Water resource management

Promoting sustainable economic development in water-constrained catchments

A current research project, funded by the Water Research Commission (WRC) and the Western Cape Provincial Department of Economic Development and Tourism, is driving solutions for integrated water resource and economic development planning in the water-constrained Saldanha Bay and the Berg River catchments. The study is being carried out by GreenCape in partnership with the University of Cape Town's African Climate Development Initiative.

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There is increasing recognition that the combined effects of climate change, population growth and continued urbanisation are exerting pressure on limited water resources. By 2012, approximately half of the major South African supply schemes were already in a water balance deficit, requiring new water resources interventions to meet projected future demands.

According to the Department of Water and Sanitation (DWS), 55% of smaller schemes supplying settlement areas or towns are currently or will be in a water balance deficit within the next ten years. At the same time, economic growth remains vital for alleviating poverty, hence the large national drive to stimulate growth.

Therefore, growth is required in spite of significant water resource constraints. However, the DWS has been careful to point out that whilst water is essential to development, its availability is not a driver to, nor constraint on, development. This position of DWS is based on the view that as much water can be made available as is required (via desalination for example).

Yet, in the case of a catchment where all readily available water is allocated (referred to as a "constrained catchment"), future development requires additional water resources, either through the development of new resources or the reallocation from other users in the catchment. Both of these approaches come at a cost: new infrastructure for water resource development will need to be paid for by the state or by the water users through increased water tariffs; reallocation from other users implies curtailment of existing use resulting in trading-off some sectors or areas against others.

Given the possible constraint of water on development, or the cost of supplying water to support development, the allocation of water should be towards those water users or developments that maximise the socio-economic benefits for the water used. Furthermore, in constrained catchments there may simply not be "enough for all, forever" and allocation decisions between competing uses or development options may need to be taken.

Decision-makers need to understand: what is the socio-economic impact of diverting more water towards agriculture in

a bid to promote food security? Conversely, what is the impact on the food processing industry and on food security, of a decision to promote more economically lucrative uses of water than agriculture?

In a perfect water market, market forces would dictate the allocation of water resources between competing users. However, water is identified as a basic human right in the South African Constitution, and is institutionally allocated and priced. Therefore, allocation decisions should be made with the understanding of the socio-economic-environmental costs and benefits of each use of water, and the trade-offs that these decisions imply.

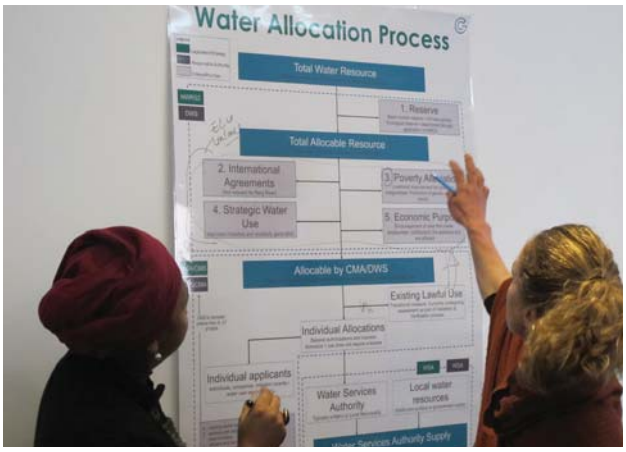
Whilst the discussion above is theoretically relevant to many catchments within South Africa, it is particularly pertinent for the Berg River catchment and the development future of Saldanha Bay. The West Coast District Municipality is supplied by water from the Western Cape Water Supply System (WCWSS), via the Berg River and Misverstand Dam and, in turn, supplies water to Saldanha Bay Local Municipality.

The West Coast District Municipality estimated system yield is 582 million m^3/a while current allocations total 609 million m^3/a. The municipality is a minor downstream user of the WCWSS, which also supplies the City of Cape Town, yet they are already using more than their allocation from the WCWSS by 6 million m^3/a.

At the same time, an ambitious development future is being planned for Saldanha Bay. An Industrial Development Zone (IDZ) is being created in Saldanha that will service the offshore oil and gas sector and is included as one of the 18 Strategic Infrastructure Projects in the National Infrastructure Plan. In addition to the IDZ, Saldanha is attracting interest from a number of investors that could cumulatively invest R72 billion and add 10 500 jobs to the local economy.

Additional water supply resources, which can be either locally developed (such as a desalination plant) or allocated from the WCWSS (through reallocation or as an outcome of the current validation and verification process that may discover that the system is not in deficit), have been investigated for Saldanha's planned development.

Both options have been pursued by the West Coast District Municipality. The desalination plant is not supported by DWS and the municipality does not have the funding to finance the plant. The municipality has applied for additional water from the WCWSS, yet as noted above, there is currently no water available for allocation. Additionally, at the regional catchment level, allocations from the WCWSS must weigh up the potentially competing demands of industrial development in Saldanha verses agriculture in the Middle and Upper Berg, verses domestic and industrial supply to the Cape Town metropolitan.
The municipality has not yet received a response from DWS on their water use license application, so in the short term, the planned investment in the Saldanha Bay area is at risk due to water supply shortages. Indeed the municipality has been unable to confirm future water supplies for several planned projects potentially leading to disinvestment.



Claire Pengelly

Infrastructure development in Saldanha Bay for the industrial development zone .

Raymond Siebrits

Model of the water allocation process being discussed with stakeholders.

A series of engagements (ranging from one-on-one interviews to workshops) with decision-makers in economic development and water resources planning spheres of government revealed that the current planning systems do not take the socio-economic considerations of water allocation into account. Decision-makers reflected a series of challenges including; a misalignment in planning approaches between water resources and economic development; a lack of feedback between water requirements and economic developments; a lack of consideration of the economic productivity or of the socio-economic benefit of various water uses in decisions over what development to promote for Saldanha and the Berg River Catchment; and a first come, first served approach to provision of water services to developments. It is therefore not possible, within current panning systems, to implement the integrated water and economic development planning approach motivated above, in which the socio-economic-environmental costs and benefits of each use of water, and the trade-offs that development decisions.

In response to the challenges reflected by decision-makers in Saldanha and the Berg River catchment, GreenCape, initiated the research project. The project has the ultimate aim of better integrating water resources and economic development planning, and aims to promote allocation decisions that take the full socio-economic cost-benefit of water use and water infrastructure into account, through the development of

necessary "tools" that illustrate alternative decision-making approaches.

The tools under development include:

1. A multi-criteria decision analysis of development applications for Saldanha Bay, weighing them against the local jobs generated, their water requirements, their fit with local skills and the environmental impact.
2. A regional catchment-scale hydro-economic model to quantify socio-economic impacts or trade-offs between water allocations, which is based on two interlinked models:
   - A water requirements projection tool enabling decision-makers to spatially view various scenarios for future regional growth and climate change, assessing the impact on water requirements
   - An assessment of the socio-economic value of water, largely focused on the economic value of water generated as an input into production, and the jobs that are indirectly created by the businesses that use water for their processes.

Parallel research into governance processes aims to ensure that the tools are optimally integrated into existing systems, and hence make positive change to the way decisions are currently made.

The development of the multi-criteria decision analysis tool for development applications for Saldanha Bay revealed insights on how the local municipalities views development applications. The municipality identifies the quantity of potable water required by a proposed development as the most important criterion for consideration, where the less water required the better. Furthermore it is concerned about in-migration impacts of the development in the area, and would like to prioritise developments based on the likelihood that most of the jobs generated will be absorbed by the local community.

In applying the tool these criteria, along with others, result in the IDZ being scored as an average development, despite the importance of this initiative to provincial and national government. This highlights how regional strategic objectives may not always be in alignment with a local authorities' priorities and constraints, and how this can impact on the viability of a development of this nature.

In calculating the water requirements of the various sectors in the catchment, agricultural irrigation requirements were estimated using bottom-up calculations, based on field sizes, crop water demands, and crop type amongst other factors. The estimations reveal that while most of the water is used by urban users (the City of Cape Town is by far the largest user), agricultural water use is predominantly consumed in the production of wine grapes. Yet, when analyzing water as an input into a farms' production, initial results indicate that the marginal economic value of irrigation water for wine grapes is lower than other crops modelled in the region.

This implies that there may be more "productive" uses for water currently irrigating wine grapes. However, when considering the impact that wine grape production has on jobs, the picture becomes more complicated due to its support of the agri-processing industry. Early estimates reveal that close to ten times as many jobs are created in the agri-processing sector in comparison to primary agriculture for the same quantity of water. The study aims to understand these linkages and the potential trade-offs in water allocation decisions in greater depth.

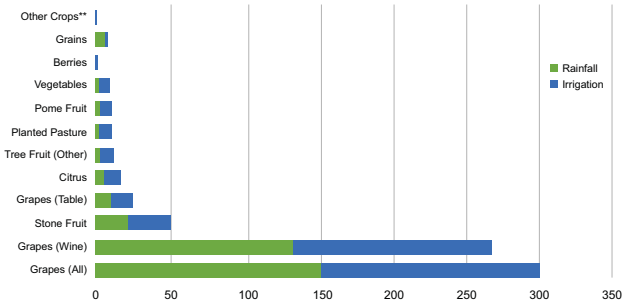


Figure: Total crop water requirements (million m³ per year), split by rainfall and irrigation requirements.

The research to date has highlighted several lessons. GreenCape's project has a strong emphasis on implementation, creating change, and co-production with decision-makers. To meet this aim, those specific decision-makers need to be involved in each step of the process, to ensure the tools under development are on track, and meeting requirements. This is challenging for all, largely due to the time requirements involved. There is a broad range of criteria that decision-makers consider for making decisions and it is not possible to incorporate all criteria into the tools at this stage.

The priorities of decision-makers can also shift based on political or external factors, and the decision-makers themselves change with successors perhaps not as interested in changing the status quo. There may be technical barriers to the use of the most appropriate tool where capacity building is necessary. Tensions can arise when what is deemed the most theoretically robust tool or solution, particularly from the perspective of academic and research rigour, doesn't match the tool that is practical or feasible for a decision-maker to implement, and to ensure research products are defensible yet implementable this tension cannot be avoided and needs to be addressed. This tension is exacerbated by data constraints experienced by the researchers; it is not possible to model the system in the most theoretically correct manner due to the lack of data or its inconsistency.

Although the research is based on the case study of Saldanha Bay and the Berg River catchment, it has relevance to other constrained-catchments. Development of the tools is coming to an end, and during this year the tools will be tested by stakeholders and the research team will promote their implementation. The final WRC report will be ready at the end of this year.

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