Journal of Hydrology 499 (2013) 349–359

Contents lists available at SciVerse ScienceDirect

Journal of Hydrology

journal homepage: www.elsevier.com/locate/jhydrol

The hydrological and economic impacts of changing water allocations in political regions within the peri-urban South Creek catchment in Western Sydney II: Scenarios

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ARTICLE INFO

Article history:
Available online 25 June 2013

Keywords:
Water saving policies
System Harmonisation
Hydro-economic modelling
South Creek catchment
Political segregation
Water allocation

SUMMARY

The aim in this paper is to assess the hydrological and economic impacts of deploying water in the political jurisdictions of the peri-urban South Creek catchment of Western Sydney. This catchment has been identified as the region in which the city of Sydney will grow into in the future, with a plan to move an extra one million people into the catchment in the next 25–30 years. In conjunction with this expansion, a plan exists to augment the existing water supply by treating waste water effluent, harvesting stormwater and improving irrigation efficiency, along with a strategy for saving water on farms. Water in this catchment is operated by and in the interests of society, where decisions on its allocation have a political perspective to them. However, the growth within this catchment and the water augmentation strategies are not split evenly amongst the political entities within this catchment, namely the Local Government Authorities. An integrated hydro-economic model segregated according to the political entities in the catchment is used in this study to address a range of water saving scenarios raised by stakeholders. The trade-offs inherent in all water allocation decisions on a regional basis are made transparent in this model and its political ramifications, defined as the impacts on different political regions, are identified. In analysing the measures designed to save water across the catchment, none resulted in a positive Net Present Value. Even just expanding the system to accommodate one million extra people resulted in significant economic losses. In addition, the impact of each measure in each political region was markedly different. The purpose of this study is to provide stakeholders in individual local government regions with evidence of the costs and impacts of rational decisions to change the management of water resources in South Creek catchment.

1. Introduction

The South Creek catchment, which is part of the Hawkesbury Nepean river system to the west of Sydney, principally spans the five local government areas (LGAs) of Camden, Liverpool, Blacktown, Penrith and Hawkesbury. Water in the catchment is controlled by the Sydney Catchment Authority (2012), while the provision of potable water to users is controlled by Sydney Water (2012), both who are answerable to the New South Wales State Government. However, actions by the State Government on large scale land planning and development issues (for which they are also responsible), also have a major impact on the benefits and costs of allocating water in each individual LGA. Stakeholders, those who have an interest in the water scarcity issue, within each LGA in the catchment face a multitude of planning problems, as the region has been identified as one of the main sites for the expansion of Sydney. Urban growth is a major issue, which in turn means that water may well need to be directed away from traditional uses, like agriculture. In addition, any suggestions have been made with respect to improving the security of supply of water, such as improving agricultural water use efficiency, treating effluent and harvesting stormwater. However, these activities and policies are not evenly spread over the catchment, which means that the impacts of both urban growth and the measures designed to remedy a possible shortage in water, will not be the same in each LGA.

In this study, a linked hydrological and economic model of the South Creek catchment, based on LGA boundaries and specified in Davidson et al. (in press), is used to address the specific issues raised by the local stakeholders, who are represented by the Local Government Authorities. They lack the range of evidence required to assess both the impacts urban growth may have on water

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0022-1694/$ - see front matter
http://dx.doi.org/10.1016/j.jhydrol.2013.06.030

security, which in this study is defined as the amount of water available at a particular point in the system with an associated level of probability of supply, and the policies suggested alleviating the pressure on water resources. The evidence these stakeholders require is the combination of physical and economic information on the:

- amount of water required for each pattern of growth (be it what would naturally occur or what might result from an expansion of population),
- quantities of water saved by various proposals, and
- net benefits or costs of each proposal to save water at whatever population growth rate is decided upon.

The first two elements relate to physical water security in the catchment which in this study can be measured principally with the amounts and changes to potable water supplies. The last issue relates to the costs and benefits of each scenario considered and can be measured in terms of the actual and changes to Net Present Values (NPVs) and in Benefit–Cost ratios. In order to combine both the hydrological and the economic impacts of each scenario in each region, it is necessary to evaluate the costs or benefit (whichever it may be) per unit of potable water saved. Once all these measures are derived, they can be compared over the whole catchment and individually between each LGA.

The nature and requirements of understanding policy needs in a catchment are best undertaken using a transdisciplinary and quantitative "systems approach". System Harmonisation (Khan et al., 2008) is an approach that is centred on a catchment and is driven by the concerns stakeholders (in this case Local Government Authorities) have within the catchment. This approach highlights how the different elements within a system are isolated and linked with one another. The defining link in this analysis is the water resource management function of allocating water from different sources to different regions and different uses, over time. More importantly, this analysis can quantify the economic impacts on individual local government areas (LGAs) within a catchment arising from decisions on different allocations of water both temporally and spatially. In this paper a model presented in Davidson et al. (in press) is used to measure the water security and economic impacts of a range of policy measures across the local political spectrum within the South Creek catchment in the Western Sydney region in Australia.

2. The South Creek catchment and its future development

The South Creek catchment is located approximately 50 km west of the city of Sydney and sits to the east of the Hawkesbury Nepean River into which it flows. The catchment is approximately 20 km wide and 50 km from north to south. It falls within portions of eight LGAs, of which only five are significant: Camden, Liverpool, Blacktown, Penrith and Hawkesbury.

The population in the catchment in 2005 was estimated to be approximately 392,000 people, with around 60% of them residing in Blacktown. The other major centre of population is Penrith. In these two mainly urban LGA's the concerns over water lie in providing sufficient supplies for domestic and recreational uses. The other three LGA's tend to have a more rural focus, especially Camden and Hawkesbury (Rae, 2007).

Current plans for urban development into Western Sydney envisage the re-zoning of areas in the catchment. To date 39,500 housing lots have been accepted for release and an additional 141,500 housing lots are expected by 2021. Most of this development is slated to occur in the North West Growth Corridor in Blacktown and in the South West Growth Corridor in both Camden and Liverpool LGAs. With such developments, the population in the catchment is expected to reach one million in the next 25–30 years (NSW Department of Planning, 2007a,b). These development plans are well under way and will not only result in dramatic changes in land-use, but also have a concomitant effect on water resources in the catchment.

Sydney is an expanding city with limited land available for growth. It has to grow somewhere and the decisions once made on how the land should be used then require supplementary actions on providing a range of necessary services including water, power, transport and education. These decisions regarding overall land use and the growth of Sydney are made by the State Government, not by the local government entities (the LGAs). Rae (2007) argues that greater planning alignment between LGAs is needed in the future and must occur in the realms of stormwater management, effluent control, sediment reduction and the development of best practice guidelines for water use in Western Sydney.

3. Scenario development

In this study, there was a need to envisage possible ways in which the future of the catchment might unfold. This was achieved by applying a Scenario Planning Framework (Malano, 2010; Van der Heijden, 1996; Van Notten, 2006) in the region. The scenarios assessed in this study were those identified by the stakeholders in the South Creek catchment and were derived from the development plans for the region (NSW Department of Planning, 2007a,b). These development plans were further discussed and clarified after meetings with the relevant authorities and stakeholders (Table 1). To appreciate the full extent of the scenarios specified in Table 1, the most important issue is to first determine the impacts of future urban population growth in the catchment. Two different futures are envisaged, one where 'growth centres' are developed to accommodate an increase in the population of an additional one million people and the other if they are not developed, termed 'natural growth'. Whether this growth in population occurs or not, will have an impact on the NPVs of undertaking a range of other innovations, such as the harvesting of stormwater, the treatment of effluent and the impacts of the Smart Farms program to save water

Table 1
Scenarios conducted on the study region.

Land use	Smart Farms	Effluent reuse	Stormwater harvesting to:		
			Public open spaces	Industrial	Residential outdoor
Natural Growth Growth predicted to remain constant in future Urban Growth Centres Two Growth centres are considered for future developed in addition to the natural growth	Increasing water use efficiency of irrigated agriculture across the Catchment	High quality effluent from wastewater treatment plants will be allocated for outdoor use, agriculture and open space irrigation	Use of stormwater to irrigate parks, golf courses, sporting fields and reserves	Use of stormwater to replace potable water for outdoor use	Use of stormwater to replace potable water in various industries