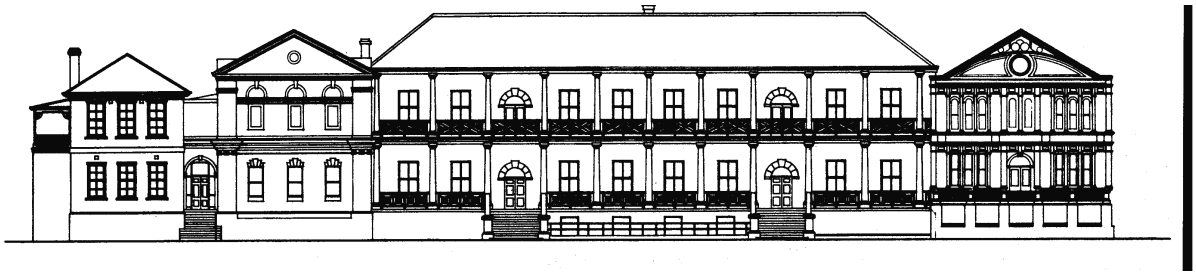
LEGISLATIVE ASSEMBLY

STANDING COMMITTEE ON PUBLIC WORKS

INTERIM REPORT ON URBAN WATER INFRASTRUCTURE



Report No. 52/11 **December 2002**

SECRETARIAT

Mr Ian Thackeray – Committee Manager
Ms Carolynne James – Project Officer
Mr Jason E Reodique – Committee Officer
Ms Natasa Tosic – Assistant Committee Officer

Parliament House, Macquarie Street, Sydney NSW 2000
Telephone: 02 9230 3308 Facsimile: 02 9230 3309
Email: pubworks@parliament.nsw.gov.au

New South Wales Parliamentary Library cataloguing-in-publication data:

New South Wales. Parliament. Legislative Assembly. Standing Committee on Public Works

Interim Report on Urban Water Infrastructure, Standing Committee on Public Works, Parliament NSW, Legislative Assembly. [Sydney, NSW]: The Committee, 2002. iii, 39pp.; 30cm.

Chair: Diane Beamer
December 2002

ISBN 0 7347 6822 2

1. Public Works – New South Wales
2. Interim Report on Urban Water Infrastructure
I. Title
II. Series: New South Wales Parliament. Legislative Assembly. Standing Committee on Public Works. Report No. 52/11

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Chairman's Foreword

Water is emerging as one of the key issues for society.

Its management is just as crucial in urban as in country areas.

As there is only a limited amount of water available, the days of simply building more dams to cater for demand are over. So we have to be much wiser and smarter in how we use that water.

This is where the very nature of our infrastructure will play an important role.

Today we recognise that our activities have to be sustainable. Traditional methods of water service delivery have been outstanding in protecting public health in urban areas. But they are looking decidedly shaky from today's sustainability perspective. They are very expensive and wasteful and they have significant impacts on the environment.

Fortunately, many alternative approaches have been developed that come to grips with the shortcomings of traditional systems but can still deliver the water services we require.

The time has come to look very seriously at integrating these alternative approaches into the urban water landscape. This will not be a simple task but it needs to start today.

This interim report provides a summary of the information which has led the Committee to this conclusion. In addition, it identifies a range of issues for further detailed consideration. These matters will be reported on, with recommendations on how this can be achieved, in the Committee's final report.

Diane Beamer MP
Chairman

Chapter One: Introduction

BACKGROUND TO THE INQUIRY

Mr Mark Pascoe from Brisbane's Water Utility told a briefing of Federal Parliamentarians last year that "Australia's water delivery systems were aging and required increasing re-investment to continue to provide an adequate service." He questioned whether "current urban water, sewerage and drainage systems were sustainable in social, economic and environmental terms" and argued that if they were found to be unsustainable "new alternatives must be looked at". He estimated the cost of replacing Brisbane's water delivery system at $5 billion. [# Government News July 2001]

Professors Troy and White from the Centre for Resource and Environmental Studies, ANU asserted in their submission to this inquiry that:

> *large elements of the water supply and sewerage systems in those centres are now coming to the end of their useful life and need to be replaced or new ways of meeting the demand for water cycle services need to be found. Simply replacing the existing systems will inevitably place significant demands on the budgets of State and local government agencies*

These types of claims, that urban water infrastructure is ageing and that its consequent replacement will be a major financial burden, even a potential problem in the near future, have been circulating in the public domain for some considerable time.

As the replacement of urban water infrastructure represents a major capital works issue, the Committee resolved to look into this matter, from a New South Wales perspective.

As well as endeavouring to determine whether the ageing infrastructure is a potential problem, the Committee felt that it would be constructive to look also at alternative approaches to existing urban water infrastructure to see what advantages they might have, particularly from a sustainability perspective.

INQUIRY

Accordingly, in May 2002 the Committee resolved to carry out an Inquiry into Urban Water Infrastructure. (see Appendix A for the terms of reference). It advertised the Inquiry seeking submissions by 26th July. Public hearings commenced on 27th September and concluded on 21st November.

In the course of the Inquiry, the Committee received 35 submissions and heard from 23 witnesses over three and a half days (see Appendix B for list of witnesses). In addition considerable background was found to be available on this very topical issue.

INTERIM REPORT

The Legislative Assembly went into recess on 11 December 2002 and will soon prorogue in anticipation of the New South Wales election next March. Upon prorogation, the Standing Committee on Public Works will no longer be constituted, due to provisions of the Standing Orders. At that point the Committee cannot table reports.

These factors create a critical timing issue for the Committee.

The Inquiry has provided a considerable amount of complex material that has to be evaluated as part of the Committee's deliberations in developing its report. This task is well advanced but still not complete.

Given that a comprehensive final report is still some way off and that prorogation is imminent, the Committee resolved to produce an Interim Report to inform the Parliament and the public of its inquiry to date.

This Interim Report then sets out, in summary, the findings and recommendations the Committee is able to make at this stage and to identify issues and areas which will be considered in the final report. (Full evidence and arguments that have led the Committee to the views set out in this report will be detailed in the final report).

The Committee will continue to work on the final report up to prorogation. Should that final report not be tabled before prorogation, the Committee recommends and urges strongly that the Standing Committee on Public Works in the next Parliament, as its first task, complete the final report into this very important policy issue.

The Interim Report is structured as follows:

Chapter Two	Urban Water Infrastructure
Chapter Three	Performance of Large Scale Centralised Reticulation Schemes
Chapter Four	Performance of Alternative Systems
Chapter Five	Interim Findings and Recommendations
Chapter Six	Issues for Further Consideration

Chapter Two: Urban Water Infrastructure

BACKGROUND

The supply of adequate drinking water and the removal of polluted waters are some of the most fundamental needs of towns and cities.

These vital services – water supply and wastewater - are typically provided by means of large scale centralised reticulation (LSCR/traditional/conventional) schemes. A similar approach has been developed to deal with stormwater.

Drinking water is collected in storages distant from the city, transported, centrally treated and then distributed to households by a reticulated system of pipes. Wastewater ("grey" – used water from the house; "black" – water combined with human waste) is collected and removed via another reticulation system to be treated at large centralised treatment systems before disposal, usually into rivers or oceans. Rainfall (from roofs and other impervious surfaces such as roads and paths) is collected and removed via a third system of pipes where it is disposed into waterways usually with no treatment.

These three separate reticulation schemes are essentially transport systems and the underground pipes – the transport network – represent a significant proportion of the costs invested in the infrastructure, being in the order of 70 per cent of the value of the water services assets.

Historically, these large engineered transport schemes were developed as a response to serious public health problems in England in the 19th century. The scale and the social impact of infectious diseases in the urban communities at that time led to the separation of drinking water from wastewater in order to ensure public health.

It has to be recognised that this 19th century engineering solution to this public health crisis has probably been the major contributor to public health in developed societies.

It also needs to be recognised, however, that these reticulation schemes have changed little in 120 years. They are "once through" systems in which water, once used, is regarded as a problem to be removed and disposed, usually into the environment.

URBAN WATER CONTEXT

In considering the performance of urban water infrastructure systems, it is useful to reflect on the contemporary circumstances in NSW and Australia.

Fresh water is a finite and valuable resource, particularly in a dry continent such as Australia. While the eastern seaboard is not particularly dry, large variations in rainfall have encouraged the development of large storages for water supply. Indeed Australia has the highest per capita water storage in the world.

Paradoxically, the availability of these large storages appears to have encouraged profligacy for Australians are, according to a number of witnesses, the largest per capita users of water in the world. The 2001 Australian Infrastructure Report Card, observed that Australians were the fourth highest per capita users of potable water in the OECD. Either way, it strikes the Committee that this extravagance is unacceptable in a country regularly affected by drought.

Such behaviour might well be a factor of water pricing for Australians pay some of the lowest costs for water in the OECD. [Report Card 2000]

In order to deliver these water services there are currently in Australia:

- 175,000 km of water mains, and
- 125,000 km of sewers

Sydney's population is growing but its water supplies are finite.

According to the Department of Planning:

> *Sydney's population has grown at a more rapid rate than forecast in the 1990s. The period since 1995 has seen the strongest period of growth since the 1960's. Overall, the population had reached 4.15 million in 2001 and this figure is now expected to reach 5 million by around 2020. Projections prepared in 1999 suggested that the population of the Sydney Region would reach 4.9 million by 2026. Over the next 15 years, the forecast demand for new housing stock within Sydney is predicted to reach 300,000 dwellings.*

In 2002 the residents of Sydney consumed approximately 600 gigalitres of water. That is 600 billion litres. Given the finite limits to water supply, while ever the population of Sydney continues to grow per capita consumption will need to fall. As Mr Alex Walker, then Managing Director of Sydney Water Corporation told the Committee, the old ways of simply meeting demand are gone:

> The old paradigm of course would have been; well, not a problem, there are plenty of us engineers around, we just go and make another dam. We will be okay. But environmentally that is not a sustainable solution any more... The modelling, as I said before, of weather and so on, suggests that we just cannot collect and store enough water in our dams to be confident that we can manage Sydney's demand as the population continues to increase.

In order to deal with these tensions, the NSW Government has implemented demand management and other measures to reduce consumption.

While the large storages and treatment systems provide a virtually guaranteed supply of drinking water for urban populations, the majority of that water is used for purposes other than drinking, for which a lower quality of water would generally be suitable. It is estimated that between one and four per cent of potable water only is actually consumed. The remainder of the potable water is used for other purposes such as gardens (27%), showers (20%) and toilets (20%). The result is that most of the potable water is contaminated during use and then requires treatment.

The supply of water to urban communities and the security of public health are regarded as essential services and, therefore, an area for government involvement. Accordingly, with the development of large scale centralised reticulation schemes came an associated development of large centralised organisations charged with the regulation and management of these systems. This centralised management, which ensures regulation of health aspects across the systems, is seen as one of the strengths of the traditional reticulation scheme.

Urbanisation impacts significantly on stormwater - dramatically changing runoff patterns. It is estimated that undeveloped catchments can absorb up to 90% of precipitation, a figure that can drop to 10% in areas after they have been developed.

Australians also have developed gardening preferences and practices that are not only out of place in the Australian context, they are very likely unsustainable. One witness described the huge demands on summer water caused by the extensive use of lawns - labelled “the urban production of grass”. These same practices are claimed to be contributing to urban salinity which is appearing in parts of western Sydney.

SUSTAINABILITY

Behind our current approach to the delivery of urban water services (ie the construction of large scale centralised reticulation schemes) lie a number of objectives. Firstly, the provision of drinking water, so essential for life. Secondly, its delivery and removal in such a way as to ensure public health. These objectives are currently being achieved via engineering solutions that have changed little in 120 years.

However, society’s expectations have changed over those 120 years.

Today, as well as these two basics (that is, water supply and public health), the community has other objectives to consider, such as sound and efficient financial management, minimisation of waste and protection of the environment. In other words, sustainability is a critical yardstick by which society today evaluates its activities.

COMMENT

In addition to the changes in expectations over the last 120 years, technology has advanced significantly. In the 19th century, with less technical know how and specific scientific understanding of the problems, the solution to the public health problem lay in a physical separation of the drinking water and water borne human waste.

In the light of more rigorous and mounting community expectations and the significant technological and management changes that have occurred over the last one hundred years, the Committee felt that a re-evaluation of large scale centralised reticulation systems from a contemporary perspective was warranted. The Committee, therefore, sought to compare the sustainability (the economic, social and environmental performance) of traditional urban water systems with contemporary alternatives.

Chapter Three: Performance of Large Scale Centralised Reticulation Systems

In this chapter the Committee reports on the renewal strategies for urban water infrastructure and reviews the performance of traditional systems in the economic, social and environmental areas. In other words it has endeavoured to evaluate the sustainability of these systems. From an economic perspective it has specifically focused on the two major metropolitan utilities - Sydney and Hunter Water Corporations.

ECONOMIC

There is no doubt that urban water infrastructure represents a huge investment on the part of the community.

According the Institute of Engineers, the replacement value of wastewater assets in New South Wales/ACT is $15,500 million while the replacement value of water supply assets is $14,000 million.

The Department of Public Works and Services told the Committee that the "cost of traditional water storage and systems is undoubtedly rising".

The Hunter Water Corporation provided the Committee with the following information:

- Current written down value of Hunter Water assets is $1.8 billion. It is estimated the gross replacement cost would be around $3 billion.
- Asset management is complicated by the variance in form of assets which have different maintenance needs and replacement schedules.
- Asset lives vary considerably in terms of category of assets. The majority of water assets have long lives, in excess of 100 years. Electrical, mechanical/telemetry type assets have lives varying from 10 to 50 years.
- The bulk of Hunter Waters assets are watermains and sewermains whose life is in excess of 100 years. Approximately 60% of water mains and approximately 70% of sewerage mains were constructed in the 1960's. The average remaining life is therefore quite long and there is not a view of any immediate infrastructure crisis.
- Current replacement expenditure is approximately $7 million per annum, a relatively small amount compared with the size of the asset base.
- The estimated total replacement expenditure over the next 20 years is approximately $267M or $13million per annum or 0.7% of the written down value of the asset.

- Since 1990's strategic asset management program for infrastructure has been introduced with targeted maintenance undertaken combined with the application of new technology.
- In the last 10 years there has been a focus on the Hunter Sewer Project which has seen in excess of $300M allocated to upgrade wastewater treatment and extend reticulated sewerage services to over 20,000 properties which previously relied on on-site facilities. The project was driven in part by concerns associated with on-site systems adjacent to Lake Macquarie and Port Stephens.

The Corporation set out in its submission the strategies it had put in place to manage the regeneration of its assets and, as a consequence, argued that there was no infrastructure "crisis":

> *When establishing remaining life of asset sets as an overall summary, consideration needs to be given to the actual service performance of the asset category. In this way the remaining life can generally be considered the remaining economic life where appropriate comparisons are made between ongoing repair/maintenance costs and the cost of replacement. With this in mind the information provided on remaining life of Hunter Water's infrastructure clearly indicates that the major asset categories still have many years of life remaining and that there is no immediate infrastructure crisis. HWC Sub*

Sydney Water provided the following information for the Committee:

- Sydney Water is responsible for water, wastewater and some stormwater services in Sydney, Blue Mountains and Illawarra region, servicing 1.6 million properties.
- The replacement value of Sydney Water's assets totals $23.9 billion
- There is a highly diverse asset base at different stages of its life cycle. The pipeline networks are the largest component of investment in assets and has a life span of around 150 years.
- Sydney Water is managing its investment through a range of structural management (incremental pipeline maintenance and upgrade) and non structural strategies (demand management and wastewater source control).
- The current issue for Sydney Water is matching the potential increases in environmental flow requirements, higher than expected population growth and changing climate conditions against a limited supply of water. To address this issue, Sydney Water is examining decentralised systems in greenfield and infill development sites.

Wastewater infrastructure

- 27 sewerage systems, 30 sewage treatment plants, 654 sewage pumping stations and 22,000 km of sewerage system pipes.
- The networks/pipes life expectancy is from 75 to 150 years with electrical and mechanical components in assets with a life of 15 years.
- Maintenance is a balance between preventative and response-based maintenance on a risk maintenance approach. Prioritisation of renew or replace is based on risk. In 2000/02 86km of new sewers were laid and 175km of sewers were renewed or replaced.

- Demand management in wastewater includes the Trade Waste Policy whereby discharging of waste water in sewers by industrial and commercial users is discouraged and on site treatment optimised.

Water Infrastructure

- Sydney Water buys raw water from the Sydney Catchment Authority. The network consists of 20,000km in length; 10 filtration plants (6 owned by Sydney Water and 4 with the private sector); and 152 water pumping stations and 200 reservoirs.
- The water pipeline network is the most costly component with a replacement value of $7.6 million. Life expectancy of the pipeline exceeds a lifespan of 100 years. 15-year span for mechanical systems.
- Strategies have been put in place to extend the life of drinking water infrastructure. Demand management campaigns such as “Every Drop Counts” over the last 20 years have assisted in stabilising consumption at around 600,000 per year, despite population growth because the average amount of water consumer per capita has declined by 18%.

Stormwater Infrastructure

- Stormwater infrastructure is designed to ensure land and property are not flooded and waterways not polluted. Stormwater is provided to 430,000 households but Sydney Water does not own stormwater assets in the Illawarra region or Blue Mountains. However there are proposals being examined by the Government to expand Sydney Water’s role in stormwater management and integrate water operations across the urban water cycle.
- Infrastructure includes: 450km of trunk channels; 37 pollution control devices; 2 wetlands and 2 drainage pump stations.
- Life expectancy of various components is 75 to 150 years. 25% of assets are over 100, 8% 99-75 years, 42% 74-50 years and 24% less than 50 years.
- Stormwater management includes demand management projects with councils and communities to influence community behaviour and source problems.

Mr Alex Walker told the Committee that asset management had not always been the orgainsation’s strength:

> In terms of asset management, we have had a long history, of course, of expertise in engineering and there is a lot of knowledge in the organisation about pipes and pumps and all the bits and pieces that go together to make up our infrastructure. We have discovered though, that we have not had a very good handle on how it all fits together, and we have been struggling to come up with a clear understanding of what levels of investment and what operating cost structures are going to be needed in the long term in order to maintain standards of performance.

However, Sydney Water is turning this around:

> So, over the last couple of years, in fact, it was really, I think, heralded two years ago when we established a whole division, called the Asset Management Division. We have been working to put together an integrated asset management plan, which would really look at all issues of risk management and performance and standards and come up with a view of investment and operating climates for the long term. We now have that in place in its first form. For the first time ever, we now have

something we can call an integrated asset management plan and it was, in fact, presented and discussed by our Board just last month.

The specifics of the Corporation's infrastructure base was discussed at hearings:

CHAIR: In reading through your submission you talk about the average of the 22,000 kilometres of sewerage pipelines and the 20,000 kilometres of water?

Ms MEESKE: Most of the water pipes - we have about 20,000 kilometres of water pipelines and there is a graph in the submission that shows the age profile. There was a significant amount of the pipelines we built in the 1930s and 40s, but by far the biggest bulk of them were built during the 1960s and 70s when we moved into very large scale greenfield development in the Western Suburbs. Those pipelines would typically have lives of up to about 150 years, so they are really not yet halfway, but I guess typical to the water industry in Australia, we are developing a maturing stock of assets there and some of them now are coming to the point in their lives where they are starting to fail. So, typically different types of water mains will fail between 60 years and 150 years. Our biggest issues are related to cast iron pipes which are about 75 per cent of our system and they are a lot of the ones that are starting - well, the older pipes in particular.

With regard to asset maintenance and renewal, Sydney Water in its submission stated that:

Maintenance planning is on a long term horizon, however there is no articulated plan for the bulk replacement of infrastructure, rather a continuous replacement program is undertaken triggered by various factors such as unplanned replacement, cost economy of replacement to substitute excessive repair costs, criticality of the asset, and feasibility of preventative measures.

This was discussed further at hearings.

CHAIR: I noticed that you replaced, what was it, 168 kilometres of new sewer - sorry, 175 were replaced. That seems to me not to be very much out of 22,000 kilometres. But the question I want to ask is, you are going to have a time when those pipes are 100 years old and typically you have got to manage your income stream so that when you are replacing them at a bulk time that it is not a disaster. Do you do that now?

Ms MEESKE: I guess typical again to the rest of the water industry we are coming to develop a more strategic approach to that because we are needing to look long term. You cannot make those decisions without a view to the longer term. In any one year the amount of renewals can vary and it will not make any difference to your performance on customer service, but if you over a long period of time under-invest in renewals you will start to see increased leaks and breaks on your water mains or failures in your wastewater system that will increase infiltration or that type of problem.

Our asset management planning indicates that at the moment we have been replacing about point 5 of a per cent of our system per year and that we need to move that over the long term, over the next 10 to 20 years, up towards the 1 per cent of the system per year and that that would focus on your critical mains. The ones that have the biggest impact on the community that are near major roads or

> shopping centres. Have a lot of disturbance and could flood properties. A lot of the smaller mains can actually be replaced as they break because they are - I mean, the fact is there are not that many that are 150 years old. They may live a lot longer as well. Some will live longer than that period and you may find that you only need to replace a very small portion of it. I mean, with sewer pipes they themselves can stay there forever. Some of the joints and cracking in the pipes can be a problem, but you can reline those too so you do not need to have a full scale replacement program, or you can clean them to make sure that tree roots are out of the system and that you are not having those sorts of problems. So, as we are going through, we are developing strategies that I guess narrow down the quantity that you need to replace but still maintain the service that was in the system.
>
> **CHAIR:** You do see yourself as having to double-
>
> **Ms MEESKE:** Yes, we -
>
> **CHAIR:** And is that - would that be a doubling of your maintenance budget then?
>
> **Ms MEESKE** We are still going through the process of determining that at this point. Not necessarily.

One view put to the Committee was that water mains can be expected to have a useful life of 40 to 100 years and that many of the pipes under the older parts of our cities may be toward the upper end of this range.

A witness advised in hearings that in Newcastle, the average age of stormwater drainage assets is about 65 years. If you give a full life of 70 or 100 years on your drainage assets, it's clear that a time was rapidly approaching when those assets may need to be replaced at considerable cost, or think more carefully about alternative solution. [Coombes]

This was not the case in newer urban areas, however, where the bulk of the stormwater infrastructure was put down in the 1960s and 1970s.

Currently, the “annual replacement costs of stormwater infrastructure is quite large in New South Wales… of the order of $70 million a year”. Yet, for stormwater there was a dearth of funding for the necessary maintenance and improvement regime.

It should also be noted that, while the water utilities contribute significantly to consolidated revenue, they also benefit from capital grants. For example, in 2001/2 the Hunter Water Corporation received $49 million in the State Asset Acquisition Program while Sydney Water Corporation received $457 million.

One significant factor affecting the need to replace ageing infrastructure is the development of new techniques to remediate ageing pipes. The Water Authorities see in new technology a means to extend the life of these assets as technology is allowing them to get the best out of their existing systems, Mr Evans from Hunter Water Corporation explained to the Committee:

> So there has been a huge revolution, a technological revolution in asset management techniques and computing techniques which has made us fly a lot less blind now about this whole question of whether there's a big sort of lump of

> replacement coming that you have to provide for. I think we have got much much better at being able to understand asset condition and therefore likely financial future requirements. As long as there's a reasonable amount of money made available through the IPART process we can take our evidence about why we need the money, given our asset management systems and our standards and our capital programs, et cetera. We believe we can maintain those systems and sort of supplement them in virtually in perpetuity without running into some sort of great unforeseen asset catastrophe, whereas 15 or 20 years ago there was much less confidence about that.

Sydney Water Corporation also agreed that technology provided a significant opportunity in terms of asset management:

> **Ms MEESKE** …There is a lot of technologies becoming available where you do not - I mean, essentially a lot of the cost in putting in pipes is digging the hole up. A lot of the new technologies allow us to slip-line existing mains and to structurally reline them so we can do it without major disturbance and having the major cost of excavations and we were working a lot with the other parts of the water industry to look at rehabilitation techniques that are non-destructive and then can re-use the assets that we have got.

With regard to planning for the replacement of the infrastructure, the Institute of Engineers, Australia took a somewhat different view noting in its 2001 Infrastructure Report Card that in NSW/ACT for sewers and water mains generally, the written down value as a percentage of the replacement value was 70 and 69 per cent, respectively. This according to the report "indicates a significant level of depreciation and need for increased renewals expenditure".

With regard to wastewater, the report went on to raise concerns about the "information gaps on the condition of the wastewater assets and the inadequate allocation for renewal and regeneration". With regard to water supply in stated that:

> *… as is the case of wastewater assets, the main drawback is the quality and reliability of the information on the buried assets that make up 70% of the replacement value of the total water assets.*
>
> *Water distribution assets are even more difficult to access to perform condition assessments that wastewater collection systems. Thus the lack of information on the condition of this asset group that was reported in the 2000 Report Card is still relevant today, as is the inadequate allocation for renewal and rehabilitation".*

A number of other witnesses raised similar concerns about the level of funding for future replacement of underground assets.

SOCIAL

The Committee looked at three elements in the social performance of urban water infrastructure – health, firefighting, and waste reduction.

HEALTH

The Department of Health took issue with the inclusion of "public health" as one of a number of social elements arguing that it needed to be recognised as an issue in its

own right. The Committee feels that it is not unreasonable to categorise “health” as part of social performance. This does not in any way diminish the importance of the health aspects, for the Committee readily acknowledges that public health protection is the primary consideration in the communal delivery of this essential service.

As pointed out above, the separation of potable water from the water borne waste system coupled with centralised management and administration of the systems have provided a remarkable improvement in public health.

While there have been some notable exceptions, (for example the Cryptosporidium scare in Sydney being the most obvious), traditional reticulation systems have to be judged a major success from the public health perspective.

CENTRALISED MANAGEMENT

A significant factor contributing to the public health success of conventional systems has been the centralised management of the systems, which took responsibility for all necessary maintenance of the systems (except for pipes on private property) in the interests of public health.

FIREFIGHTING

Another vital aspect of the urban water reticulation schemes is its role in firefighting.

According to one witness, the provision of water for firefighting represents up to 60 per cent of the capacity of the reticulation network. This means that there is an element of overdesign within the systems, with larger pipes and higher pressure to accommodate this function.

However, as with the public health issue, the Committee recognises and acknowledges that traditional water reticulation systems have been a vital tool in protecting urban communities from fire.

WASTE REDUCTION

A significant problem faced by contemporary industrialised society is waste and communities are trying to find ways to reduce wasteful practices.

The Committee was told by one witness that traditional systems are unsustainably wasteful because, “we import very large volumes of water from catchments under stress to cities like Sydney and Newcastle, but similar volumes of stormwater and roof water are disposed as waste products via very expensive pipe drainage systems.”

One of the fundamental approaches to dealing with waste is to reuse resources. Yet, current approaches to urban water based on the 19th century engineering solutions, are particularly wasteful of a very precious, limited natural resource. Water is used once and then discarded. Indeed, in the case of stormwater, the water is simply discarded without any utilisation while, in the case of wastewater, the water is merely the transport agent.

That there is an underlying philosophy of waste in the use of urban water has been confirmed by the CSIRO. It reported recently that Australia wastes 92 per cent of its city runoff and 86 per cent of its effluent water.

This waste is a consequence of the design of large scale centralised reticulation systems, particularly their lack of integration. These water supply and removal models assume abundant water resources and the ability to treat and dispose of any amount of polluted waters.

In addition to the waste of the water and its by-products (bio solids and effluent) these systems use considerable resources simply to transport potable water and "waste" water. As was pointed out above, it is estimated that there is approximately 300,000 kilometres of water supply and sewer pipes in Australia – a huge investment in resources in themselves.

ENVIRONMENTAL

There was virtually no disagreement with the claims that traditional once-through piped systems for water supply, stormwater and sewerage create problems for the environment.

The creation of large storages to hold the water supply has effects on the natural environment through inundation and the stifling of natural river flows. While sewage is now treated to generally very high standards, there are still public concerns about release treated effluent into natural environments. Stormwater is causing considerable concern as the rush of high velocity flows carries considerable untreated material into waterways where it causes considerable damage.

The traditional practices of damming rivers and discharging treated effluent into sensitive water bodies have adversely impacted the environment, and are no longer acceptable to the community. Even with expensive water-related infrastructure sophisticated water works and treatment plants industrialised countries still contribute to local and global pollution.

This adverse impact on the environment does not come as a surprise for traditional systems evolved at a time when environmental issues were not a consideration. Hence the impacts, the environmental costs, have not been part of the appraisal process, a point raised by a number of witnesses.

SALINITY

A specific environmental issue emerging is that of salinity. While salinity is a problem usually associated with non-metropolitan areas, it is becoming an issue in Western Sydney Region where salinity has been found to cause damage to homes and infrastructure. To-date, damage has been recorded in a wide range of locations in Western Sydney including Campbelltown, Camden, Penrith and Baulkham Hills.

The salinity is largely attributed to the dramatic change in the natural environment associated with the development process. Although one witness attributed its rise specifically to the community's obsession with lawns.

COMMENT

In terms of social performance the importance and effectiveness of conventional systems lies in the protection of public health through, firstly, the physical separation of potable water and wastewater and, secondly, through the centralised treatment and management of the water services. The resulting protection of public health has been the outstanding advance in urban centres in developed countries. Similarly they provided the necessary resources to protect the community from fire.

In economic terms the performance of the systems is not so clear cut.

Asset management systems and maintenance regimes have been developed along with new technologies to maximise the economic life of these assets. There is no compelling evidence at the moment that there is an imminent crisis in infrastructure replacement. However, based on some evidence there are still some concerns in this area.

Of more concern is the costs of these systems.

They require significant capital outlays for construction and maintenance – for systems which might be overdesigned and are fairly inflexible. These enormous sunk costs raise legitimate concerns and justify a consideration of cheaper alternatives.

In addition to the financial impost of these large engineered solutions there is considerable waste of water inherent in the design principles of the scheme and major environmental costs.

The CSIRO in its submission observed simply that “in terms of total resource cost, which includes such externalities as social values and environmental effects, centralised systems are the epitome of unsustainable practice”.

In an era when sustainability and inter-generational equity are real concerns the disadvantages identified above must be considered significant. Given the financial and environmental impacts and the fact that these schemes now represent a technology and an approach that is over a hundred years old – a period which spans the most spectacular technological change and innovation in history- the Committee felt that there was merit in reviewing alternative approaches to the delivery of water services.

Dr Janusz Niemczynowicz, Associate Professor of Water Resource Engineering at the University of Lund in Sweden has articulated the situation:

> *The main target of urban water management and related infrastructure, i.e. creation of health-protecting living conditions in cities, was achieved by organizing material flows that moved the residuals outside the living sphere of population. The main goal was to create habitable conditions in cities rather than protect the environment outside cities. In present society, which is aiming to be sustainable, the focus has changed. It is generally understood that the wellbeing of societies depends on the state of the environment and especially the state of water resources. However, it is also understood that the conservation and recycling of natural resources and used materials is a*

> *basic condition for the future sustainable society. It is doubtful if present infrastructure and management methods can fulfil these new goals. Niemcyznowicz*

The Parliamentary Commissioner for the Environment in New Zealand summarised the situation neatly, saying, “while our water systems have been evolving over the years, I believe the industry and community evidence indicates that the ‘model’ has now reached the end of its design life”.

In the next chapter the Committee looks at the alternative approaches to urban water infrastructure.

Chapter Four: Performance of Alternative Systems

ALTERNATIVE SYSTEMS

Systems developed as alternatives to the current large scale centralised reticulation systems reflect a range of technologies and approaches.

A number reflect technological developments that have emerged since the 19th century. Others are built on ideas that have been around for some time. For example, tools such as composting toilets and rainwater tanks have been utilised for a long time. Indeed, composting toilets were at the centre of a debate in NSW in the 19th century between proponents of water closets – reticulated schemes – and the dry composting toilets.

In general, alternative approaches and solutions range from simple tools such as the rainwater tank through the better integration of current reticulation systems to fully independent on-site water systems. Each has it advantages and disadvantages.

The CSIRO has defined the essential elements of these approaches, noting that "concepts of integrated water management and closed urban water systems are emerging as new paradigms for the 21st century urban water system development and management. The objective of the closed water system is to reduce the net total loss of water from the system, whereas the objective of the integrated urban water management is to take a holistic view of the system." [CSIRO]

Alternative approaches aim to integrate all elements of urban water services, reducing water use and wasteful practices, and reusing wherever possible. Generally, they aim to deliver the water service as close as possible to the source. As a rule they are more localised in nature, without extensive transport networks, and hence benefit from a reduced pipeline costs.

From the evidence gathered during the Inquiry, the Committee reports as follows on the performance of these alternative systems. (Examples of some of these systems can be found in the case studies below.)

ECONOMIC

Generally, where these alternative systems replace large reticulation systems, particularly in greenfield situations, they exhibit lower costs than LSCR systems in delivering a similar service.

Dr Speers from the CSIRO outlined his organisation's findings in this area:

> **Dr Speers:** … We undertook a study from Asia New Urban Development in Brisbane where we looked at a range of scenarios for servicing that area with the objectives of minimising wastewater production and maintaining natural stream flow post-development. The outcome of the analysis of those scenarios is that there is really only about 10 percent cost difference between the conventional systems and

> the more innovative sustainable systems, but when you take externalities into account, which might include environmental externalities as well as deferred costs of dam construction and so on, all of the alternatives became cheaper than the conventional system, but of course those externalities are currently not included in prices.
>
> **CHAIR**: That is going to that triple bottom line?
>
> **Mr SPEERS**: That is right, this is about the triple bottom line, and as long as it is not dealt with, we are making false investment decisions.
>
> **The Hon. PETER COLLINS**: Is it significantly cheaper?
>
> **Mr SPEERS**: No, just cheaper. The point was that all of them [the alternative approaches] were cheaper, and the range of scenarios went from the base case, obviously, the conventional system, through to one which was merely sort of current best international practice, all the way through to what you might call the hard green option, which was closed loop at the household allotment scale. My point is that all of those alternatives became cheaper than the base case when the externalities were included. So you may not want to go to that closed loop system, but there is a whole range of options that are available to you if those externalities were included.[# ToUE 1/11 pp 35/6]

This finding was agreed by Dr Coombes from the Stormwater Industry Association:

> **Dr Coombes:** … The economic work we have done at the University of Newcastle shows that more often than not, the decentralised solution if you include all of the benefits and all of the costs, is break-even or better, wherever you put it, so we need to use whole of water cycle economics from a community perspective, to understand whether or not we should put such a measure in place...[# ToPCE 27/10 pp30/1]

The Centre for Resource and Environmental Studies has come to a similar conclusion:

> **Professor WHITE:** In our submission we mention a development at Bungendore where there are 30 houses that are totally rain fed and their effluent is treated and recycled back to their system, including a fire tank, a pressure tank. There are examples where you could actually look at the costings that occur in having a self-sufficient system. The problem there was that they simply could not supply reticulated water, so they had to look at water independence. It is clearly, in terms of returns, an economic proposition. It is not out of bounds at all.[# ToUE 31/10 p23]

Given that much of the cost of traditional reticulation schemes is tied up in the transport systems, it is not surprising that alternative approaches can offer cheaper solutions.

Another cost advantage of alternative systems is in their modular, flexible nature. Large scale centralised reticulation systems require significant up front investment. Decentralised systems require only enough investment to service the immediate needs of a particular site. Further development can be met with another decentralised system or addition.

In addition, decentralised sewerage systems can be constructed to operate under pressure. This means cheaper construction costs (small pipes, ability to follow the topography) as well requiring less transport water and protection from stormwater invasion (being sealed).

Where retrofitting was considered there was much less unanimity.

It has been argued for some time that rainwater tanks are not cost-effective given the payback period required for a suitably sized tank. The Committee acknowledges this might currently be the case. The Committee does not propose to canvas all the arguments in this interim report but observes that the cost-effectiveness might well be a factor of the pricing of water and current failure to include all costs (including social and environmental) in the analysis. At this point, however, the Committee is content to note the CSIRO view:

"In general terms though, we have found that, if a rainwater tank is used for a combination of water supply, water supply peak leveling and stormwater peak flow mitigation, they can be a cost effective element of a water servicing approach" CSIRO Sub

SOCIAL

In some aspects of social performance, it is claimed that alternative approaches appear to be weaker.

HEALTH

The Department of Health advised the Committee that the multiple levels of protection (secure catchments, water treatment, centralised maintenance, etc.) made large scale centralised reticulation systems the most attractive system from a public health perspective. It advised the Committee that alternative approaches did not have the same multiple layers and so they needed to be very cautious in approving their implementation.

While the Department was aware of the advantages of alternative systems and are keen to assist their development, their number one priority was the security of public health.

They were, therefore, very careful and concerned about advocating these systems until their health performance could be absolutely ensured.

MAINTENANCE OF SYSTEMS

A major criticism leveled at alternative solutions is that they shift responsibility for the systems, particularly the maintenance, from centralised management to individuals and communities. There was, accordingly, a very real threat to public health in this arrangement because there is a risk that maintenance standards and schedules would not be sustained.

In response to these criticisms of alternative approaches, some have argued that decentralised and on-site systems do (and have) operated without significant health impacts. For example, a significant number of Australians live unattached to

reticulation systems and some thirty per cent of Americans have on-site sewerage systems. It was also put to the Committee that the more localised approach of the alternative approaches could enhance public health protection because any problems in a centralised system affected the whole of the urban population (eg the Sydney Cryptosporidium outbreak).

The CSIRO described a range of scenarios that might be considered in maintaining alternative systems:

> **Mr SPEERS**: …The US EPA has recently released some guidelines for management or a hierarchy of management for on site systems, which ranges from the householder being solely responsible to a level where the equipment is owned by the sewerage service provider or the water company, with a step in the middle where it is maintained by the company but owned by the householder, some such hierarchy, along those lines anyway, and the preferences for US authorities, and bear in mind 40 percent of the US is on on-site systems or thereabouts - I think that is the right figure, it might be 30 percent, but anyway it is a significant proportion - most authorities, as I understand it, have opted for the option of maintaining the equipment but not owning it.

The Committee inspected decentralised and on-site systems in New Zealand that have the approval of local councils. The maintenance contracts remained with the system provider and were monitored in a centralised location. Householders were removed from the process. Of course, governments will always be the last resort for these systems and it is not too difficult to envisage systems where water utilities or local bodies maintain a role in monitoring and maintenance of systems for an annual fee. Indeed, the private sector could be utilised.

This notwithstanding, the Committee recognises that this remains a question mark over the performance of alternative systems.

FIREFIGHTING

According to the NSW Firebrigades submission water remains the most efficient and readily available method for extinguishing fires and, historically, the establishment of NSWFB fire stations has been linked to the establishment of water infrastructure. Water suppliers have carried a social responsibility for reliable emergency water supplies and any changes to the current arrangements would have major ramifications for the NSWFB, requiring “very significant investment in new fire service infrastructure”.

It concluded by observing that:

> *While the need to look at alternative solutions for provision of water infrastructure is appreciated, the NSWFB’s prime directive of saving life and property dictates that the organisation must counsel against any suggestion that aging water supply infrastructure not be replaced, or be replaced with alternatives that do not meet firefighting requirements.*

As was also noted earlier, water supply reticulation is overdesigned to allow for firefighting. With more efficient water use on-site, thus reducing demand for centrally provided water, it might well be possible to design systems purely for firefighting.

The CSIRO identified a number of techniques in what it described as a “tool box” which can be utilised, in appropriate circumstances, for more sustainable water services. One of which was the use of “domestic fire sprinklers”.

The question to be considered is, can that protection be provided without the overdesign in the current system or even by alternative means.

WASTE REDUCTION

By their very nature – focusing on integrated and closed water cycle solutions - alternative approaches to the provision of urban water services are less wasteful than traditional approaches.

ENVIRONMENTAL

The environmental performance of alternative approaches is generally regarded as their strength. By integrating all aspects of the water cycle, reusing water wherever possible and reducing peak events, they can significantly reduce the impact of urban water on the environment.

The harvesting of rainwater reduces the demand on stored water (estimates vary but a range of 60 to 80 per cent has been suggested to the Committee). This in turn reduces the need for environmentally damaging storages and can free up water for environmental flows.

On-site storage can reduce stormwater runoff hence reducing damage to waterways. Furthermore this can put feed water back into the water table as well as reducing pollution in waterways.

CASE STUDIES

The Committee has summarised a number of case studies by way of examples of alternative approaches.

CASE STUDY 1 (STORMWATER)

HAMILTON BUS STATION RE-DEVELOPMENT, NEWCASTLE, N.S.W.

A portion of Newcastle's main bus station at Hamilton has been re-developed for 27 one-, two- and three-bedroom inner city residences. Site contamination resulting from long use as a transportation centre, created major problems for those planning the re-development. Almost all roof and surface runoff generated in storms up to the "once in 50 years" event will be collected and treated for use by residents either in-house or for irrigation. The adjacent bus-washing facility will also benefit through replacement of former mains water use by groundwater recharged with cleansed stormwater.

The main features of the re-development include :

- all roof runoff from four groups of residences will be diverted to underground rainwater tanks from which supply for hot water systems and toilet flushing will be drawn;

- overflow from rainwater tanks, gravel-filled trenches and miscellaneous paved areas will pass to a central area where cleansing and subsequent recharge will take place;
- groundwater drawn from a single production well will be treated (activated carbon) for colour removal and used for all open space irrigation including household gardens;
- sufficient groundwater is available from site recharge to supply the bus-washing facility (maximum 2,000 kilolitre per annum) in addition to irrigation requirements;
- the scheme includes provision for conversion to conventional practice should water quality (monitored continuously) fall below accepted levels;
- it is anticipated that residences will show mains water reductions of 40% - 46% with overall scheme water use reduction expected to be around 60%; some surface runoff from portion of the re-development (fronting Denison Street) will pass directly to street drainage, but 83% of all site storm runoff will be included in the scheme.

CASE STUDY 2 (DECENTRALISED SYSTEM)

GOLDEN VALLEY SUBDIVISION – COROMANDEL, NEW ZEALAND

- This project is being developed by Innoflow Technologies for an area called Coromandel's Kuaotunu Bay Beach. A beach front consisting of 40 residential lots where the developers desired a local wastewater management system.
- The objective was to institute a wastewater plant that could compensate for a limited water supply to the area and have no adverse effect on the environment.
- The solution is a dual reticulation system which includes:
- "Septic Tank Effluent Pump (STEP) on each lot reticulated via a small bore Modified Effluent Drainage System (MEDS) to a Recirculating Packed Bed Reactor (RPBR) discharging to a shallow dripline irrigation systems with an automatic Redox Probe Controlled Chlorine Dosing disinfection system delivering recycled water back to each individual household for controlled reuse".
- The systems is controlled using a remote monitor/ control panel which means that maintenance costs are reduced but monitoring takes place 24 hours.

Various constraints of the project were matched against the system:

Constraint	**Solution**
Limited area for treatment plant	Use watertight design and utilise flood retention zone filter bed shaped appropriately.
Area prone to flooding	Use small bore polythelene collection and watertight design
Limited water supply	Use eater reduction fixtures; reuse treated effluent to augment firefighting supply; reuse disinfected effluent to toilet flushing
Limited area for disposal	Utilise steep terrain otherwise not suitable for development
Very flat site requires pumping to treatment plan	Utilise small individual pumps on each lot (MEDS) which means low power costs
Remote location, limited on-site technical support	Use programmable control system with telemetry which allows remote trouble shooting and control to reduce maintenance costs.

As a greenfield site various capital savings could be made in comparison with an existing site. For example the dual reticulation system were laid concurrently significantly reducing capital costs.

CASE STUDY 3 (WASTE TREATMENT)

RODNEY COUNCIL, NEW ZEALAND

- The Council has been examining management options for a cluster of 4 communities (Riverhead, Waimauku, Huapai, and Kumeu). Surrounding these villages are various disposal sites including two forests, pastureland, and wetland areas adjacent to the Kumeu River
- Example of an integrated wastewater (sewerage and stormwater) systems development for council/catchment area.
- Currently considering centralised options utilising conventional technology and piped systems with central treatment plants and disposal and decentralised options using new technology and small scale dispersed treatment plants and disposal.
- Disposal options include local land disposal into recreational/passive reserves, wetlands and pasture.
- Various factors must be considered in evaluating which system is the best. Cost flexibility, system performance and environmental effects.

Consideration has been given to a spectrum of options from:

Option A - connection to the existing main reticulation network,- $45.7 million (NPV);

Option B - stand-alone community schemes - $30.5 million (NPV). This is a specific scheme for each community into separate treatment systems;

Option C - combined community schemes, $34-49 million (NPV). This is a specific scheme for each community but linked to combined treatment systems; and,

Option D - decentralised systems. $24 -$28 million (NPV). This is a number of separate schemes within each community and totally independently treatment system for each.

The preferred was **Option D** (decentralised scheme) because:

- They cost less
- True user pays system
- Simple and robust technology
- Less forecasting risk
- Low construction impact
- Low environmental impact
- Easily set up for central management
- Reuse opportunities easy to implement
- Integrate positively with other urban design features

The subsequent phases from this assessment are to consult the community to gauge the acceptability of a decentralised system; identify preferences for certain

issues, e.g., reuse of effluent for cropping, pasture, wetlands; and, examine design implications for each township in Council areas.

Chapter Five: Interim Findings and Recommendations

AGEING INFRASTRUCTURE

In recent times, the large water utilities have made significant changes to the way they manage their assets. They have established strategic asset management regimes and systems which allow greater control of their infrastructure portfolios. They are now looking to new technologies to manage renewal and rehabilitation of these infrastructure assets as they age and deteriorate. Sydney Water and Hunter Water both advised the Committee that renewal of infrastructure was in hand.

A number of stakeholder groups still raised questions, however, about certain aspects of the utilities' infrastructure management. In particular concern has been expressed about the levels of investment being set aside for future infrastructure regeneration as well as the quality of the information the utilities have on the state of their underground assets.

At this stage of the inquiry then, the Committee is satisfied that an infrastructure regeneration crisis is not imminent. However, the issue would benefit from further detailed investigation.

SUSTAINABILITY OF EXISTING AND ALTERNATIVE SYSTEMS

In evaluating the performance of traditional systems against alternative systems, the advantages and disadvantages can be summarised as follows:

CENTRALISED

Advantages	**Disadvantages**
Public health protection	Heavy initial capital costs
Freedom from householder responsibility	Built-in inflexibility; risks from changes in growth forecasts; not responsive to rates of development
Known performance	Environmental problems
Predictable costs	Existing ratepayers pay for future use
	Wasteful of a valuable but limited resource

DECENTRALISED

Advantages	**Disadvantages**
Flexibility: build as you need; pay as you go	Community uncertainty
Less capital upfront	Limited performance information
Reduces forecasting risk	Public health questions
Systems are cheaper	Maintenance responsibilities
Environmental protection	
Full utilisation of valuable but limited resource	

The Committee is swayed by the advantages of alternative systems over traditional schemes and is in agreement with the views of the New Zealand Parliamentary Commissioner for the Environment when he says "a major redesign [of water services] is needed. The evidence for this " …is compelling and there is a wide spread consensus that this is so amongst those who are grappling with day-to-day operations. This does not imply a massive failure of the current system but rather a recognition that as knowledge grows, and needs change, so does the way we do things benefit from major reshaping".

Similarly the Committee agrees with CSIRO's observation on the important role of alternative approaches in delivering sustainability to the community:

> *The introduction of more diversity in the configuration of systems by embracing new technologies and techniques, and ensuring that there is more integration and greater interaction between water services will lead to more socially acceptable and environmentally friendly outcomes. This new approach based on decentralisation and integration is put forward as a key to moving forward along the path to sustainable development.*

In its submission, Sydney Water implicitly stated the need to become more sustainable in delivering urban water services. In achieving this it observed that:

> *Sydney Water's challenge requires evolutionary progress from discrete systems to integrated water cycle management, and where practical, from centralised to local solutions.*

After weighing up the arguments put to the Inquiry, including the views of a number of experts, the case studies and evidence of site inspections (as summarised in this Interim Report), the Committee is convinced that alternative approaches to delivering urban water services are more sustainable than conventional systems.

Indeed it has come to the view that, if sustainability is one of society's underpinning values, a new paradigm for urban water for the 21st needs to be set in train.

The characteristics of this new urban water paradigm are integration and closed loop systems, as Dr Speers outlined:

> *The concepts of integrated water management and closed urban water systems are emerging as new paradigms for the 21st century urban water system development and management. The objective of the closed water system is to reduce the net total loss of water from the system, whereas the objective of the integrated urban water management is to take a holistic view of the system. Rising awareness on improving sustainability of urban water systems is the main driver for emerging of both concepts. Both concepts can be employed together. Thus, there is a general understanding about aiming to develop a closed water system as much as possible by taking of a holistic view about the urban water system is the road to providing a sustainable urban water system.CSIRO*

Moving to this new paradigm will not be a simple process. Rather it will be complex and throw up many challenges:

> *In future 'recycling societies', the same raw materials will be used many times over. Concepts such as 'wastewater' or 'solid waste' will disappear, because, in a sensible society of the future these residuals will constitute new resources. Creation of a recycling society requires change of infrastructures and will not be without challenges and problems.*

And it certainly does not mean that existing conventional systems will simply be discarded. As the Institution of Engineers, Australia, noted in its submission to the Inquiry:

> *centralised, large systems will continue to deliver the majority of water services for the next few decades and that alternative systems will only have a limited, albeit important role in the majority of urban environments.*

The Committee agrees with this to a point.

Certainly existing large scale centralised systems as they operate are unsustainable. But they will continue to be an integral part of the provision of water services in urban areas for some considerable time. This will happen for a number of reasons.

Firstly, they are already in place and represent a considerable investment on the part of the community. Secondly, much of the infrastructure still has considerable operating life. Thirdly, these existing systems can, with the addition of some alternatives solutions, be made to operate more sustainably.

However, the focus now has to move to adopting more sustainable approaches.

Given that society does not have a "clean slate" upon which more sustainable alternative approaches can be simply drawn, a two-part approach, in which existing conventional infrastructure operating in a more sustainable way is but one part, will need to be adopted.

A number of contributors to the inquiry recommended such a dual approach:

> *In the industrialized world there are two parallel methods of fulfilling system conditions within urban water management. The first is to improve the function of the existing infrastructure and applied technologies. The second method is to develop new, basically different system solutions, infrastructure and management methods that are designed to fulfil sustainability system conditions, i.e. where the creation of circular material flows and conservative use of energy is an overarching target.*

The Department of Public Works and Services told the Committee:

> **Mr ANDERSON:** Yes, there are two approaches: There is substantial room to improve the performance of the existing reticulated systems, optimise those and redesign them to suit the change in the patterns of urban development where we have gone from quarter acre blocks to where most new subdivision blocks are 500 or 600 square metres and there is substantial room to optimise the existing systems and reduce costs. At the same time there are substantial opportunities to make use of the new technologies. The rainwater tank is being reinvented and can provide a

> very useful supplementary supply to extend existing supplies and the advances in membrane technologies are opening up new avenues to recycle water in a variety of interesting ways. [#ToUE 31/10 p7]

Sydney Water has acknowledged that there is a need to provide water services more sustainably and that its WaterPlan21 was looking at how to do just that. When questioned that in Western Sydney the Corporation was simply replicating traditional approaches on relatively new sites, the Corporation acknowledged that "you are right, it could be better" but that "it is hard to change the world overnight". Because lead times for water infrastructure projects are significant what "you are seeing is a progressive change, not necessarily a radical change".

The Committee has formed the view that the challenge now is not in whether a new paradigm of better integrated and closed water cycle systems should be adopted. It should. The challenge is to create the right circumstances and give the right signals to ensure that it actually happens as soon as possible.

To achieve this the Government will have to play a central, strategic role to ensure this happens.

A number of issues will need to be addressed and resolved for the change of focus to alternative approaches to occur:

HEALTH

A critical issue.

The Committee does not feel that alternative solutions and maintenance of public health are fundamentally incompatible. What will be needed is a cooperative, positive approach to develop appropriate standards and management regimes. It is essential that health regulators be very proactive in assessing alternative approaches.

STRATEGIC POLICY FOCUS

A number of contributions to the Inquiry raised concerns about the multiplicity of agencies involved in delivering water services across the State. This array undermined coordination and led to confusion.

One witness from an urban Council complained that "a number of competing objectives have become evident" across the numerous government and statutory bodies responsible for different parts of the water cycle management system [# ToUE 31/10 p29] Worse still, some of the agencies were not "willing" to try to resolve problems.

Mr Evans from Hunter Water Corporation gave an indication of the regulatory overlay affecting his organisation:

> **Mr Evans:** … Essentially, that regulation falls into environmental regulation as specified by the EPA, essentially for waste water discharges. It falls to what we call water extraction regulation. The Department of Land and Water Conservation, as owner of the water on behalf of the Crown, specifies the terms and conditions of extraction of water from the environment and IPART regulates at two levels. One is

> what we call a customer service level, the determination of standards for continuity, pressure, that sort of thing; and the other one is to regulate price. The Department of Health has a sort of ancillary direct regulatory role with respect to drinking water quality for health reasons.[# ToPCE 27/10 p1]

The Committee pursued the issue of agency coordination with PlanningNSW at public hearings.

> **The Hon Peter Collins:**…Who is coordinating on behalf of the Government….?
>
> **Mr PRATTLEY:** That is a difficult question to answer currently. Currently the closest thing we have to an integrated approach is the Water CEOs group which has the CEOs of all of the agencies involved: EPA, Health, Planning, DLWC, all of the agencies involved in water issues. That is taking a very active and proactive role in trying to address these issues. Different agencies have responsibilities for different elements of that. EPA has some responsibilities; Health has some responsibilities, Sydney Water clearly does, and we do.[# ToUE 1/11 pp 6,7]

One submission argued in fact that this multiplicity of organisations undermined a coherent policy focus and actually hindered the take up of alternative approaches:

> *The second arises from the institutional structures we have constructed to supply water and sewerage services. Part of the lack of purchase in pursuing the adoption of new approaches to water supply and the management of wastewater flows arises from the multiplicity of agencies dealing with different aspects of the water cycle. The State has irrigation authorities, catchment management authorities, water retailers, local government bodies, fishery bodies such as oyster farmers, national park authorities, planning authorities waterway authorities etc, all of which have responsibility for some aspect of the water cycle. [# Submission No 33 p5]*

The Australian Water Association declared in its submission that currently "good proactive planning" is absent and in its place "we rely on reactive engineering to solve our problems".[# Submission No 20 p2]

Consequently, a consistent recommendation put to the Committee was that a more strategic policy approach was required in order to introduce sustainable urban water practices.

Lgov NSW observed somewhat acerbically but succinctly that "Certainly there needs to be greater co-ordination, but whether by one body or a novel experience of Government departments talking to each other, that would certainly be an improvement".[# ToUE 1/11 p19]

In its submission PlanningNSW made the following relevant points to this discussion:

> *The Department is also conscious of the need to ensure that there is a coordinated approach to the management of the catchments from which the Sydney Metropolitan Region obtains its urban water supply. This issue is being addressed by the Department through the development of a Regional Environmental Plan for the drinking water catchments.*

In evidence the Department told the Committee new approaches have to be embedded in the planning stage:

> **Mr Prattley:** …that the new projects that are being planned, particularly the larger scale ones, do really embody these principles as fundamental and not just add-ons, not just doing a conventional development and then saying: What can we do to make it a bit more sustainable? It has to be embedded right back in the basic design philosophies and we are working very closely with the Water CEOs group and EPA to ensure that those principles are embodied.[# ToUE 1/11 p8]

The Stormwater Industry Australia put it most succinctly in its submission: "there must be strategic forward planning put in place, if Sydney is to improve and sustain an urban water balance."[# Submission No 9 p6]

Professors Troy and White argued in their ANU submission that:

> *What is needed is some rationalisation of them [the agencies] that would more appropriately enable the government to give effect to its stated concern to pursue and apply principles of ecologically sustainable development to the management of the water cycle.[# Submission No 33 p5]*

Baulkham Hills Council supported the notion of a more integrated approach for it is

> … promoting a holistic approach to water cycle management to overcome some of those problems… We would support that holistic approach to the whole issue of water provision. [# ToUE 31/10 p33]

PlanningNSW offered its planFIRST model as a tool for integrating land use and natural resource planning:

> **Mr Prattley:** … The department considers the implementation of sustainable urban water infrastructure outcomes will be dependent upon the adoption of strategic integrated decision-making processes, and to this end the planning and consultation processes that are being developed under the planFIRST model, we believe will provide a much more appropriate mechanism to explore integrated land use and natural resource planning and help achieve those outcomes.
>
> PlanFIRST will provide agencies such as DLWC, Sydney Water and the EPA with the ability to identify key integrated water cycle management and urban water infrastructure priorities at the regional level and translate those outcomes, including demand management policies if necessary, into local plans. This approach, we believe, will achieve significant cost savings and will ensure that the full social, environmental and financial costs of urban water infrastructure provision are considered in a more integrated manner.[# ToUE 1/11 pp 3,4]

RESEARCH

While considerable knowledge of the performance of traditional systems has been accumulated over time, the same cannot be said of alternative systems. It is essential to expand this knowledge so that informed, balanced evaluations can be made in order to adopt the most appropriate solution to particular circumstances.

In introducing more sustainable urban water infrastructure it will be imperative that new technologies and new approaches to managing urban water infrastructure and associated water quality management processes are investigated and fully understood.

There has to be ongoing research of the options and, just as important, a process to ensure that the research findings actually influence policy options.

FLEXIBILITY AND TOOLBOX OF OPTIONS

The key to achieving the most sustainable outcome was flexibility.

No single technological or institutional solution will deliver the best urban water outcomes. Thus, rather than mandating one single solution, the most sustainable outcomes will be achieved through identifying the most sustainable solution from range of possible options.

A broad range of options, therefore, should always be available in the early planning phases to ensure the most sustainable solution is adopted. Part of the problem with traditional systems is that at the moment they are really the only option seriously considered.

CSIRO identified a number of techniques and technologies which could form part of a "tool box" of solutions from which the most appropriate solution (or "tool") can be selected:

> *…we do not consider it possible or appropriate that specific techniques be universally recommended on sustainability grounds, as this disregards the context and local circumstances in which they are placed. In general terms though, we have found that, if a rainwater tank is used for a combination of water supply, water supply peak levelling and stormwater peak flow mitigation, they can be a cost effective element of a water servicing approach. Well performing water efficient appliances, fittings and practices are an important element of this tool-box of techniques, along with a host of others, including water sensitive stormwater treatment technologies, decentralised water and wastewater treatment plants, vacuum and grinder pump wastewater reticulation systems, domestic fire sprinklers and pressure reduction in the water supply reticulation system. CSIRO sub*

A critical factor in analysing the options in the tool box is to ensure that all the costs of particular approaches are identified and evaluated. In other word, a triple bottom lined approach should be part of the decision-making process.

At the moment current evaluation process do not take into consideration externalities and are, as a consequence, unfairly tipping the balance in favour of conventional systems. As the CSIRO stressed, it is necessary to incorporate triple bottom line analysis in decision-making in order to avoid "false investment decisions".

Unfortunately, triple bottom line accounting is still being developed, although a number of witnesses referred the Committee to examples where this approach has been utilised.

Another factor which unfairly tips the balance in favour of conventional systems is that water utilities have an in-built bias toward them. Water utilities tend to be locked into this type of infrastructure solution for reasons other than the merits of the infrastructure. In the words of the CSIRO the systems have become "self-perpetuating":

> *There is also a degree of self perpetuation with the conventional approach to providing greenfield water services, as there is considerably more experience with the current system and less known about alternatives, increasing the perceived risk associated with these alternatives. The costing of infrastructure, rather than fuller costing, which takes into account externalities also perpetuates conventional approaches.*

Mr Pamminger Francis from Yarra Valley Water described this phenomenon in the following way:

> *Water sensitive Urban Design challenges the paradigm in which water utilities have operated in for the last two thousand years. A paradigm view can limit an individual's ability to see another perspective… The key point is that once you see one view, it is hard to see the other….. [W]ater companies, or any company that has faced little change over a period of time, can get trapped in a particular way of seeing things. The challenges for water utilities is to be able to see outside their traditional way of providing services which been based on major centralised infrastructure.*

A major task in moving to more sustainable urban water infrastructure is to overcome the dependence or infatuation with these traditional systems. The challenge is to develop approaches and policies to break the cycle of dependence, where it needs to be broken.

While the most immediate application of alternatives approaches is in greenfield sites, in time methodologies will have to be developed to better evaluate and utilise the range of options in brownfield sites as traditional infrastructure networks in these areas approach the end of their usable life.

> *There are lots of sub-costs and developing a methodology to identify where an existing system might be replaced by one that is more innovative in a developed area is one of the key challenges that is facing us.*

More specifically on this point Dr Speers pointed out that

> …You hear a lot also about Greenfield sites and what can be done in Greenfield sites, but the fact is at the moment absolutely none of us live in Greenfield sites, we all live in developed sites, and that is where we have the least understanding of what options might be available. So understanding and developing ideas about how developed sites can be improved is an issue as well and that will require a number of players to collaborate, planning agencies, local councils, Sydney Water and so on. We are beginning on some of that work. We have a project going at Freshwater Beach, north of Manly, to begin to look at how one would manage the total water cycle for that small catchment better, but it is the beginning of research and much more needs to be done.

PRICING

One of the most consistent themes throughout the Inquiry has been the question of the pricing of water. Most witnesses before the Committee noted that water was priced too low. For example:

- DPWS – "At the moment it [water] is dirt cheap…It is so cheap that people do not value it". [# ToUE 31/ p 15]
- Blacktown Council – "I think water currently is very cheap" [# ToUE 31/10 p34]
- Albury City Council - I do not disagree with the need to look at alternative systems and so on, don't get me wrong. Some of the things that have been said I agree with. I think the price of water is not a controlling mechanism at the moment and that needs to be looked at very seriously, particularly in urban situations. Even in our area the cost of water is too cheap.[#ToUE 31/10 p35]

Professors Troy and White acknowledged that "major changes" could be "introduced by changes in pricing". [# ToUE 31/10 p22]

The pricing issue was vital to moving to alternatives such as reuse, because, according to one witness, "a key to developing reuse options will hinge on the pricing of fresh water. Currently, fresh water is cheap relative to recycled water" which limits the viability of recycled water options.

In some ways it is easier to change behaviour on energy than water for, as Mr Evans from Hunter Water Corporation stated, "people's energy bills are a much bigger proportion of weekly earnings than water bills". The implication being that water might well be underpriced.

According to SIA the pricing of water is distorted:

> *Typically the price of potable water is thought to be of the order of $0.80 to $1.20 / kilolitre depending upon location and the nature of the water supply systems. However it is suggested that the real cost of water is of the order of $4 - $5 at minimum. (Reynolds, Tomorrow Today Strategic Engineering Planning).[# Submission No 9 p2]*

At the hearings, the Association's representative observed:

> **Dr Coombes:** …One of the disturbing issues, to make my point, is short term economic analysis and we use a very unrealistic value of water, and this is highlighted in the least cost planning strategies that Sydney Water have to dictate the order of demand management strategies they use, and suggest we use the long run marginal cost of water to decide on alternative strategies, rather than an artificial short run cost that does not account for the cost of dams or the cost of staff, and, you know, the cost of running your assets.[# ToPCE 27/10 p23]

EDUCATION

Given community concerns with some forms of alternative approaches being developed, or even in use, it will be necessary to ensure that there is an increased level of community awareness and education when implementing new technologies.

The Committee makes the following findings and recommendations:

FINDINGS

FINDING ONE

If sustainability is one of society's underpinning values, a new paradigm for urban water infrastructure for the 21st needs to be set in train. This paradigm will be based on infrastructure that ensures integration and closed water cycle.

FINDING TWO

Large scale centralised reticulation schemes will continue to provide high quality water services for many years. However, until they reach the end of their life they need to be operated as sustainably as possible through greater integration.

FINDING THREE

The new paradigm will only come about if Government takes a strategic lead in creating the circumstances which ensure alternative systems become an integral part of urban water infrastructure solutions. This will require the identification or establishment of a lead agency to drive total water cycle policy.

The following recommendations reflect the outcome of the Committee's deliberations to date. (The Committee will make further recommendations in its Final Report in line with the issues identified for further action in the following chapter).

RECOMMENDATIONS

RECOMMENDATION ONE

Rainwater tanks (on-site storage) be compulsory for all new dwellings, where they are used for a combination of water supply, water supply peak leveling and stormwater peak flow mitigation.

RECOMMENDATION TWO

Current subsidies for rainwater tanks should be extended to additional tanks for those in bushfire risk areas.

RECOMMENDATION THREE

All new development should be approved subject to Water Sensitive Urban Design Principles.

RECOMMENDATION FOUR

The Department of Housing take the lead in providing on-site storage for residents.

RECOMMENDATION FIVE

The Department of Education should install on-site storage tanks in schools – as part of better water management and as an educational tool.

RECOMMENDATION SIX

That all Government contracts for building construction include provisions for water cycle management to ensure the adoption of water reduction, reuse and efficient discharge systems (this should include PFP arrangements)

RECOMMENDATION SEVEN

Information on water conservation techniques (including landscaping) should be freely and publicly available to all householders.

RECOMMENDATION EIGHT

Meaningful (tangible) visual representations of water usage should be displayed on water bills. (For example, the number of equivalent swimming pools consumed in the payment period).

Chapter Six: Issues for Further Consideration

The issue of urban water infrastructure is complex. In the time available the Committee has been able to make a number of recommendations. However, there are still a number of outstanding issues to be dealt with. They require careful consideration, and perhaps some further investigation, in order to resolve to the Committee's satisfaction.

In addition to issues raised in the previous chapter, the following summarise matters that also need further consideration. They will be dealt with in the final report of this Inquiry. For convenience, the issues are categorised as follows:

- Existing Infrastructure
- Alternative Approaches
- Transitional

EXISTING INFRASTRUCTURE

Society has considerable investment in the current (traditional) reticulation systems. It makes sense to get the most out of this infrastructure without falling for the trap of being so infatuated with these large engineering systems that change is impossible. Making the existing infrastructure work harder through a more integrated, less wasteful approach to providing urban water services is an important approach.

ISSUES TO CONSIDER

- Tools for integrating the three separate reticulation systems

ALTERNATIVE APPROACHES

The advantages and disadvantages of the full range of alternative solutions need to be available to decision makers, industry stakeholders and householders so that informed decision can be made. This should include the full social and environmental costs of all alternatives.

ISSUES TO CONSIDER

- Health implication of all alternative systems
- Management of the range of alternative systems
- Decision making matrix
- Education of all stakeholders
- Funding base for stormwater infrastructure
- Penalise inappropriate design
- Drive Innovation

TRANSITION

The necessary change of direction, a change of direction which in the view of the Committee will benefit the whole community, will not occur without some very positive signals to the community generally and the authorities responsible for urban water infrastructure delivery.

ISSUES FOR FURTHER CONSIDERATION

- Strategic Policy Focus and Direction
- Pricing of water
- Include all externalities in the decision-making process
- Research – Considerable research needs to be done in a range of areas
- Overcoming the “self-perpetuation” of traditional schemes

APPENDIX A

TERMS OF REFERENCE

The Committee to inquire into and report on:

The provision of urban water* infrastructure in New South Wales, with particular reference to:

1. Factors (historical, social etc) which have led to current systems of centralised reticulation infrastructure for the delivery of urban water services

2. Age and expected life of this existing infrastructure

3. Full replacement cost of this infrastructure

4. Environmental, economic and social performance of these systems

5. Alternatives systems and approaches which can provide high quality water-related services to the community at a lower cost and with better environmental outcomes. For example:
   - smarter engineering solutions, including decentralised water supply and waste water treatment and management
   - water sensitive urban design principles
   - adoption of modern biological treatment processes

6. Environmental, economic and social performance of such alternative systems, particularly:
   - potential cost savings of alternative approaches (including capital and operating costs)
   - advantages of better integrated administrative and policy arrangements
   - recognising stormwater and waste water as a resource rather than a problem (for disposal)
   - financing options

7. Strategies for introducing alternative systems as existing infrastructure approaches the end of its design life

8. Any other related matter.

* "water" is taken to mean water supply, sewerage and stormwater and "urban" includes all urban areas (not just major metropolitan areas)

APPENDIX B

LIST OF WITNESSES

Friday, 27 September 2002

Mr. Dave Evans, Managing Director, Hunter Water Corporation

Dr. Peter Coombes, Chairman, Stormwater Industry Association

Dr. Charles Essery, General Manager – Town Water Treatment and Recycling, Department of Land and Water Conservation

Mr. Andrew Kasmarik, NSW Branch President, Australian Water Association

Mr. Brian McRae, Technical Director, Australian Water Association

Mr. Julian Briggs, NSW Branch Committee Member, Australian Water Association

Mr. Alex Walker, Managing Director, Sydney Water Corporation

Dr. Judi Hansen, General Manager – Environment and Innovation, Sydney Water Corporation

Ms. Judith Meeske, Asset Planning Process Leader, Sydney Water Corporation

Thursday, 31 October 2002

Mr. Will Strachan, General Manager – Infrastructure and Environmental Services, Department of Public Works and Services

Mr. John Anderson, Technical Director – Infrastructure and Environmental Services, Department of Public Works and Services

Prof. Patrick Troy, Visiting Fellow – Centre for Resource and Environmental Studies, Australian National University

Prof. Ian White, Professor of Water Resources – Centre for Resource and Environmental Studies, Australian National University

Mr. Darryl McGregor, General Manager, Albury City Council

Mr. David Workman, Project Planner, Baulkham Hills Shire Council

Mr. James Rennie, Waterways Rehabilitation Officer, Blacktown City Council

Friday, 1 November 2002

Mr. Gary Prattley, Executive Director – Metropolitan Planning, PlanningNSW

Councillor Michael Montgomery, President, Shires Association of NSW

Councillor Pat Brassil, Local Government Association of NSW

Mr. Jerome Argue, Civil/Environmental Engineer, Northrop Engineers Pty. Ltd.

Mr. Andrew Speers, Director – Urban Water, Commonwealth Scientific and Industrial Research Organisation

Thursday, 21 November 2002

Dr. Stephen Corbett, Acting Director of Health Protection, Department of Health

Ms. Christine Cowie, Manager – Water Unit, Department of Health

Dr. Charles Essery, General Manager, Town Water Treatment and Recycling, Department of Land and Water Conservation