



# Management of coastal canal estates in Australia: Challenges and opportunities



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## 1. Introduction

Climate change is placing pressure on coastal developments through impacts such as sea-level rise, storm surge, erosion and drought (Hennessy et al., 2007; Harvey and Stocker, 2015; Stocker et al., 2012a, b; Wong et al., 2014). Climate change impacts are often interlinked with a range of other interacting issues including poor water quality and ecological degradation. The outcomes are complex coastal issues with multiple triggers and no easily identifiable starting point for remediation.

Canal estates are essentially a subset of coastal development more broadly. Around Australia, they have been built to provide highly desirable waterfront living and recreation, often adjacent to attractive natural environments (Harvey and Stocker, 2015). Some bring public as well as private benefits, such as navigational access, while others bring private benefit at the expense of public good, including environmental quality. They are attended by even greater management complexity than other coastal developments. The management of canal estates globally is often problematic due to engineering (Pattiaratchi et al., 2011), cultural (Harvey, 1998), environmental (Nuttall, 1991; SKM, 2007), economic (Koloj et al.,

2005) and political (Stratford, 2009) reasons. In canal estate management, cultural, political (Stratford, 2009) and economic (Australian Government Takeovers Panel, 2006) issues are less researched than environmental issues but they are just as pervasive. Climate change, through sea-level rise and drought, will interact negatively with all of these issues to impact canal estates.

With a view to ensuring the protection of the environment and maintenance of values for residents and local governments, this paper aims to assess current canal management practices, strategies and issues as well as the likely future impacts of climate change on canal estates.

Very little research exists on current management practices, strategies and issues for canal estates in Australia. Furthermore, there is no 'best practice' management approach for canal estates across Australia. The different approaches are a function of different governance and management issues in each Australian state. The regulation of canal estate development and the role of science in development proposals are key governance issues in Australia (Harvey and Stocker, 2015). Western Australia (WA) is the only state to have a specific policy regarding canal estate development with some other states and territories incorporating these developments into broader coastal (Queensland, NSW, Victoria), state/territory (Northern Territory), or marina (South Australia) planning policies. Similarly, WA is the only state to specifically include science-driven guidelines for coping with climate change-induced sea-level rise (WAPC, 2013). New canal estates are currently banned in New South Wales (NSW) as a result of environmental issues and public concern over existing estates, and until 2014 new canal estates were also banned in Victoria due to public concerns over acid sulphate soils and environmental degradation (Harvey and Stocker, 2015). At Ralphs Bay, Tasmania, a proposed canal and marina development in the local Conservation Area resulted in an extensive and prolonged community campaign to protect the coastal habitat and stop the development occurring (Tasmanian Times, 2009). The campaign became highly politicised and a Bill to prohibit the development of canal estates in Tasmania was passed in the Lower House but not the Upper House of the Tasmanian Parliament. The Tasmanian Planning Commission finally ruled against the Ralphs Bay development citing a lack of community

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benefit other than economic benefits derived from construction (Coastal Collaboration Cluster, <http://coastalcluster.org.au/sites/default/files/attachments/Ralphps%20Bay%20Tasmania.pdf>, accessed 30 March 2016). It is thought to be unlikely that any canal developments will occur in Tasmania in the future given the history of the proposed Ralphps Bay development.

In Australia, canal estates often vary in their physical structure and can be separated into five basic types including those that are: part of an artificial lake system; on artificial canals adjacent to a natural estuary; on a natural estuary with minor modifications; on a natural estuary; and on partially reclaimed seabed (Harvey and Stocker, 2015). Different canal estate types are likely to have different issues associated with ecology and exposure to climate change impacts. For example, canal estates situated on land-locked artificial lake systems will be less likely to be affected by climate change impacts such as storm surge and erosion, or sea-level rise. All canal estate types cause ecological damage through the loss of local terrestrial (Harvey and Stocker, 2015) or intertidal habitat.

Canal estates regardless of type, are part of a broader coastal social-ecological system (Stocker et al., 2012a) in which they are embedded. This system consists of biophysical, social, economic and cultural assets, the use of which is governed by a combination of ecological and social processes. This social-ecological system and the specific location of the estate will create site-specific political, economic and cultural issues. For instance, Aboriginal sacred sites should be treated sensitively.

Both positive and negative impacts arise from the inherent connections between canal estates and the broader social-ecological system. For example, the exposure of acid sulphate soils during the process of construction may affect water chemistry. Similarly, agricultural and industrial run-off into canals may increase risks to aquatic plants and animals (Porter and Porter, 2001; Harman-Fetcho et al., 2005). On the Queensland Gold Coast, the presence of canal estates has reversed the function of the coastal estuarine system from carbon sink to a source of atmospheric carbon dioxide through the increased water-to-air carbon dioxide flux (Macklin et al., 2014). Other impacts that may occur through connection between canal estates and the broader social-ecological system include fish kills (Luther et al., 2004), wrack accumulation (EPA, 1991), siltation, flooding from rivers (City of Gold Coast <http://www.goldcoast.qld.gov.au/council/flood-heights-maps-2222.html> – accessed 6.8.15) and sea-level rise as a consequence of climate change (MacPherson et al., 2011). An increase in extreme weather events is predicted as a consequence of climate change (Easterling et al., 2000). This prediction impacts residential canal estates through increased insurance premiums as well as the actual risk of flooding. For example, the devastating Queensland floods in 2011 affected much of the state and have resulted in large increases in insurance for waterfront properties, including those on canals (ABC, 2013).

Positive impacts on canals resulting from a connection with the social-ecological system may include the presence of dolphins, birds and other wildlife in canal estates and the ability to flush canals through exchange with the larger water body. Positive impacts of canal estates on the surrounding social-ecological system are less numerous; however, it has been suggested that well-designed canal estates may enhance an estuary by increasing habitat diversity for some species (Catlan and Williams, 1985). For example, canal estates in Queensland have provided habitat for bull sharks. With increased destruction of natural habitats, canals have become increasingly important to large juvenile bull sharks, which could potentially attack humans (Werry et al., 2012). Whilst canals are thus good news for the sharks, residents are warned to avoid going into the water at dawn and dusk or to allow pets to swim in the water. The key benefits of canal estates to the surrounding

system are social, such as boating and canal tourism. Adjacent marinas with boardwalks and cafes can provide additional attractions. These benefits tend to occur when a canal estate is publically accessible through a natural estuary.

Critically, this integral connection between canal systems and the broader environment creates complexity for governance in a social-ecological system. Management can be challenging where an estuary or coastal zone with canal estates falls under the jurisdiction of multiple agencies. For example, the state agencies governing infrastructure, environment, primary production (e.g. fisheries), health, and tourism may be involved in managing an area. In addition, local government and each of these state agencies may have overlapping and unclear lines of responsibility (Metcalf et al., 2014). It is assumed that resource users will never self-organize to maintain their resources and it is up to governments to create solutions, but in fact some government policies actually accelerate resource destruction (Ostrom, 2009). On the other hand, there are examples where resource users have invested their time and energy to achieve sustainability (Ostrom, 2009). Certainly, without discussion and cooperation among all responsible agencies, large complex issues such as water quality, with multiple causes and effects, may become intractable (Dunstan, 1990).

The differing design-induced and site-specific pressures in each canal estate result in the need for a broad range of management approaches in order to ensure the values associated with each estate are maintained. A lack of accepted management strategies has added to the already high public concern regarding environmental impacts of canal estates. For instance, environmental issues contributed to the ban on canal estates in NSW (Parliament of NSW, 1995) and the previously held (until 2014) ban in Victoria (Victorian Coastal Council, 2008). Rather than banning canal estates, WA opted to require a high level of scientific evidence to be gathered during the initial planning process to ensure the protection of the environment and the frequency of monitoring to be undertaken (Harvey and Stocker, 2015). Water quality management and canal design guidelines, including the need for appropriate planning with regard to sea-level rise due to climate change, have also been produced by the WA Planning Commission (2012, 2013). Canal development proposals in South Australia (SA) are subject to rigorous Environmental Impact Assessment if they are deemed major projects and otherwise are subject to development control through the SA Department of Planning, Transport and Infrastructure (Harvey and Stocker, 2015). There are currently no specific guidelines for the consideration of climate change impacts in canal estates in South Australia; rather, these developments fall under the state-wide sea-level rise and coastal development policy.

As yet, generally accepted strategies or guidelines for on-ground management of canal estates do not exist in Australia. Furthermore, to date there has been no peer-reviewed research on canal estate management strategies or recommendations for the future. Research regarding canal estates across Australia often focusses on environmental impacts, water quality and wildlife (Cosser, 1989; Dunstan, 1990; Ljung et al., 2010), rather than on the strengths and weaknesses of management strategies. The economic and social values of canal estates and the complex web of interacting impacts on canals and surrounding environments suggest there is a clear need for such research and, eventually, the identification of 'best practice' strategies for the management of all canal types in Australia.

This paper aims to assess the development and management of canal estates. First, it assesses the similarities and differences among canal estate types and their management. Second, using two case studies, it identifies current and potential future management issues and suggests potential improvements to canal management. Such a study is important in order to maintain values

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