) within only a short lead time of say 3-6 years.

The USHO Study (Reference 3) identified that 50 GL/a of stormwater could be harvested for non-potable uses in Adelaide utilising wetlands located within existing open spaces for capture, and underlying aquifers for longer-term storage. This system has been successfully demonstrated by many schemes already in operation in Adelaide. Using this system, the Northern Region of Councils have already built infrastructure to enable it to enter the water supply market with water of a lower quality, suitable for up to 70% of the water needs of the local region. However, extending this opportunity to residences is however understood to be presently frustrated by residential customers of this 'new' water:

- being faced with high costs for the initial pipe distribution network, while
- still being required to pay fixed charges to SA Water for the operation and maintenance of their share of the SA Water distribution system which would not be so fully utilised if they switched a large part of their water demand to the council's schemes.

A pricing mechanism that could assist the introduction of a second pipe network for lower quality water by third parties would see potential customers of the new water having their SA Water fixed water charge component reduced (or even subsidised) in proportion to their supply via the new water system pipelines.

The existing SA Water pipe network is often oversized, is rapidly ageing and subject to frequent bursts and/or leaks. A long sustained rise in replacement costs for pipes, commencing over the next decades, might be expected (see Appendix 2 extracted from Reference 2).

The emergence of two-pipe supply systems, new distributed source locations and decentralised sewage treatment options all add complexity to the pipe replacement problem. Since 70% of the costs of the new water systems may continue to reside in distribution pipe networks with long asset lives, it will be of the highest importance to future water customers that their networks are planned in an integrated manner with the long term in mind.

2. UNDER-UTILISATION AND INEFFICIENT DEPLOYMENT OF EXISTING WATER INFRASTRUCTURES

The recent decision to establish a desalination plant was 'sold' to the SA public as an insurance policy against future drought. The results of calculations made by the author confirm those given by ATSE in Reference 4 and show conclusively that:

- Unless stormwater and wastewater are brought into the water supply equation, the 100 GL/a desalination plant will be inadequate to carry supplies through once in 25-50 year droughts under population and climate change expectations over the next 25-50 years.
- If stormwater and wastewater are brought into the supply equation they have (and will retain) sufficient flow volume and regularity of flow to sustain water supplies through a once in 100 year drought even under expected climate change and a trebling of Adelaide's population. However,
- Urgent investigation will be needed to develop additional storage for stormwater capture and long term drought storage. The former is a matter for urban planning. The obvious location for the much larger and longer term storage is in the aquifers beneath Adelaide. Low cost injection, storage and recovery from these aquifers has been demonstrated. Research is urgently required into determining (and increasing) the capacity limits and means of operations of these aquifers under future water supply operations.

If the implications of these findings are followed through, and stormwater and wastewater are developed as non-potable water sources, the likelihood of having to use the high cost desalination plant at anything more than about 10% of its capacity after the next few years will be very low. Desalination may increasingly be needed into the future in other locations with genuine water shortage, but in view of their limited short term peak flow generation rates, they should always be introduced and operated in association with additional storage.

The desalination plant must now be paid for, but its running cost could be reduced by (for example) switching its feed water from seawater (at 35,000 ppm) to nearby groundwater (at 2000-5000 ppm), thus starting to increase the urgently required additional storage capacity in the aquifers for potable and non-potable water. It is understood that the primary cost of the plant lies in the filters. Where not required, these could be sold and/or relocated to situations where the needs are greater.

The large 'loss of face' to SA Water which are implicit with these suggestions are indicative of the enormous gap that now exists between the inefficiencies of the present water systems and the far greater efficiencies offered by the IUWM concept systems. The enormity of these inefficiencies will become more apparent once IUWM starts to be introduced. This inefficiency gap has been allowed to build up through the combination of unchecked, partial system monopoly powers in SA Water and the virtual abrogation of in-depth water systems planning by the various State water agencies since their split from the EWS Department in the early 1990s.

Stormwater is clearly a cheaper and more sustainable water source than desalinated seawater. Planning for the earliest inclusion of stormwater to replace desalinated water should be adopted by Government as a means of increasing security and reducing costs. The Stormwater Management Authority has not been given this responsibility and would require the active cooperation of SA Water if it was. There is a planning void in this area which requires urgent attention by Government..

3. EXTERNALITIES ASSOCIATED WITH SA WATER SYSTEMS AND OPERATIONS

The principles of IUWM address the whole urban water cycle as one system and seek designs which reduce unwanted externalities. Water related pollution and flooding are two major externality areas which can be reduced by involving stormwater and wastewater into the future water supply designs.

3.1 Pollution of the Gulf

Additional costs caused by the discharge of stormwater, partially treated sewage wastewater and desalination process brine to the coastal waters exist, but are poorly defined or quantified. Options exist for reducing the levels and impacts of pollution by additional processes. In the case of stormwater and wastewater various of the polluting agents can often be recovered at a cost less than the prices that can be obtained for the subsequent sales of the separated pollutants and for the pollutant-free water. The rising productivity of the coastal waters adds to the benefits. In the case of stormwater, where the capture and treatment processes involve wetlands, these are often seen as local attractions which add value to surrounding developments.

Once again, any changes to pricing for water or sewage disposal should be designed to encourage the reduction in these externalities in the most productive manner.

3.2 Flood damages

Adelaide has been progressively developed onto the natural flood-out plains of the westward flowing creeks emanating from the Mt Lofty Ranges and hills face escarpments. In the 170 years since Adelaide was founded several large floods have occurred. By chance the largest were in earlier years when Adelaide was less developed. The risk of major flooding with large damages is as present as supply shortfalls during droughts. The provision of storage is as important to flood mitigation as it is to drought mitigation.

ATSE (Reference 4), amongst others, has identified that stormwater harvesting is the next cheapest option for future water supplies. Stormwater capture is best carried out via temporary storage in wetlands. Wetlands can be designed to operate for both water supply and flood mitigation. IUWM would capture this additional benefit and provide reduced costs to both water supply and flood mitigation services.

Insurance against flood damages is urgently required for the majority of Adelaide dwellers. Insurance funds could and should (inter-alia) pay for the removal of buildings from the worst risk areas and their replacement (as appropriate) with wetland water capture/flood mitigation ponds

It is suggested that ESCOSA should look into the introduction of flood insurance as a means for introducing improved efficiency in water planning and providing urban dwellers with an essential service in flood risk mitigation with at least an equal benefit as desalination has to drought risk mitigation.

3.3 Price paid for Wastewater

Sewage costs are dominated by the fixed cost of sewers. These have historically escalated as the treatment plants have progressively moved further way from the city as the city has grown. Sewer costs could be at least halved by decentralising sewage treatment to a local scale (both the length

per service and the maximum diameters of the sewers are reduced). The costs of the odour control and additional treatment that would be required to enable publicly acceptable local recycling of wastewater would bring the cost back to about par with that being presently paid by customers of the present system. However, the local residents would then have an additional cheap source of non-potable water for the same cost as their current sewerage cost.

Sewer Mining by third parties is becoming increasingly feasible. Its early introduction will be in the long term interests of the community, and pricing policies should encourage it. However, once again, unless carried out in a planned manner, the community may have to pay for underutilised present infrastructure as well as new infrastructure.

The present SAW pricing structure for sewerage contains components which tend to perpetuate assets in their present deployment. Pricing policies should be developed to encourage switching to new water systems without risking rising costs to those unable to change to the new systems as they are introduced (or not offered the opportunity to change).

4. LACK OF GOVERNMENT ACTIVITY IN WATER SYSTEMS PLANNING

4.1 How Planning has Fallen Behind

The recognition of the need for and feasibility of improved water systems arose first via the worldwide emergence of ESD in the late 1980s. One of the local SA responses to ESD and the parallel response interest in economic reform was the corporatisation of SA Water and the setting up of an EPA and a series of separate water regulatory/planning agencies.

It is argued that if it was not for the chance acquisition of the MFP project in Adelaide in the early 1990s and its eventual chance siting in the Salisbury Council area, no innovative water schemes would have been trialled in SA at all over the past 25 years. The development of Mawson Lakes which emerged via the MFP process is the only example of IUWM at a community scale that exists in SA. The ongoing development of stormwater capture via wetlands, with long term storage in underlying aquifers, was mainly initiated by Salisbury Council as a parallel process to the development of Mawson Lakes within its Council area.

Neither SA Water nor any of the State water planning/regulatory agencies have played any significant role in the design or operation of any of these innovative water schemes. The capture of stormwater and recycling of wastewater to replace the traditional importation and sales of drinking water is contrary to the financial interests of SA Water. Wastewater for Mawson Lakes was originally planned to be treated and recycled on site (i.e. a community scale system). SA Water's involvement in supplying treated wastewater from Bolivar only came about through a construction error leading to high salinity levels in the Mawson Lakes sewage.

Since their establishment, the attention of the various State water agencies has been almost entirely taken up with River Murray matters, the creation of the NRM Boards and the assessment and regulation of rural water. The skill base in hydrology and water systems engineering has been almost entirely replaced by lawyers and general managers. The planning of water systems has therefore been left almost entirely to SA Water, which sees the maintenance and productivity of its existing

assets as it only and primary task. These assets have greater than required capacity (it is only the water that flows through them which is limited) and thus SA Water has no incentive or interest in alternative systems such as implied by IUWM.

Since the largest concentration of expertise in water engineering lies in SA Water, consideration should be given to the extension of their responsibility to all aspects of urban water engineering in so far as these are all inter-related via the designs and operations of the same infrastructures. This would require that a means for securing cooperation between SA Water, Local Councils and communities should be developed for researching and trading off different water and land related objectives, e.g. flooding, biodiversity, watercourse planning, density of development, etc.

The author has not seen evidence that DEWNR, as the peak water planning agency, has ever even begun to recognise these planning needs and opportunities. Several recent publications (e.g. Reference 5) discuss barriers to adequate water planning and show that they are common in all Australian States. Since integration implies a single 'lead-shop' as well as cooperation between 'players' the re-activation of DEWNR (or alternate 'lead-shop') becomes crucial if the community benefits of IUWM are to be investigated and eventually achieved.

The recent proposal by ESCOSA to split SA Water into separate bulk supply and retail components as a means for reducing costs may have merit, but it is suggested that the bringing together of the means for planning water systems on an integrated basis, covering the interests of SA Water, Local Councils and the customers is of more urgent and fundamental importance in securing a reliable, low cost set of essential community water services in water supply, flooding and pollution reduction.

4.2 Goyder Institute

The 2006-2008 drought highlighted the SA government's lack of adequate preparedness for any interruption to its ongoing level of access to the River Murray for supplementary water supplies despite the emergence of significant water quality and availability problems over the previous 20 years.

Unfortunately, neither the subsequent desalination plant nor the creation of the Goyder Institute for water research could (or will) solve the basic problems of inadequate institutional planning arrangements. While the Institute is potentially of great benefit to the future of water planning in SA, the author's experience to date suggests that projects are being chosen largely in areas suited to academic rather than practical planning outcomes and what is already known is being slowly revisited.

Of particular concern is that:

- information on SA Water system costs is reportedly being withheld to researchers by SA Water. SA Water also appears to be able to exert negative pressure on research into areas which are seen by it as being contrary to its short term financial interests
- despite the national and international endorsement of IUWM the author is unaware that this has been investigated and/or endorsed by the Institute as a specific concept. No attention appears to be being given to the implications of water planning on urban planning (or vice versa) that the uptake of alternative future water systems will imply.

- there is an acceptance of overly long research timetables possibly related to an unstated reliance on the desalination plant as an insurance against any imminent shortfall in water supplies. These combine to remove any sense of urgency by the State Government in making changes and in commencing communication to the public on the needs for, or practicalities of planning for a new generation of more efficient (and cheaper) water systems.

The Goyder Institute should not be asked to confirm what is already known. Its basic findings will inevitably confirm those of the Productivity Council/NWI etc. and will inevitably require administrative reforms for their implementation. The Government should be signalling this to the public and actively seeking solutions to what will be a major reform task. How much longer does the public have to wait?

4.3 Payment of Money from SA Water for Water Planning

It is understood from introductory notes prepared by ESCOSA in relation to this submission that a contribution of the order of $50m is being made by SA Water to DEWNR "to support water planning and management activities required for the implementation of the NWI and the SA *Water for Good* plan".

The urgent need for DEWNR to act as 'lead-shop' in investigating the efficiency gains to be had through the introduction of IUWM-type principles in water systems planning is the central recommendation of this submission.

Recent telephone enquiries to DEWNR staff by the author have revealed that no matters of any significance to water systems planning is being carried out by DEWNR at present. These findings suggest that the bulk of the SA Water contribution to DEWNR may go to maintenance of present undertakings rather than to any investigation of basic water systems to increase future security or identify means for reducing costs of water services to the SA public.

It is suggested that ESCOSA's responsibility to the customers of SA Water should extend to ensuring that payments made by SA Water to DEWNR are expended in a manner which can be shown to meet the needs of the customers. Particularly at this time of rising water supply costs, these needs include systems investigations/planning to specifically lower these costs along the lines outlined in this submission.

5. CONCLUSION - NEED FOR GOVERNMENT ADOPTION OF IUWM

Customers of water services in SA are faced with a situation in which water planning on their behalf has not kept pace with changing circumstances of increasing demand, decreasing water availability from traditional sources, the rapid advance of new water related technologies and improved planning strategies. This is despite the emergence over the past 2 decades of the new paradigm of IUWM which addresses these matters directly and proposes a set of 'best practice' principles for more efficient water systems into the foreseeable future. IUWM has been endorsed by the UN and by the NWI as future best practice (Reference 5).

SA has the highest cost for water supplies in Australia. Adelaide is also one of the more flood risk State capitals. Water storage is the key to both these unsatisfactory water situations. The aquifers

underlying Adelaide are the obvious key to providing the much needed long-term storage for drought proofing. Despite this, very little has been done in water planning over the past 30 years to address these problems and opportunities. This submission argues that the direction for making significantly reduced costs in water services lies in coming to grips with these realities.

The reasons for the lack of uptake of ideas to address the inadequacies of the present water situation are common throughout Australia and elsewhere (Reference 5).

In SA these are:

- DEWNR does not have the resources, skills or clarity of mission to embrace the totality of planning for the design and operation of a 'new paradigm' water system in which integration is required across all catchment flows and the design and operation of all infrastructures involving water supply, drainage, flooding and wastewater services.
- The customers of the water services have little or no input into decisions on the design and operation of their water services and no choice in the services they receive. They are also poorly provided with information regarding possible changes and opportunities arising.
- SA Water's short term profit objectives stifle investigation of any long term infrastructure changes, such as are implicit in IUWM which might threaten its existing customer and/or profit base. Local government has responsibility for stormwater and has opportunities to steal customers from SA Water. No adequate mechanism exists to bring these two water planning areas together to meet the long term needs of the urban public.

Whilst different water pricing policies may assist, this submission argues that their introduction without having a clearly understanding and agreed 'direction' for much more basic reform of the water sector could result in outcomes detrimental to the long term interest of the SA public.

A clear statement from the Government is needed, stating that desalination is only a stop gap and that lower costs non-potable water supplies will be sought from stormwater and wastewater and that a major re-organisation of water services will be undertaken involving SA Water and Local Government in order to bring these changes about in an orderly fashion.

The author trusts that ESCOSA is aware of this situation and would be very pleased to be assured that this was so.

END

References

1. Clark R.D.S (1990). Asset Replacement – Can We Get It Right? Published in the Australian Water Association February Journal.
2. Clark R.D.S (1993). Is Big Really Best? Paper presented to Sydney Water Board Conference Ecologically Sustainable Water Management -Threat or Opportunity? 15th November.
3. Wallbridge and Gilbert (2009). Urban Stormwater Harvesting Options Study. For SA Stormwater Management Authority.
4. ATSE (2012). Sustainable Water Management – Securing Australia's Future in a Green Economy. Australian Academy of Technological Sciences and Engineering for the Australian Research Council.
5. UWSRA (2010). Knowledge –Action Systems for Integrated Water Management. Urban Water Security Research Alliance Tech Rept 29.

APPENDIX 1. What is IUWM?

The main implications of the adoption of the Integrated Urban Water Management (IUWM) concept are that water supply, sewerage and stormwater drainage should all be planned and operated as one system with multiple purposes including basic water supply and reductions in flooding and pollution. The design of the water systems will be integrated with the many aspects of land planning which interact with the water flows and the diverse social and environmental needs of the urban population.

A major outcome of the application of IUWM will be the gradual decentralisation of water operations to meet the particular local requirements and limitations at least cost and maximum benefit. IUWM has major implications for urban planning in respect to the 'greening' of urban watercourses and co-location of wetlands and detention basins for water capture, pollution reduction, aesthetics and flood minimisation.

Treatment plants would be downscaled and moved closer to the sources and demands for water, thus saving on pipe costs which make up 60% of all water system costs. Wherever possible existing water infrastructures could be checked to determine their possible redesigned to serve multiple purposes, thus greatly increasing their economic productivity. The aquifers beneath Adelaide can potentially store large quantities for drought security and are largely under-utilised. The changes to urban water systems will be dramatic. By timing the introduction of the new systems components to replace the old and aging infrastructure the change-over costs can be reduced. Asset replacement scheduling will therefore have to assume a large place in the planning for the new systems. For obvious reasons, asset replacement decisions must embrace a total asset life time horizon and involve a far wider public base than SA Water customers only.

APPENDIX 2. From Reference 2.

The top figure shows the post war boom in water asset capitalisation in SA, much of which was provided by Federal Govt grants. The transposition forward by 100 years and the various early estimates of how future replacement costs might arise are shown. The author has no information of what the latest projections are, but assumes that replacement costs will rise. The original paper by the author (Reference 1) suggested that part of this bulge could be removed by not replacing the assets in their past layout. A very startling idea at that time!

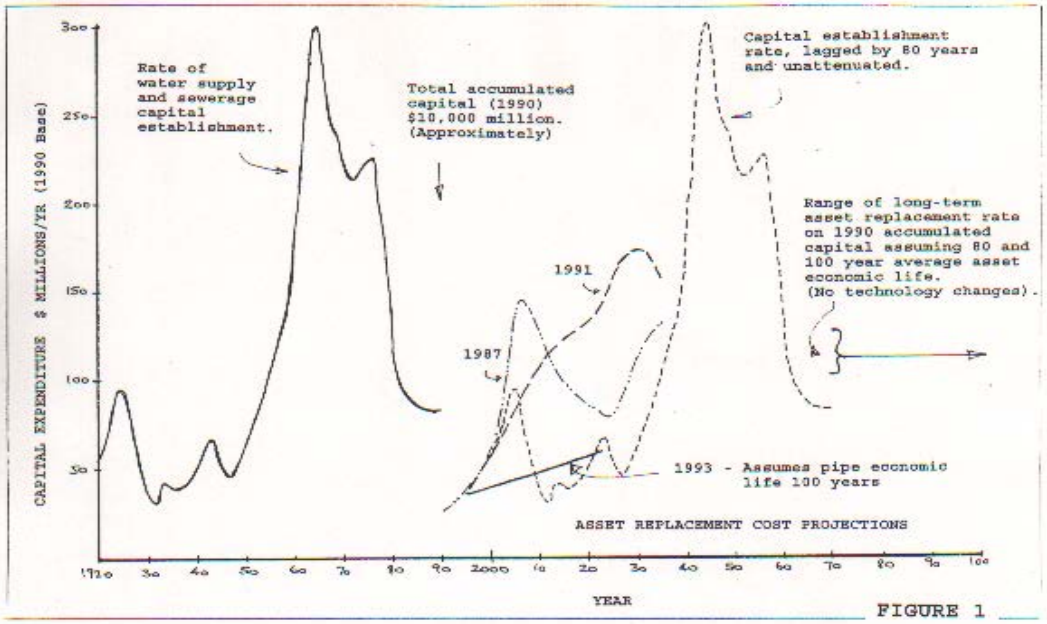

FIGURE 1

TABLE 1

PUBLIC URBAN WATER INFRASTRUCTURE VALUES
SOUTH AUSTRALIA - ($ Millions 1990 Base)

	ADELAIDE	COUNTRY
WATER SUPPLY		
Water Mains (Lt 400mm)	1105	1433
Gt 400mm	938	2358
Tanks	80	179
Service Connections	347	184
Water Treatment	2	7
Water Filtration	282	45
Pumps	122	194
Dams and Reservoirs	302	145
WASTEWATER		
Sewer Mains (Lt 400mm)	1448	310
Gt 400mm	438	17
Service Connections	288	35
Sewage Treatment	366	85
Pumps	47	31
	5765	5020
DRAINAGE		
Pipes and Channels	510	?

TABLE 2

APPROX EXPENDITURE BY EWSD SA
($ Millions pa. 1990 Values)

REVENUE	
Rates	340
Grants	10
TOTAL	350
EXPENDITURE	
Interest	110
Operations	90
Administration	60
New capital Works	70
Asset Replacement	20
TOTAL	350