

SCOPING STUDY ECONOMIC VALUE OF IRRIGATION IN URBAN GREEN OPEN SPACE

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ABSTRACT

Irrigation of open green spaces in urban areas generates a range of environmental and social benefits. Until now there has been little research into the economic value of these green open spaces. The aim of this paper is to develop some credible models that will enable an economic value to be placed on these broad community benefits.

Keeping in mind the preliminary nature of the work being undertaken, estimates have been prepared describing the demonstrated net economic, social and environmental benefits attributable to urban green space in an economic context.

The information is presented in the form of two case studies representing 'typical' urban local government areas, one with a low area of public open space per hectare, and the other with a large area of public open space per hectare. Comparisons between the two case study areas are made and conclusions drawn.

Policy issues are discussed within the context of the benefits assessed, and recommendations are made for areas of further research in the context of where most benefit can be expected.

INTRODUCTION

The CRC for Irrigation Futures (CRC IF) National Workshop in Sydney 2004 identified a need to establish appropriate technical, social and economic indices that define irrigation efficiency in the urban context, since the efficiency indices used in agricultural irrigation are often not very meaningful in urban contexts.

The forum recognised that solutions for urban irrigation issues need to be developed not only in a technical context but also in social, economic and political contexts.

This paper has been prepared from a report (Morison and Mathieson 2008) that contained the combined findings of two working papers. Working Paper 1 included a literature review which identified a number of key research papers and leads in assessing the current state of research in the field drawing on work to date by CRC IF honours students, Ed Mosley of Melbourne University and Dena Fam of University of Western Sydney. This together with other relevant research reports and documents were collated, annotated and incorporated into the report.

Working Paper 2 drew on the findings of the literature review (Working Paper 1) and included a comprehensive list of the types of community benefits that arise from green open spaces in urban public areas and to a lesser extent, private open spaces. These benefits include but are not limited to reduced obesity, improved mental health, improved biodiversity, safe surfaces for sporting events, lower petty crime and improved tourism. For each type of benefit, the methods that have been used to quantify these benefits were documented.

This is a summary of the report (Morison and Mathieson 2008) that brought together the findings of the two working papers together with a preliminary attempt to make a dollar value estimate of the benefits of urban open space.

Information is presented on two case studies representing 'typical' urban local government areas: Ashfield, which has a relatively low area of public open space per hectare and Mosman, which has a large area of public open space.

SUMMARY

The study provides a framework for quantitative assessment of social, environmental and economic benefits and costs associated with urban irrigation and urban open space.

For each set of social, environmental and economic indicators an estimate was made of the change in benefits arising from an increase in the area, quality or access to green open space. The intention was to provide a framework for undertaking a marginal analysis that will be useful in future policy considerations and analyses. As well, for environmental and economic measures, an attempt was made to estimate the value of the existing stock of green open space (at least some aspects of the existing stock).

Social Benefits

Obtaining small area data describing the number of people suffering depression and mental health issues or needing preventative health care was beyond the scope of this project. Estimates for Ashfield and Mosman have been calculated using national averages and, as such, may not reflect the actual data for each area. Given the lower socio-economic indicators for Ashfield would suggest that socio-economic problems are more prevalent than in Mosman and that indicators in both areas could be different to national averages.

Estimates of social benefits for Ashfield and Mosman arising from a hypothetical increase in access to or utilisation of green open space are presented in Table 1.

Table 1 Estimates of social benefits from existing data

Social Indicators	Ashfield	Mosman
Hypothetical increase in proportion of the population with access to/utilisation of green open space^a	5%	5%
Depression & mental health:		
Estimated number of people suffering depression & mental health problems ^b	1,553	1,027
No. of depression sufferers with increased access to green open space	78	51
No. of depression sufferers who experience a significant reduction in depth of depression ^c	50	33
Reduction in depression related medical costs per annum (\$m) ^d	0.038	0.025
Reduction in depression related lost productivity per annum (\$m) ^e	0.152	0.104
Total potential annual benefit - depression & mental health (\$m)	0.190	0.129
Obesity:		
Estimated number of obese people ^f	6,335	4,204
No. of obese people with increased access to green open space	317	210
No. of obese people who experience a significant reduction in weight ^g	206	137
Reduction in obesity related financial costs per annum (\$m) ^h	0.241	0.160
Reduction in obesity related well being costs per annum (\$m) ⁱ	1.093	0.725
Total potential annual benefit - obesity (\$m)	1.334	0.885
Total potential annual benefit from increased provision/utilisation/access to green open space (\$m)	1.524	1.015

^a Increased area, better access, better quality, etc.

^b Based on national average of approximately 4%.

^c 65% of depression sufferers will benefit (www.beyondblue.org.au).

^d \$750 per person per annum (www.beyondblue.org.au).

^e Calculated on the basis of lost productivity cost of \$5,000/ person (estimated to be up to \$10,000 per per per annum (www.beyondblue.org.au)) and labour force participation rates of 60% in Ashfield and 62% in Mosman.

^f Based on national average 16.8% for females and 15.1% for males.

^g Of those suffering obesity who do have improved access to green open space, only two-thirds will reduce weight to avoid the costs of obesity

^h Calculated on the basis of obesity related financial costs of \$1,173 per person per annum (Access Economics 2006).

ⁱ Calculated on the basis of obesity related well being costs of \$5,309 per person per annum (Access Economics 2006).

The analysis has been undertaken assuming an increased area, better access to or better quality (e.g. from watering) of open space in Ashfield and Mosman, and that the increases will result in utilisation of open space by an additional 5 per cent of residents. It is assumed that that proportion of depression and mental health sufferers will increase their use of green open space and for approximately 65 per cent there will be a significant reduction in the depth of depression (www.beyondblue.org.au).

Under this set of assumptions the benefits of reduced medical costs and avoided losses in productivity were estimated to be \$190,000 per annum in Ashfield and \$129,000 per annum in Mossman.

The improvements to or greater provision of public open space are also assumed to result in increased utilisation of open space by people suffering from obesity and for approximately two-thirds will experience a significant reduction in weight. Under these assumptions the benefits of avoided financial costs (including medical costs and losses in productivity) and reductions in obesity related well being costs were estimated to be \$1.3 million per annum in Ashfield and \$885,000 per annum in Mossman.

Environmental Benefits

Estimates of environmental benefits for Ashfield and Mosman of existing open space as well as arising from a hypothetical increase in access to or utilisation of green open space are presented in Table 2.

The analysis was limited to the environmental services generated by trees in open public space. Although tree numbers were provided by Ashfield Council, they were not available for Mosman and so were estimated simply on the basis of Ashfield's average number of trees per hectare. Benefits have been quantified on a per tree basis in four categories: reduced air pollution, reduced utility expenses, reduced stormwater runoff and aesthetic benefits.

The benefits of existing trees across the four environmental categories were estimated to be \$1.7 million per annum in Ashfield and \$9.2 million per annum in Mosman (Table 2).

The analysis was extended assuming a 5 per cent increase in tree numbers/area of parks and gardens in Ashfield and Mosman. Virtually all green open space in Ashfield is municipal parks and gardens, whereas in Mosman it comprises just 15 per cent of green open space.

Under this set of assumptions the environmental benefits were estimated to be \$87,000 per annum in Ashfield and \$71,000 per annum in Mosman (Table 2).

Table 2 Estimates of environmental benefits from existing data

Environmental Indicators	Ashfield	Mosman
Environmental value of existing trees in green open space		
Area of public open space (ha) ^a	48	252
Estimated number of trees in green open space ^b	7,500	39,686
Benefits of existing trees:		
Reduced air pollution (\$m) ^c	0.153	0.812
Reduced utility expense (\$m) ^d	0.384	2.029
Reduced stormwater runoff (\$m) ^e	0.486	2.571
Aesthetic benefit (\$m) ^f	0.707	3.743
Total annual benefit (\$m)	1.730	9.155
Hypothetical increase in tree number/area of parks and gardens		
	5%	5%
Area of public parks and gardens (ha) ^g	48	39
Estimated number of trees in public parks and gardens	7,500	6,132
Hypothetical increase in number of trees	375	307
Benefits of increased tree numbers:		
Reduced air pollution (\$m)	0.008	0.006
Reduced utility expense (\$m)	0.019	0.016
Reduced stormwater runoff (\$m)	0.024	0.020
Aesthetic benefit (\$m)	0.035	0.029
Total annual benefit (\$m)	0.087	0.071

^a Includes municipal parks and gardens as well as national parks, bushland and other reserves.

^b Tree numbers provided by Ashfield Council but not available for Mosman. Estimated using Ashfield's average number of trees per hectare.

^c Estimated to be \$20/tree/an (Peper et al 2007).

^d Estimated to be \$51/tree/an (Peper et al 2007).

^e Estimated to be \$65/tree/an (Peper et al 2007).

^f Estimated to be \$94/tree/an (Peper et al 2007).

^g Virtually all green open space in Ashfield is municipal parks and gardens, whereas in Mosman it comprises just 15% of green open space.

Economic Benefits

Estimation of economic benefits was limited to the effect on property values. The first set of estimates relate to the value of community land in the form of parks and gardens but excluding national parks and bushland reserves. Data provided by the respective councils shows a significant difference in per hectare values between the two areas, the value in Mosman (\$6.3 million/ha) being approximately 3.5 times that in Ashfield (\$1.8 million/ha).

In addition to the direct asset value of the green open space, these areas have a direct positive impact on the price of houses adjacent to parks, reported to be around 10 per cent (Dann 2004). The residential property value effect clearly demonstrates the difference in both the area of parks and the median value of properties in Ashfield and Mosman. The information presented in Table 3 shows that these two effects result in the portion of residential housing values attributable to green open space being 6 times greater in Mosman (\$97million) than in Ashfield (\$15 million).

The analysis was extended assuming a 5 per cent increase in tree numbers/area of parks and gardens in Ashfield and Mosman. Given the way in which community land is valued (taking account of legal, construction and zoning restrictions), improvements to accessibility or quality of the land are unlikely to significantly affect its valuation.

Under this set of assumptions an annualised measure of the increase in the capital value of residential housing was estimated to be \$57,000 per annum in Ashfield and \$364,000 per annum in Mosman.

Table 3 Estimates of economic benefits from existing data

Economic Indicators	Ashfield	Mosman
Asset value of green open space:		
Area of public open space - excluding national parks, etc (ha) ^a	47.7	39.0
Council valuation of public open space (community land) (\$m/ha) ^b	1.8	6.3
Council valuation of green open space (community land) (\$m)^b	87	245
Green open space impact on house values:		
Median house price (\$m) ^c	0.574	1.900
Estimated house price premium for proximity to parklands ^d	10%	10%
Number of residences adjacent to public open space ^e	264	509
Portion of house value attributable to green open space (\$m)^f	15	97
Total impact of green open space on asset values (\$m)	102	342
Hypothetical increase in quality/area of parks and gardens:		
Increase in capital value of community land (\$m) ^g	0	0
Increase in capital value of houses (\$m)	0.758	4.836
Total increase in capital values (\$m)	0.758	4.836
Annualised measure of increase in capital value (\$m)^h	0.057	0.364

^a Includes municipal parks and gardens but excludes national parks, Taronga Park Zoo and other reserves.

^b Data provided by Ashfield and Mosman Councils.

^c For the 6 months to September 2007 (www.homepriceguide.com).

^d Dann (2004).

^e Calculated on the basis of the estimated length of parklands bordering residential areas and the average boundary length between residential properties and parklands (28 metres).

^f Calculated as the premium above the median house price multiplied by the number of houses adjacent to parklands.

^g Given the way in which community land is valued (taking account of legal, construction and zoning restrictions), improvements to accessibility or quality of the land are unlikely to significantly affect its valuation. Therefore, the change in value was assumed to be zero.

^h Calculated for a 30 year period with a discount rate of 7%.

Aggregate Net Benefits

In aggregate, the additional social, environmental and economic benefits from increased area or access to green open space was estimated to be approximately \$1.7 million in Ashfield and \$1.5 million in Mosman (Table 4).

By deducting additional park maintenance costs, the annual net benefit of the hypothetical 5% improvement in area and/or access to municipal parks and gardens was estimated. Although accounting for only a limited number of social, environmental and economic indicators, the annual net benefits were estimated to be \$1.4 million in Ashfield and \$1.2 million in Mosman.

Table 4 Estimates of net annual benefits from increased quality, area and/or access to public open space

Social, Environmental and Economic Indicators	Ashfield	Mosman
Hypothetical increase in quality/area/access to parks and gardens	5%	5%
Benefits (\$m)		
<i>Social Benefits^a:</i>		
Reduction in depression related medical costs per annum	0.038	0.025
Reduction in depression related lost productivity per annum	0.152	0.104
Reduction in obesity related financial costs per annum	0.241	0.160
Reduction in obesity related well being costs per annum	1.093	0.725
<i>Total Social Benefits</i>	<i>1.524</i>	<i>1.015</i>
<i>Environmental Benefits^b:</i>		
Reduced air pollution costs per annum	0.008	0.006
Reduced utility expense costs per annum	0.019	0.016
Reduced stormwater runoff costs per annum	0.024	0.020
Aesthetic benefit	0.035	0.029
<i>Total Environmental Benefits</i>	<i>0.087</i>	<i>0.071</i>
<i>Economic Benefits^c:</i>		
Increase in capital value of community land	0.000	0.000
Increase in capital value of houses	0.057	0.364
<i>Total Economic Benefits</i>	<i>0.057</i>	<i>0.364</i>
Additional benefits from increased area/access to green open space	1.668	1.450
Costs (\$m)		
Increase in maintenance costs per annum ^d	0.243	0.235
Other costs	0.000	0.000
Additional costs from increased area/access to green open space	0.243	0.235
Net Annual Benefits (Benefits - Costs, excludes capital and other costs)	1.425	1.215
Benefit Cost Ratio (excludes capital and other costs)	6.9	6.2

^a See Table 1.

^b See Table 2.

^c See Table 3.

^d Calculated as 5% of the annual maintenance cost of parks and gardens being \$4.863 million in Ashfield and \$4.698 million in Mosman.

CONCLUSIONS AND RECOMMENDATIONS

Design Issues

As population increases in cities, the need for more public open space will increase as will the need for its maintenance. Potentially, population densities will increase within cities. Urban demographics will continue to change in the future as they have changed in the past.

Australian cities did not have the chance to develop slowly into proper urban communities, as they had in Europe, before the advent of the industrial revolution, population explosion and the motor car led to urban sprawl, frustrated commuters, city centres choked with traffic during the day and deserted at night (Seidler 2003). Cities are for people, and people need space to stroll, sit and meet their friends.

Much of Australia's green space is earmarked for urban development but there is little known about the risks to human health associated with its loss. For example, further research into the physical properties of urban parks that offer maximum health benefits may offer developers some basic design principles. Older suburbs can be 'retro-fitted' with green spaces to improve their health benefits (Pyper 2004). While proximity of a park influences its utilisation by the community, features such as lighting, toilets and drinking water, park layout, features and maintenance affect how much the park will be used (Frumkin 2003).

A current research partnership between Penrith City Council and University of Western Sydney is investigating the role of Universal Design (UD) in overcoming barriers and enhancing accessibility in relation to public open space. The project aims to develop a strategic planning tool to be utilised by councils (www.penrithcity.nsw.gov.au).

Research is also needed to determine people's motives in visiting natural areas, the various activities they carry out and the needs they expect to be fulfilled, to assist in urban park design. Early data in the UD project suggests that practical measures such as developing play equipment for teens and adults may be desirable to enhance individual and community well-being (ibid).

Further Research Issues

The findings presented in this paper indicate the importance of green open space to the community and the need to continue to investigate ways in which of this valuable public asset can be best managed and utilised for the broader community's benefit.

To this end a number of priority research areas were identified, including the following:

- Undertake contingent valuation/choice modelling to ascertain people's willingness to pay for green open space to establish more accurate values – separate urban and rural studies required.
- Investigate the potential for carbon neutral or carbon offset partnerships
- Determine the value of:
 - 'green exercise'
 - sporting fields to community – urban and rural
 - community markets in urban open space
- Investigate the benefits/relationships between:
 - nursing homes, hospitals and open green space
 - workplaces and open green space
 - parks' proximity to public transport
- Related to the above, investigate the net benefits from rationalising parklands to provide suitable economies of scale – i.e. contiguous to allow wildlife corridors, transport opportunities, broader range of activities/facilities to attract longer visitations.

In the context of the broad areas of research listed above, Maller et al. (2005) made the following, more specific suggestions:

- Determine the potential health and well-being benefits arising from contact with nature for a range of population groups.
- Explore how contact with nature via parks could contribute to population health priority areas (especially in cardiovascular disease and mental health).
- Determine the importance of natural spaces for community health, and the actual health benefits people derive from parks.
- Examine whether the destruction of the natural environment directly affects human health and well-being and/or is linked to the prevalence of mental ill-health in modern society.
- Examine whether human health in a range of population groups is affected by lack of opportunities to experience nature.

National Approach to Urban Irrigation efficiency

The Proceedings of the CRC for Irrigation Futures National Workshop, Sydney, 2004, identified a lack of comprehensive and reliable information on urban irrigation practice and technology, particularly on how much water is used for outdoor irrigation, how effective different irrigation methods and products are, and the factors that impact on irrigation water use.

In 2006, the CRC for Irrigation Futures funded 'The Efficiency and Audit of Residential Irrigation Systems in the Sydney Metropolitan Area' which highlighted issues with domestic irrigation practices. The study concluded that an effective assessment of irrigation method efficiency, leaving water conservation measures in place and improving the watering strategy of homeowners is likely to yield significant water savings.

The cost of inappropriate policy decisions has been highlighted in a recent paper by Grafton and Ward (2007). They found that using mandatory water restrictions to control domestic water supply in Sydney created a welfare loss in 2004/05 of \$235 million. They argued that raising the price of water is a far more efficient mechanism to control water usage.

The findings reported in this paper and the outcomes of previous conferences and forums indicate that solutions for urban irrigation issues need to be developed not only in a technical context but in social, economic, environmental and political contexts as well.

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