

# ALTERNATIVE WATER SUPPLIES FOR HEALTH AND WELLBEING

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## ABSTRACT

Over the past decade a dryer climate has resulted in declining water resources for Victoria's metropolitan and regional communities. Water restrictions mean that managers of public recreation spaces need to think creatively about how to maintain these important community assets.

By incorporating natural stormwater management systems into parkland design, public health and the environment benefit. Department of Health (DH) has commenced work to develop strategies to secure a sustainable future for communities most at risk. The work has involved cross functional collaboration on projects to facilitate equity amongst communities and ensure access to good quality recreation spaces.

It is hoped this approach will achieve innovative outcomes through the development of new water resources which will support redevelopment of recreation spaces resulting in healthy lifestyles.

## INTRODUCTION

Chronic diseases are the leading causes of death and disability worldwide. Disease rates from these conditions are accelerating globally, advancing across every region and pervading all socioeconomic classes. The World Health Report (2002) reducing Risks Promoting Healthy Life: indicates that the mortality, morbidity and disability attributed to the major chronic diseases currently account for almost 60% of all deaths and 43% of the global burden of disease. By 2020 their contribution is expected to rise to 73% of all deaths and 60% of the global burden of disease. Four of the most prominent chronic diseases – cardiovascular diseases, cancer, chronic obstructive pulmonary disease and type 2 diabetes – are linked by common and preventable biological risk factors. These include high blood pressure, high blood cholesterol and obesity, and by related major behavioural risk factors: unhealthy diet, physical inactivity and tobacco use. Action to prevent these major chronic diseases should focus on controlling these and other key risk factors in a well-integrated manner.

Regular physical activity reduces risk and provides therapeutic benefits for people with heart attack, colon cancer, diabetes, and high blood pressure and may reduce the risk of stroke. It also helps to control weight; contributes to healthy bones, muscles, and joints; reduces falls among older adults; helps to relieve the pain of arthritis; reduces symptoms of anxiety and depression; and is associated with fewer hospitalisations, visits to doctors and other health services, and the need for medications. Physical activity does not need to be strenuous to be beneficial. For example, 30 minutes of moderate-intensity physical activity on most days will benefit adults of all ages.

Until recently, Victorian water resources have been sufficient to meet demands in maintaining public parks and sport fields which are necessary to encourage all age groups to participate in physical activity. However, the social and political landscape surrounding water resources has changed substantially in the last five to ten years. The increasing acceptance of scientific evidence over the projected impacts of climate change and an extended period of drought has placed most areas on water restrictions. As a result, many sports grounds are now unplayable due to poor grass coverage and hard surfaces and many public parks used for passive recreation are in a state of decay.

Reliable alternative water supplies are essential to maintain the physical infrastructure in order to sustain the activities that support our health and wellbeing and the economy. This is not something that can be achieved by one organisation or a few individuals alone.

Whilst we previously built new dams to meet additional water demands, we are now being more efficient with our water use and examining alternative sources to supplement drinking water. In recent years we have made a significant shift towards the use of water resources generated within the urban boundary, for example recycling wastewater and installation of rainwater tanks. However, the location of treatment facilities means that recycled water is often not a realistic alternative for irrigating parks and gardens in most communities.

Urban stormwater systems are designed to take rainwater from our streets and guttering to the closest waterway. Unlike sewage, stormwater is not treated before it enters our waterways. In urban areas an increase in the number and size of impervious areas has reduced the amount of rain that infiltrates the ground or is retained by vegetation. Consequently, increased quantities of stormwater runoff enter the drainage system and the receiving waterways. Urbanisation has also changed the timing for stormwater discharged into water environments, as stormwater drainage systems have been constructed to remove stormwater from urban areas as quickly as possible in order to minimise the risk of flooding and to prevent water from becoming stagnant.

Slowing stormwater runoff by incorporating measures such as grass swale drains, vegetated filter strips, porous pavements and wetlands can not only remove urban pollutants from receiving waterways but provide a suitable alternative source of water for irrigating public parks.

This report outlines the role of stormwater schemes as an alternative water supply to irrigate public open space to facilitate physical activity.

## ROLE OF URBAN ENVIRONMENTS ON HEALTH AND WELLBEING

### **Health and physical activity**

There is general consensus that regular physical activity has positive health benefits, such as reducing the risk of diseases like type II diabetes, heart disease and obesity as well as protecting against some forms of cancer (Bauman et al., 2002; VicHealth, 2007). There are also associated mental health benefits, with participation in sport being linked to positive social and psychological outcomes (VicHealth, 2007; Kingwell, 2004; Maller et al., 2002).

The Centres for Disease Control in the United States have found that despite the known benefits of physical activity, more than 50% of adults do not get enough physical activity to provide health benefits; 25% are not active at all in their leisure time. Activity decreases with age, and sufficient activity is less common among women than men and among those with lower incomes and less education. About two-thirds of young people in grades 9–12 are not engaged in recommended levels of physical activity (CDC 2005).

Physical inactivity is responsible for an estimated 8,000 deaths per year in Australia,

and costs the health system at least \$400 million in direct health care costs (Bauman et al., 2002). It is also ranked second only to tobacco control in being the most important factor in health promotion and disease prevention in Australia (VicHealth, 2007b).

The National Physical Activity Guidelines for Australians recommends adults exercise for at least 30 minutes of moderate-intensity physical activity on most, preferably all, days, and children aged 5-18 exercise for 60 minutes of moderate to vigorous activity a day (DoHA, 2007). However there is evidence that rates of participation in physical activity in Australia are declining. Surveys in 1997, 1999 and 2000 showed increased awareness of the health benefits of being active but some evidence for a decline in regular participation (Bauman et al., 2002). VicHealth reports that 54% of Australian adults are not doing enough physical activity to achieve health benefits (VicHealth, 2007).

Sport organisations also play a role in bringing communities together, particularly in regional areas. In their study of sport in rural communities Townsend et al. (2002) concluded that “physical activity and sport make a significant contribution to the health and wellbeing of rural people and their communities.” Other qualitative studies have found that rural sporting clubs may prevent against increased alcohol consumption, antisocial behaviour, crime and depression (MAV, 2007).

### **Health and environment**

The importance of the relationship between environment and health was recognised in the World Health Organisation's Ottawa Charter for Health Promotion (WHO, 1986), and further reiterated in the Jakarta Declaration (WHO, 1997), which specifically stated that the environment can permit or deter people from being physically active.

There are benefits to people's overall health when planners, developers and local councils make provision for active living. Research has shown that urban planning needs to create opportunities for active living through the provision of parks, gardens and sports facilities. Ellaway et al (2005) found that people living in areas with high levels of greenery are three times more likely to be physically active and 40 per cent less likely to be overweight or obese than those living in areas with low levels of greenery.

Giles-Corti et al. (2005) found that better access to public open spaces was associated with a 50% increased likelihood of high levels

of walking. Cohen et al. (2006) demonstrated that teenagers living near parks engaged in more vigorous physical activity. Edwards & Tsouros (2006) concluded that people who can easily access green spaces and parks are more active. Other research from across Australia and worldwide has had similar findings (incl. Powell et al., 2004; Corti et al., 1996; Kavanagh et al., 2007).

Maller et al (2002) conclude that “the individual and community benefits arising from contact with nature include biological, mental, social, environmental and economic outcomes’. Maller et al (2002) also showed that well designed public open space is restorative, reducing mental fatigue and stress. Other evidence suggests that people who are more active are also more likely to have healthier food choices and get more involved in their communities. These communities in turn, are more resilient and social networks are strengthened. (Sustainable Development Commission, 2008)

Further evidence about the relationship between health and environment is demonstrated by Maas et al (2009). This study of medical records from 195 general practitioners in 96 Dutch practices, serving a population of 345,143 people found that patients who lived within 1 km radius of green space, reported a lower prevalence rate of 15 disease clusters. The relation was stronger for children and people with lower socioeconomic status. Furthermore, the relation was strongest in slightly urban areas and not very apparent in very strongly urban areas the relationship was stronger for children and lower socioeconomic status.

As Rowe and Thomas (2008) point out, the impact of climate change on health will be strongly related to local environment and socio-economic factors and adaptations made to lessen the full range of these impacts.

#### IMPACT OF DRYING CLIMATE ON URBAN ENVIRONMENTS

The Bureau of Meteorology reports that for large parts of southern and eastern Australia, dry conditions have persisted since October 1996 (Bureau of Meteorology, 2007). Best-estimate projections of rainfall patterns in Australia predict continued drying in southern Australia. The CSIRO and the Bureau of Meteorology have concluded that the drought in many parts of the country is linked to, or at least exacerbated by, global climate change (Garnaut, 2008; Bureau of Meteorology & CSIRO, 2007).

Projections for Australia are for water security problems to intensify with more frequent and intense droughts, increases in the severity and frequency of storms and coastal flooding, heatwaves and fires, significant loss of biodiversity, risks to major infrastructure, more blackouts and a decline in agriculture and forestry production (DHS, 2007; Garnaut, 2008; Bureau of Meteorology & CSIRO, 2007).

Climate change modelling indicates that drought could be up to 20% more common by 2030 over much of Australia and up to 80% more common in south-western Australia by 2070 (Department of Climate Change, 2008).

The Cost of Delivering Sport Taskforce identified in 2001 that water issues were one of the five main areas impacting on sport (Sport and Recreation Victoria, 2001). It also found that sport and recreation organisations based in country Victoria considered all water related issues, including availability and cost, of major significance to the whole community. The reduction in water resources resulting from climate change has resulted in water restrictions in most areas. The impact of these restrictions has been reflected in changing practices of councils in relation to the use of sports grounds.

Local councils are employing a range of measures to combat the effects of drought on their sports grounds. The Cost of Delivering Sport and Recreation to the Victorian Community Report states that as of 2001 only 2-5% of sport facilities were using water re-use plans – a figure that “reflects the high capital investment required” (Sport and Recreation Victoria 2001). Water issues and costs were found to be considerably greater in country Victoria than in metropolitan Melbourne. The Report also asserts that the unknown health risks associated with water re-use, combined with the large capital input, is limiting the suitability of water re-use strategies.

Many councils have spent large amounts to maintain sports grounds. In a survey done by the Municipal Association of Victoria during 2007, twenty councils reported allocating additional funding to addressing the impact of drought on sport facilities – approximately \$1.6 million (MAV, 2007).

#### OVERVIEW OF STORMWATER USE IN URBAN ENVIRONMENTS

Stormwater harvesting is essentially the realisation of a water sensitive city; it is about generating water close to where it is needed. In Melbourne the volume of stormwater that runs down the drains when it rains is

approximately the same as the entire annual water demand of the city (PMSEIC, 2007).

Stormwater quality varies due to the different pollution sources, the range of activities in a catchment at any point in time, climate (e.g. Rainfall intensity, extended dry weather), and catchment infrastructure (e.g. leaking sewers) (Mitchell et al 2006).

As stormwater harvesting is a relatively new source of water compared to rainwater tanks and effluent recycling from sewerage treatment plants, I undertook an investigation into Victorian councils understanding of stormwater harvesting and reuse during 2009.

Victorian councils with population centres of greater than 10,000 were requested to complete a survey based on the impacts of drought on recreation spaces and their ability to manage decentralised stormwater harvesting schemes. Forty two councils participated. To ensure that the responses represented the views of the broad staff base, rather than an individual officer, the survey was conducted with officers representing parks and gardens, sustainability and environment, engineering/asset management, sport and recreation and public health. Councils participating represented metropolitan urban (42.9%), metropolitan urban fringe (19.0%), regional centres (16.7%) and rural (21.4%)

Some of the interesting outcomes from this work are described in the following paragraphs.

### **Variable rainfall patterns**

The issue of variability in local climates was highlighted. It was identified that some eastern suburbs of Melbourne have on average more than 110 days of rain per year while most western suburbs have less than 90 days. Only half of these were likely to generate significant run-off for harvesting and reuse. Between year variability was an uncertainty related to long-term cycles such as the El Nino Southern Oscillation Index and possible long-term changes in rainfall due to climate change was also a limiting factor.

### **Potential health risks**

Investigations of stormwater harvesting systems that have been implemented in the past few years indicate that there are major gaps in understanding of the potential health risks of stormwater harvesting systems. Although the schemes deliver mainly non-potable water (typically for garden watering and sometimes toilet flushing), it was acknowledged that stormwater, like all classes

of water recycled and reused in the urban water system contains pathogens, heavy metals and chemicals that pose a public health risk.

### **Demonstrating cost benefit**

Quantifying the cost-benefit for stormwater harvesting and reuse proposals can be difficult. While the capital cost for projects are relatively easy to estimate, maintenance costs, environmental and public health benefits are more difficult to quantify.

If predetermined criteria based on the comparison of relative weightings or rankings were developed, then this approach would allow for an in-depth assessment of the multiple parameters and objectives normally associated with such schemes could be achieved.

### **Skills and capacity**

Water restrictions have increased demand on council resources. In addition to councils' established business of maintaining parks and gardens, councils are developing water allocation policies, communicating new policies to stakeholders, monitoring ground conditions, renegotiating ground use and access, rescheduling fixtures, moderating disputes, policing ground use and enforcements by unauthorised users.

The development of strategic plans to address water security is therefore a significant issue.

The variable capacity of councils, clubs and associations to adapt is resulting in inequitable outcomes. Large well resourced urban councils are more able to respond to water related challenges, while councils with smaller revenue bases in dryer regions are facing more difficult challenges with the provision of recreation spaces for their residents.

### **Governance**

Guidance, such as the Australian Runoff Quality Manual, Melbourne Waters' WSUD Engineering Procedures – Stormwater Guidelines, and CSIRO's Urban Stormwater Best Practice Environment Management Guidelines, provide adequate technical advice about construction of stormwater harvesting schemes. However, there are insufficient tools to help develop and implement sustainable water strategies to meet health and wellbeing objectives. Furthermore, access rights and entitlements to stormwater runoff need resolution.

Councils tend to be conservative when funding non-mainstream activities. Stormwater

harvesting is a relatively new activity where only the most progressive councils are prepared to undertake works trialling innovative or unproven technologies. Most councils are reluctant to invest in works that have no proven track record without a government framework to identify reliable technologies and provide the methods to demonstrate benefits.

#### POLICY CONTEXT: STORMWATER, HEALTH AND WELLBEING

In Victoria, the relationship between urban environments and health continues to evolve. Liveable communities and health and wellbeing are two areas of priority in *A Fairer Victoria* (Victorian Government 2008). This document defines 'Liveable Communities' as:

*"Liveable communities are where people feel safe, there is a sense of belonging and community pride, and where there are job opportunities, affordable housing, good local services and facilities and enjoyable environments."*

The links between health and urban environments are also acknowledged in the recently released discussion paper of the National Preventative Health Taskforce, *Australia: the healthiest country by 2020* (Australian Government 2008). One of seven major actions to reduce obesity identified in this document is to:

*"Reshape urban environments toward healthy options through consistent town planning and building design that encourage greater levels of physical activity and through appropriate infrastructure investments."*

The Victorian Climate Change Green Paper (Victorian Government 2009) highlights the need to better understand the impacts and consequences of climate change on mental health and social dislocation. It identifies mental health impacts may arise as a result of extreme weather events or disruption to social, economic, demographic and environmental conditions that support good physical and mental health. The Green Paper states that the Government can support adaptation to climate change by maintaining strong public health and human services infrastructure, promoting resilient communities and individuals, and by incorporating climate change responses into existing health policies and programs.

Healthy Spaces & Places (Australian Local Government Association 2009), was developed in response to local government requests for practical guidance in designing walkable and ultimately more liveable communities. Healthy by Design provides a framework to support the role local councils in planning, designing and regulating environments that allow for and encourage healthier lifestyles. It draws together a variety of design considerations into one guide, including aspects that relate to walking, cycling routes, streets, local destinations, open space, public transport and fostering of community spirit.

The Victoria Climate Change Green Paper (Victorian Government 2009) identifies the need to use less fresh water and capture more water for reuse and recycling. In adapting to climate change it highlights the importance of water sensitive urban design to protect and enhance city parks and open space, which in turn improves thermal comfort of our built up areas.

Melbourne 2030 (Victorian Government 2002) is an overarching Victorian government policy that is part of *Our Growing Victoria* vision that aims to balance economic, social and environmental goals so that future generations can enjoy a better quality of life. It identifies stormwater reuse as a key principle to achieve this goal and establishes and action to:

*"adopt guidelines to encourage use of stormwater by local government, developers and households; and to ensure that local treatment and recycling of stormwater for non potable uses is considered in new developments."*

#### CONCLUSION

Public health practitioners, urban planners and water engineers face new challenges in managing the health of populations through the adoption of alternative water strategies for our cities and towns. While public health, planning and engineering disciplines have shared a close early history, separation in recent decades has weakened our capacity to enhance health and wellbeing. With the majority of people living in urban environments and the emergence of lifestyle health challenges, there is a new need to reassess the relationship between these professions. Responding involves two key challenges. The first is to advance our understanding of contemporary urban-health relationships and the second requires a reconnection between

public health and colleagues in the water and strategic planning sectors.

Of the range of solutions available, harvesting of stormwater in the urban landscape offers great potential. However, this potential has not been tapped due to widely perceived difficulties in its implementation, despite its fundamental role in the total water cycle (Radcliffe, 2003). Stormwater harvesting systems could be fully integrated into the urban landscape to deliver a wide range of benefits.

Stormwater recycling is an important strategy for improving urban water cycle management, particularly given the current and increasing stresses on existing water resources throughout urban centres. Although progress has been made in the field of stormwater recycling, there are numerous knowledge gaps that need to be filled before it can be safely and efficiently integrated into the urban water cycle on a widespread scale.

At present, the largest obstacles to implementing stormwater recycling are:

- lack of regulation and design criteria;
- lack of clear design guidelines; and
- lack of a method to adequately assess costs and benefits of recycling systems against conventional practices.

Stormwater is currently not effectively regulated. Given the potential for stormwater reuse, higher priority should be given to the development of specific guidelines to facilitate appropriate implementation and to allow harvesting and reuse systems to be designed effectively and safely. If stormwater reuse can be implemented via a well defined, step-by-step process it follows that councils will be more inclined to incorporate stormwater reuse schemes for maintaining recreation spaces.

There is a clear need for the development of innovative technologies (or modification of existing technologies) for the collection, treatment and storage of stormwater. Until this knowledge gap is addressed stormwater reuse will most likely be limited to well-off communities, further reducing the availability of recreation spaces for lower socio economic neighbourhoods.

Design standards for stormwater treatment for the purposes of reuse, based on targeted

research, are also needed. Performance modelling for design evaluation purposes also needs further research, to adapt it to the requirements of integrated stormwater treatment and reuse. Reliable models should be developed that are capable of predicting the efficacy of water treatment technologies.

Existing models, such as MUSIC, Australian Runoff Quality Manual, Melbourne Waters' WSUD Engineering Procedures – Stormwater Guidelines, and CSIRO's Urban Stormwater Best Practice Environment Management Guidelines, could be used as a starting point for their development. Designing efficient systems would then be more accessible to councils.

There is currently no agreed methodology to objectively assess the costs and benefits of stormwater reuse schemes, and little progress has been made in assessing stormwater reuse options against the true costs of current practices. A well-structured approach, based on sound science, should be developed to resolve these issues, if widespread adoption is to be achieved.

The development of well defined guidelines with respect to construction, operation and maintenance is required, to ensure adequate information is available. Without guidelines, it is likely that the integrity of schemes is at risk, with potential impacts on public health and amenity.

The involvement of all concerned parties (i.e. government at all levels, water industry, social policy, planners, civil infrastructure, sport, recreation, health, environment and sustainability and the community) is a key factor in determining the success (or failure) of an integrated water reuse projects. A clear process, supported by policy that facilitates this involvement from the initial stages of a project should be developed. Most importantly, the development of a clear regulatory framework and appropriate design guidelines would be helpful in overcoming many of the implementation issues and uncertainties currently encountered by proponents of stormwater reuse schemes.

Notwithstanding the limitations described above, there is great potential for the integration of stormwater treatment and reuse in Victoria. The combination of climate and relative availability of space means that stormwater reuse could provide a significant input to securing recreation spaces for health and wellbeing.

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