Managing Water as a Constraint to Development: A case for integrated planning in the Berg Water Management Area

SYNTHESIS REPORT

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Executive Summary

The Berg Water Management Area (WMA) is a heavily used system, supplying water to a number of local municipalities, including the City of Cape Town metro. It is also a 'constrained catchment', meaning all readily available water is already allocated.

Given the importance of water in meeting the growing demands of the Berg WMA economy, as well as human and ecological needs, water and developing planning requires consideration of competing and often equally important economic, social, and environmental priorities.

In South Africa, the current institutional structures and planning process either (a) lack the appropriate structure, alignment, and/or mandate for this integrated planning approach; or (b) are appropriately structured for integrated planning, but are not meaningfully implemented due to lack of tools, knowledge, capacity, and/or time. On the ground, this translates to a planning system that is ill-equipped to address the challenges that are inherent in a constrained system.

In order to better understand the ways in which water constraints impact the Berg WMA economy, now and into the future, the Western Cape Government (WCG) and the Water Research Council commissioned a collaborative three-year study. The study, conducted by GreenCape with support from the University of Cape Town (UCT) African Climate and Development Institute (ACDI), also analysed current decision-making and planning processes in order to develop actionable tools and insights for decision-makers on how to plan for 'smart' use and development of water resources in the Berg WMA.

This synthesis report focuses on the key insights and messages relevant for government planners, consultants, and associations involved in water services, water resource, and economic development. The aim of the report is to raise awareness regarding the future economic impacts of limited water supply in the region and generate support for improved integrating decision-making at the local and regional level.

Future water constraints will severely impact economic growth and employment opportunities, but these impacts will vary by sector and by municipality.

The future water supply deficit is projected to cost the region more than **R146 billion and almost 650,000 jobs per year by 2040**.

While both urban and agricultural sectors will feel the water supply deficit equally by 2040, **99% the opportunity cost of the supply deficit will be generated by the urban sector.** This disparity is due to the vast difference in economic value per drop between urban and agricultural water use, R993 versus R11 per m^3.

By 2040, the City of Cape Town's opportunity costs far outstrip any other municipality, totalling over R100 billion per year. As the primary driver of economic growth and employment in the region, this will result in severe economic and social impacts for the entire region**. The magnitude of Cape Town's opportunity costs justifies the focus for Western Cape Water Supply System (WCWSS) supply augmentation in the city.**

While the significance of Cape Town for the region is clear, Cape Town alone should not be the entire focus of in water conservation or water supply interventions. Smaller economies, especially those most reliant on agriculture, particularly Swartland, Drakenstein, and Stellenbosch, will require substantial volumes of water for irrigation and growing populations.

Current water resource and economic development planning processes do not promote 'smart' use and development of limited water resources.

The inter-dependence of water and economic development planning is not recognised in practice. Water resources and economic development plans are generally each treated as independent variables in the planning of the other.

There are several key misalignments within the current planning system that must be addressed in order for effective integrated planning to take place:

- **Planning processes function in a top-down manner** through which national development goals inform local planning but are not necessarily compatible with the local municipality's available resources, budgets and capacity.
- **Projects are assessed on a first-come, first-served basis.** If a water use licence application or an environmental impact assessment meets the required criteria, it cannot be declined in favour of an application, not yet submitted, which may produce a more socially or economically favourable outcome.
- **Water Service Authorities (WSAs) are often unable to develop local bulk water resources** due to lack of capacity, resources and effective coordinating platforms. In the absence of a water board or regional water utility, WSAs turn to the Department of Water and Sanitation (DWS) to solve water supply issues through the development of regional bulk water schemes, which may not adequately address local water development needs.
- Because grant funding from the state is only relevant for water infrastructure projects that fulfil a social objective, financing for "commercial" projects need to be raised by the municipality. This presents a major challenge for municipalities who **lack the capacity and creditworthiness to raise off-budget finance for water infrastructure projects.**

The sum of these misalignments translates to development decisions made without accurate reflection of future water supply. Water intensive development may be approved without enough water resources available and, conversely, water intensive developments may be refused without consideration of future water resource development. This has significant implications for both private and public sector development and, if left unaddressed, will continue to constrain 'smart' water use and development in the Berg WMA.

In order to ensure the smartest use and development of water resources, integrated planning approaches should be adopted by local and regional institutions.

Key insights of the study highlighted the need for further action in many areas, all of which are summarised in Chapter 4. Of these areas, the following recommendations should be prioritised:

- WCG and local municipalities should advocate for the establishment of a **Regional Water Utility as a mechanism for regional coordination** of cost-effective and resource-efficient water use and water development.
- In the absence of a Regional Water Utility, **provincial government should step in to support Water Service Authorities (WSAs) and municipalities** in planning, financing, and implementing 'smart' water use and water resource development.
- **Municipalities should adopt decision-support tools to help prioritise 'smart' water uses.** Such tools compare the socio-economic-environmental costs and benefits of different water uses and prioritise options based on local economic, social, and environmental priorities.
- Insights from the **hydro-economic GIS model should be utilised by the Department of Water and Sanitation (DWS) to prioritise urgent water augmentation interventions** in areas where the water deficit will most constrain economic growth. WCG can also use the model to help assess the appropriateness of development plans and to identify which municipalities need targeted support.

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List of acronyms

ACDI	African Climate and Development Initiative
CanESM2	Second generation Canadian Earth System Model
CMA	Catchment Management Agency
CSAG	Climate System and Analysis Group
DM	District municipality
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
GCM	General Circulation Model
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GVA	Gross Value Add
IDP	Integrated Development Plan
LM	Local municipality
MCDA	Multi-Criteria Decision Analysis
MTSF	Medium Term Strategic Framework
NDP	National Development Plan
NEMA	National Environmental Management Act
NPC	National Planning Commission
NWA	National Water Act
NWRS	National Water Resources Strategy
NWSMP	National Water and Sanitation Master Plan
PSDF	Provincial Spatial Development Framework
RWU	Regional Water Utility
SBLM	Saldanha Bay Local Municipality
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land-use Management Act
SWMP	Sustainable Water Management Plan
TCTA	Trans-Caledon Tunnel Authority
UCT	University of Cape Town
WCDM	West Coast District Municipality
WCG	Western Cape Government
WCWSS	Western Cape Water Supply System
WMA	Water Management Area
WSA	Water Services Authority
WSDP	Water Services Development Plan
WUL	Water Use License
WULA	Water Use License Application

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1. Background

1.1. About the Berg WMA

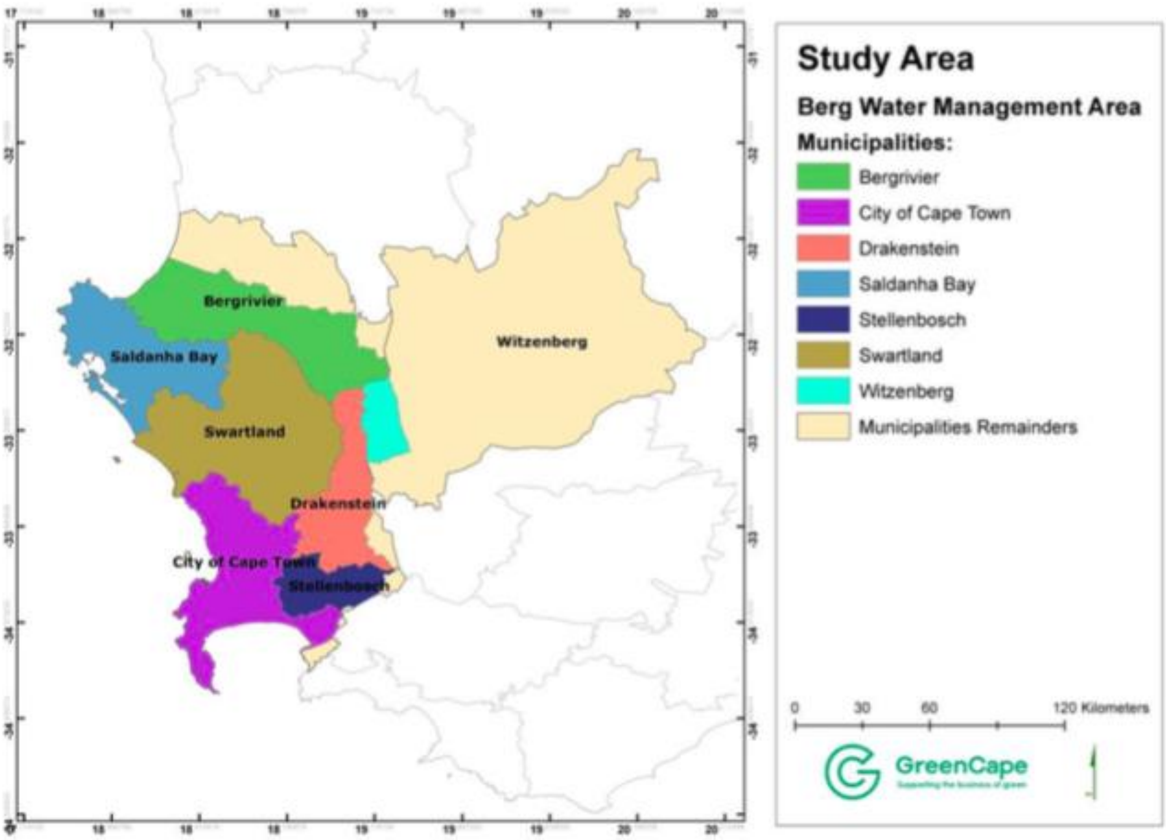

Figure 1: Berg Water Management Area including municipal boundaries

The Berg Water Management Area (WMA) (Figure 1) is a heavily used system, supplying water to a number of local municipalities, including the City of Cape Town metro, as well as a significant amount of the agricultural demands across the region (Figure 2). The supply network, collectively termed the Western Cape Water Supply System (WCWSS), helps to ensure that the water supply system is managed in an integrated and efficient manner.

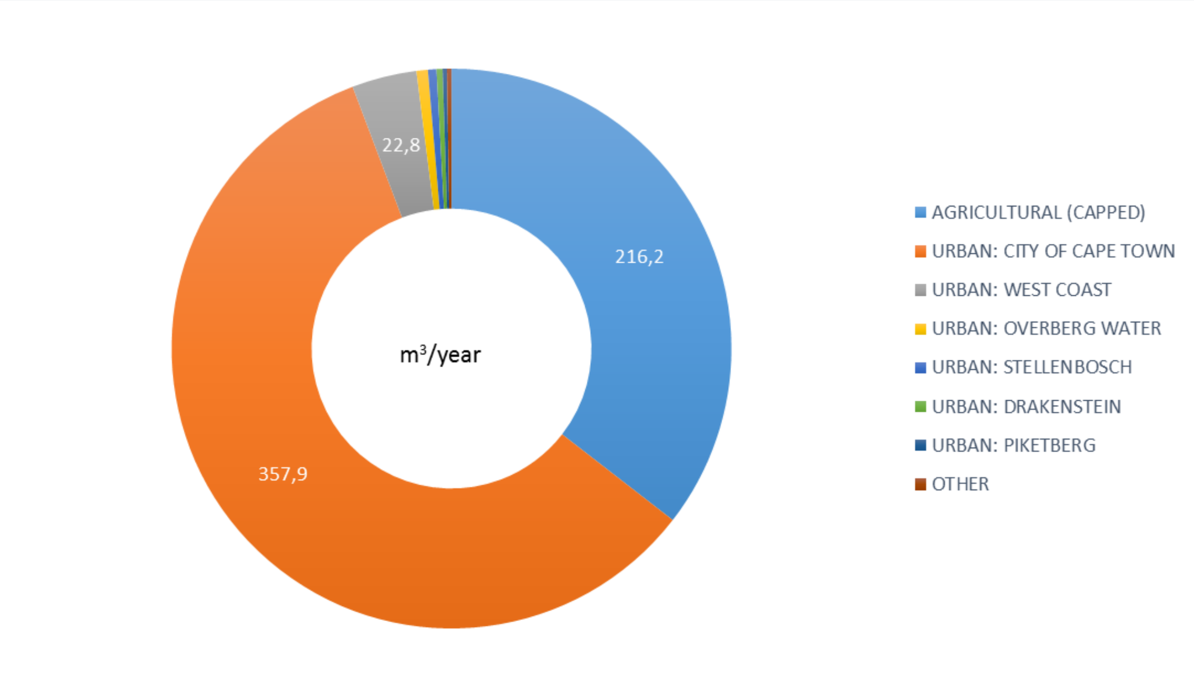

Figure 2: Water use (m³/year) in the Berg WMA by user

The latest WCWSS consumption and allocation figures reveal that, in 2014/15, the system was already over-allocated (**Error! Reference source not found.**). However, the usage had not yet exceeding the yield of the system.

Table 1: 2014/15 WMA snapshot (DWS, 2015a)

	Water in million m³/a
Total integrated system yield	570
Total allocations (2014/15)	609.12
Total use (2014/15)	547.26
Year water requirements exceed system yield	2019

The DWS planning scenario (based on high water requirement growth, 50% success of water conservation and water demand management measures, and no impact of climate change) indicates that the **Berg WMA's water requirements will exceed the system yield in 2019.**

In an effort to mitigate the water supply deficit, several water augmentation schemes are currently in stages of planning and implementation (Box 1). This process has been accelerated with great urgency in response to the current drought in the Western Cape. However, even with the addition of the earliest possible supply augmentation scheme, the Voëlvlei Augmentation Scheme (predicted to come online in 2021), the total system yield will still fall short of total allocations. A number of new supply schemes will need to be implemented urgently in to meet the continued growth demands of the system.

Box 1: Water supply augmentation and the 2017/2018 water crisis

Feasibility studies have been completed by the City of Cape Town for large-scale desalination, water reuse and groundwater use. Implementation of these schemes is underway, with the City of Cape Town supplementing their large-scale interventions with short-term emergency projects to bridge the water supply requirements in the current water crisis (Figure 3).

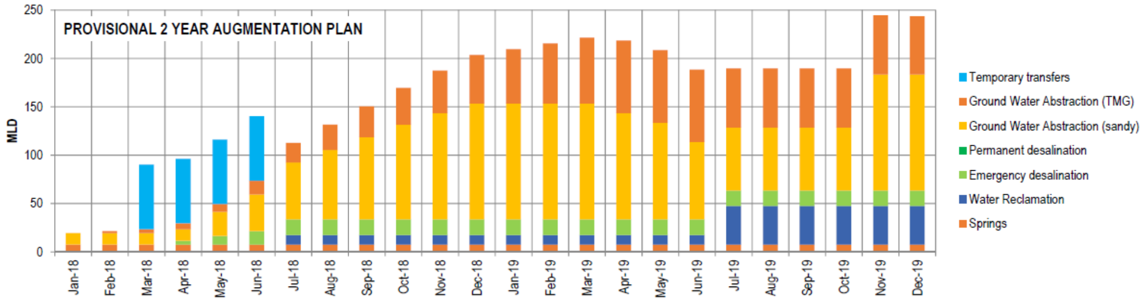

Figure 3: City of Cape Town 2 year water augmentation plan (CCT, 2018)

1.2. What are the key challenges facing the Berg WMA?

The Berg WMA, in particular, faces two sets of challenges:

1. External challenges

Climate change, population growth and urbanisation are placing more and more pressure on constrained water systems. These pressures are largely beyond the control of local decision-makers, who face the practical implications of these forces in their towns and municipalities.

As the Berg WMA approaches a system-wide water supply deficit in 2019, the social and economic impacts of this deficit will be felt throughout the region (as is already the case in areas, like Saldanha Bay, where a deficit currently exists). However, the current understanding of the ways in which water use and the local economy are connected and, moreover, what the economic and social impacts of a water deficit will be, are limited.

2. Decision-making challenges

In systems where there is not enough water to go around, decision-makers must weigh the costs and benefits of competing and often equally important uses of water. This requires an integrated approach through which economic and water resource development decisions are considered in tandem:

- Proposed economic developments should be weighed according to the relative socio-economic benefits that the activity provides for local communities in comparison to the water that it requires.
- Water augmentation or supply projects should be prioritised according the potential economic and social value that will be generated by the increase in water supply or, alternatively, where

the lack of water supply will have the most significant negative economic impacts. Furthermore, there should be a consideration of the ability of future economic development to support the new water resource through tariffs.

In South Africa, the current institutional structures and planning process either (a) lack the appropriate structure, alignment, and/or mandate for this integrated planning approach; or (b) are appropriately structured for integrated planning, but are not meaningfully implemented due to lack of tools, knowledge, capacity, and/or time. On the ground, this translates to a planning system that is ill-equipped to address the challenges that are inherent in a constrained system.

1.3. Our response

In response to these challenges, the Western Cape Government (WCG) and the Water Research Commission (WRC) funded a three-year study that aimed to better integrate water in economic development planning, and vice versa. The study, implemented by GreenCape in partnership with the University of Cape Town (UCT) African Climate and Development Institute (ACDI), sought to understand how decision support tools could add value to existing legislated processes by filling knowledge gaps or by providing a collaboration mechanism.

In order to determine what support tools were best suited to meet the needs of decision-makers, the above challenges were analysed and specific constraints/barriers were identified:

- **External challenges:** A **hydro-economic analysis** of the region provided insight into the connection between water and the economy, along with the magnitude and economic impact of the future water supply deficit in each of the municipalities (Chapter 2).
- **Decision-making challenges:** A **governance and planning systems analysis** helped develop a collective picture of the constraints facing comprehensive municipal planning within the Berg WMA (Chapter 3).

The aim of this brief is to provide an overview of the findings of the analyses and to present select recommendations as they relate to municipal planners and consultants involved in water services, water resource, and economic development planning.

For the full project report and a detailed explanation of the decision-making tools developed, visit: https://www.greencape.co.za/content/focusarea/water-for-sustainable-development.

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2. The present and future impact of water availability on the Berg WMA economy

Box 2: Key messages from the hydro-economic analysis

- **Securing water for the city of Cape Town is crucial.** As the driver of economic growth in the region, and the largest water user, a water supply deficit in the City of Cape Town will have significant regional impact. By 2040, the opportunity costs of the water supply deficit in Cape Town far outstrip any other municipality, resulting in severe economic and social impacts for the overall region. The magnitude of Cape Town's opportunity costs justifies the focus for WCWSS supply augmentation in the city.

- **Competition between urban and agricultural water users will continue.** Because 1 m^3 of agricultural water adds significantly less economic and social value than the value from non-agricultural water, a reduction in water supply for agricultural purposes would not severely impact the entire region. However, it would have very significant economic and social impacts on local economies that have a high concentration of agricultural value, primarily Bergrivier, Swartland, Stellenbosch, and Drakenstein. Competition between urban and agricultural water uses is being experienced in the current drought, and will continue into the future.

- **Smaller municipalities will struggle to absorb the impact of the water supply deficit.** Although Cape Town is regionally the most important municipality in terms of economic impact, the city alone should not be the entire focus of in water conservation or water supply interventions. Due to its size, Cape Town is best positioned to absorb the economic shocks that will be felt due to a water supply deficit. For smaller municipalities, the opportunity costs of the water supply deficit grow to a considerable percentage of the size of the current local economies by 2040 (in Saldanha Bay and Swartland the cost far surpasses the size of the current economy), meaning these economies will be severely constrained by the water deficit, with substantial impact on livelihoods.

- **The long-term viability of the wine grape industry should be evaluated.** Grapes, largely wine grapes, consume most of the irrigated water in the region, approximately 79%. As the regional climate changes, grapes are expected to increase water requirements by 34% by 2040. While grapes require an average amount of water per hectare when compared with other crops grown in the area, there are alternative options for crops that offer high economic value, but low water intensity. Assuming farmers have information readily available to them in order to make informed trade-offs, crop switching could provide a solution in the face of increasing water scarcity.

2.1. What is the water intensity of the Berg WMA economy?

The "**water intensity" of an economy** refers to the how reliant (and thus how vulnerable) an economy or sector is on water as an input to provide economic value (GVA) and social value (employment).

In the Berg WMA, 10% of economic value (GVA) is generated by heavily water intense sectors, including agriculture, and 19% of GVA is generated by moderately intense sectors (Figure 4). Employment figures are slightly less, with heavily and moderately water intense sectors, including agriculture, generating 23% of total employment.

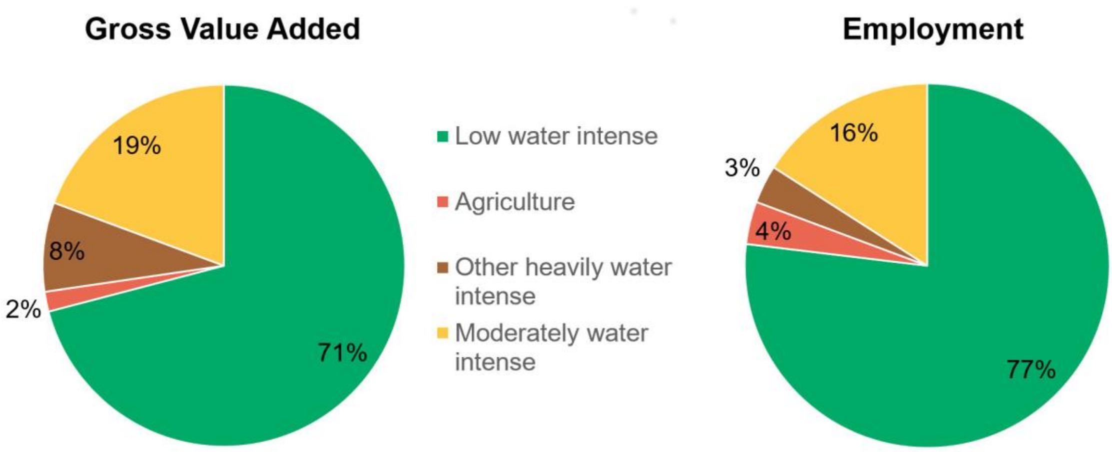

Figure 4: Gross value added and employment by water intensity of sectors in the municipalities in the Berg Water Management Area[1]

Changes in water availability for the agriculture sector and heavily water intense industries would have little impact on the region's economy as a whole.[2] This is due to the fact that the City of Cape Town, an economy with low water intensity, dominates the region's economy, contributing 84% to the overall GVA of the Berg WMA.

However, variation in the water intensity of local economies outside the City of Cape Town is significant. Municipalities that rely on agriculture or heavily water intense industries are most at risk. This is most evident for the Bergrivier Municipality, where 37% of employment is generated by the agriculture sector, and Swartland, where 21% of the economy is generated by heavily water intense industries.

For more information on the water intensity, water requirements, and water supply deficit for each municipality in the Berg WMA, see Appendix 1: Municipal Snapshots.

[1] Authors' calculations utilising Quantec (2016) data and WWAP (2016) definitions. Agriculture is also a heavily water intense sector. Refer to tables 7 – 10 in Appendix 4 of the full technical report.
[2] It is important to note that this analysis looks at impact on the the agriculture sector in isolation. It does not consider the impact that changes in irrigated water supply will have further down the value chain, notably on the agro-processing sector.

Box 3: What is the value of water in the Berg WMA economy?

In order to weigh the economic impact of one water use versus another, it is necessary to place a value on water. Within this model, we examined the economic dimension, **"value per drop",** and social dimension, **"jobs per drop",** of water within two categories: the agricultural value and non-agricultural value, "urban". The Rand value and number jobs generated for each category was divided by the amount of water used in order to get a value per m^3.

Table 2: The economic and social value of water in the Berg WMA

	Agricultural use	Urban use
Value per drop [3]	R11 per m^3	R993 per m^3
Jobs per drop [4]	234 jobs per m^3	4,201 jobs per m^3

2.2. How will water demand change in the future?

The value of water, and the intensity of water use in the economy, can provide an indication of how vulnerable an area is to water constraints. In order to better understand how water availability may impact a local economy's growth prospects within the Berg WMA, now and into the future, a **regional hydro-economic GIS tool** was developed, focusing on the years 2025 and 2040.

Within the model (Figure 5), future **water demand** was calculated by projecting water requirements for both agricultural and urban water use for 2025 and 2040.

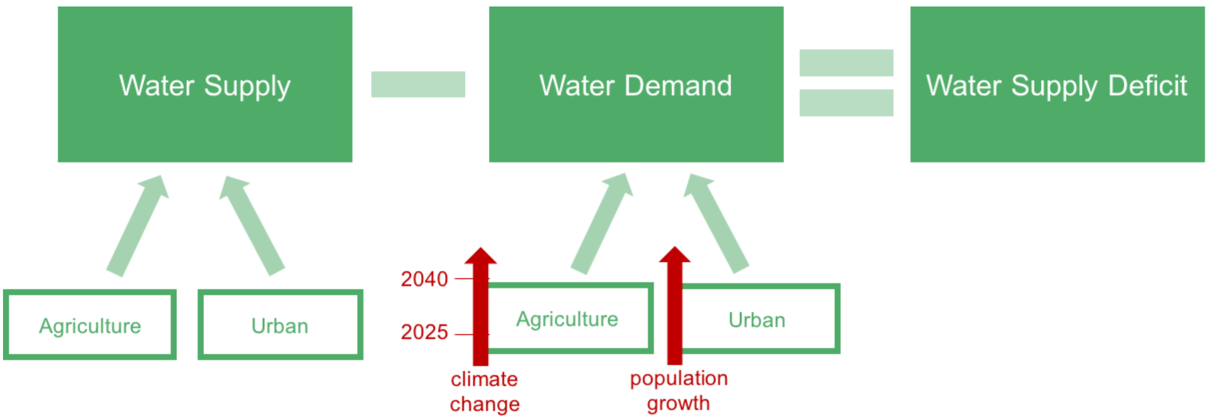

Figure 5: Simplified representation of the hydro-economic model (A)

[3] The agricultural value of water was generated using the average value of irrigated crops generated per hectare for different regions divided by by water used for irrigation. The urban value was calculated using the GVA for the municipality and dividing it by the amount of water that the municipality used.
[4] For the social value of water, employment was used as an indicator at the sectoral level. Employment estimates for agriculture and non-agricultural sectors were divided by the amount of water used.

Climate change was taken into account when projecting agricultural water demand in the future, using various climate models to predict temperature and rainfall patterns in the future (Box 4). **Population growth** was taken into account when projecting urban water demand, again, using a spectrum of high and low growth trajectories to provide for sensitivity analysis. For the purpose of this report, the most conservative projections were used to calculate the water supply deficit.

2.2.1. Agricultural water demand

Current water requirements for agriculture were calculated according to crop type, irrigation type, and climatic conditions of the region. The results show that how grapes, largely wine grapes, consume most of the irrigated water in the region, approximately 79%. Drakenstein, Swartland and Stellenbosch are the largest irrigated agricultural water consumers.

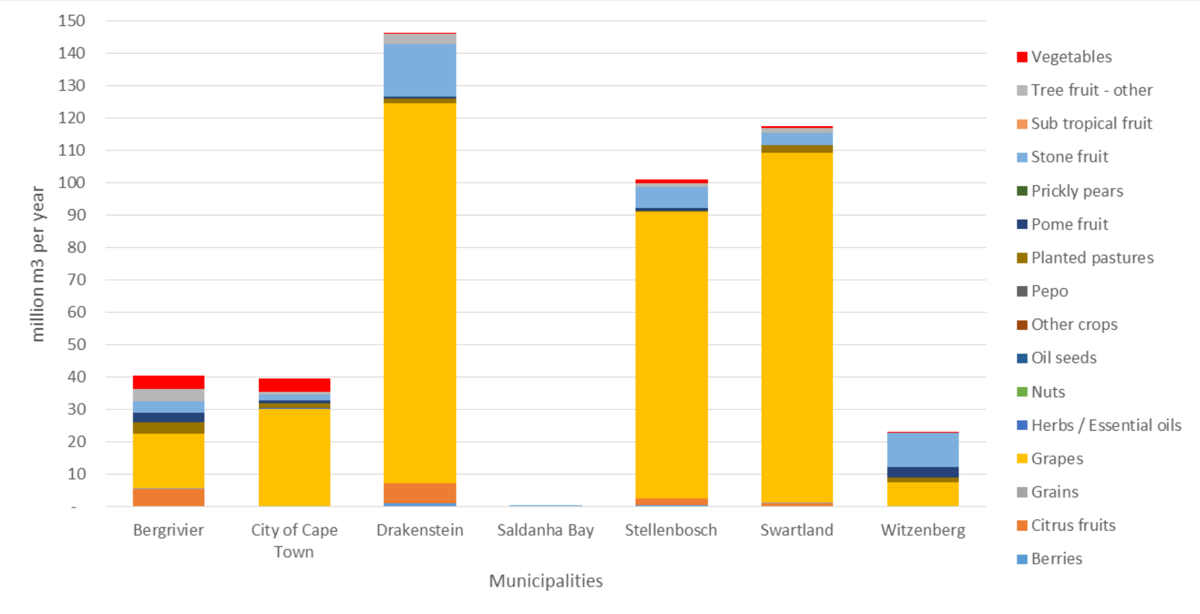

Figure 6: Irrigated agriculture water requirements per year in the Berg WMA

An estimation of future water requirements for irrigated agriculture was generated for the years 2025 and 2040. The crop and irrigation type were assumed to maintain constant, but climatic conditions were updated according to climate models that predict future rainfall and temperature under both low and high emissions scenarios (Box 4).

The results show that increased irrigated water requirements are expected across the region, with a consistent increase between 2025 and 2040 (Figure 7).

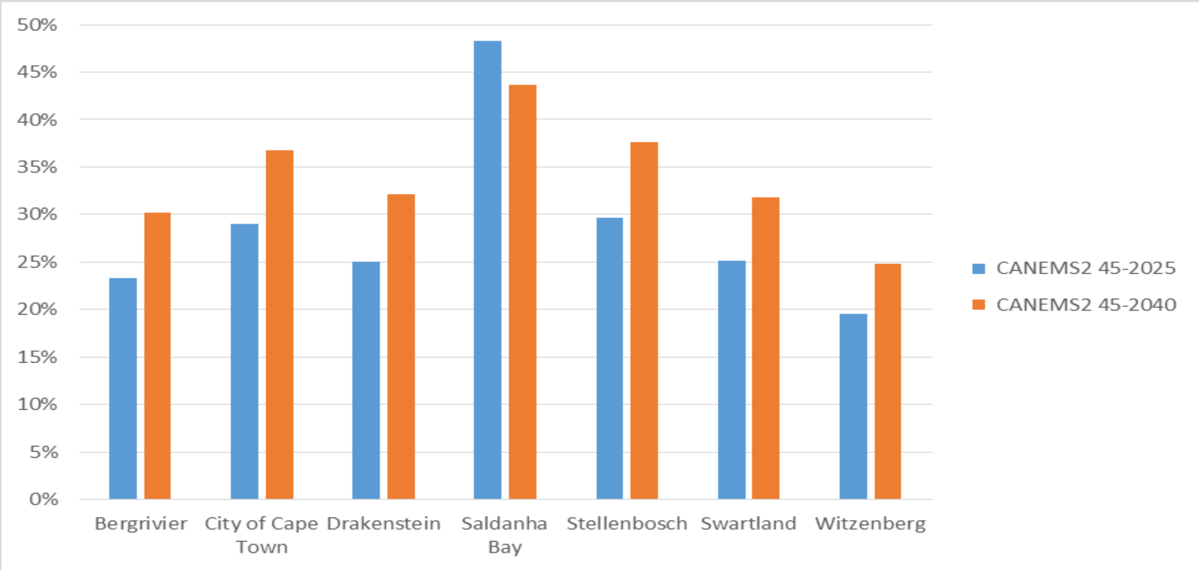

Figure 7: % increase in irrigated water requirements by municipality in 2025 and 2040 using CANEMS2 45 climate model

Box 4: Modelling climate change impacts on agricultural water demand

While it is certain that climate change will play a role in altering future water requirements, it is uncertain what the magnitude of the impact will be. As a highly water intense sector, agriculture will be particularly impacted by the changing climate, with some municipalities affected more than others, based on geographical location, crop composition, and the sector's share of local value add and employment.

Without any degree of certainty as to which climate model best represented the future climatic conditions in the region, three climate models were selected to represent the best, worst, and moderate case scenarios—FGOALS, GFDL-ESM2G, and CANESM2. For each model, low and high emission scenarios were considered. Figure 8 and Figure 9 show the temperature and effective rainfall comparisons between the climate models used, including historical data (1979-2014).

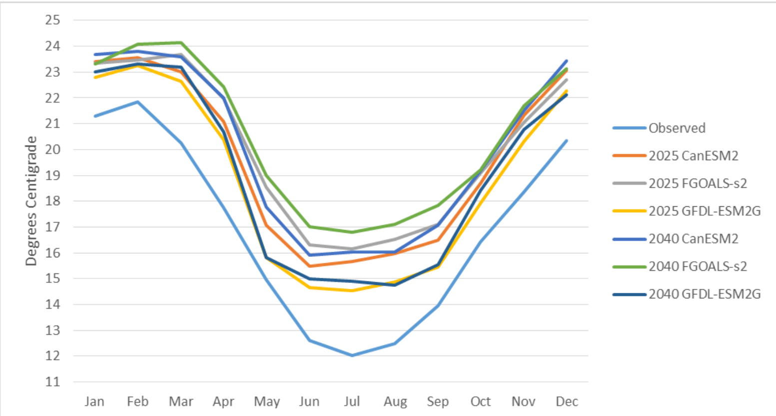

Figure 8: Mean monthly temperatures in the Berg WMA

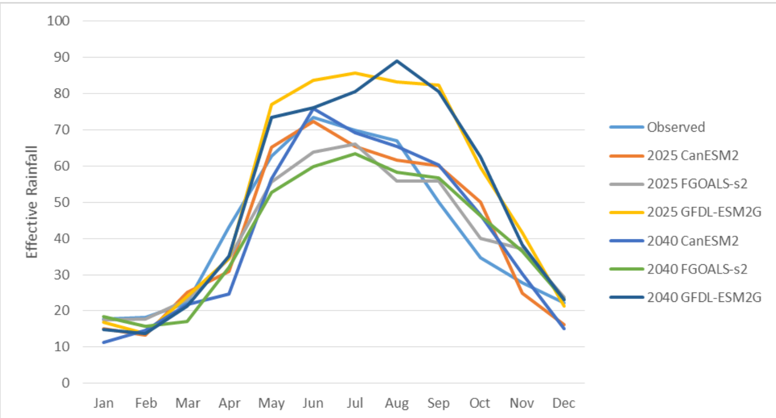

Figure 9: Mean monthly effective rainfall in the Berg WMA

When applied to the Berg WMA region, these models predict the following trends:

- **TEMPERATURE:** All climate change models predict higher temperature than the currently observed trends and this will increase the evapotranspiration rates of the crops.
- **RAINFALL**: Rainfall predictions are too variant to predict changes in rainfall volume accurately in the future. However, the results do show a shift in rainfall patterns with later rain expected in autumn and spring.

2.2.2. Urban water demand

The assessment of non-agricultural water use is particularly important for the Berg WMA, home to an urban population that is growing rapidly, driven by job prospects and the strong economic performance of the City of Cape Town.

Current water consumption was measured using 2011 data, the year of the last national census, as the baseline. The results show that the City of Cape Town is responsible for 85% of the total urban water usage in the Berg WMA (Figure 10). The average per capita consumption for the region is approximately 247 litres per capita per day—16% higher than the national average.

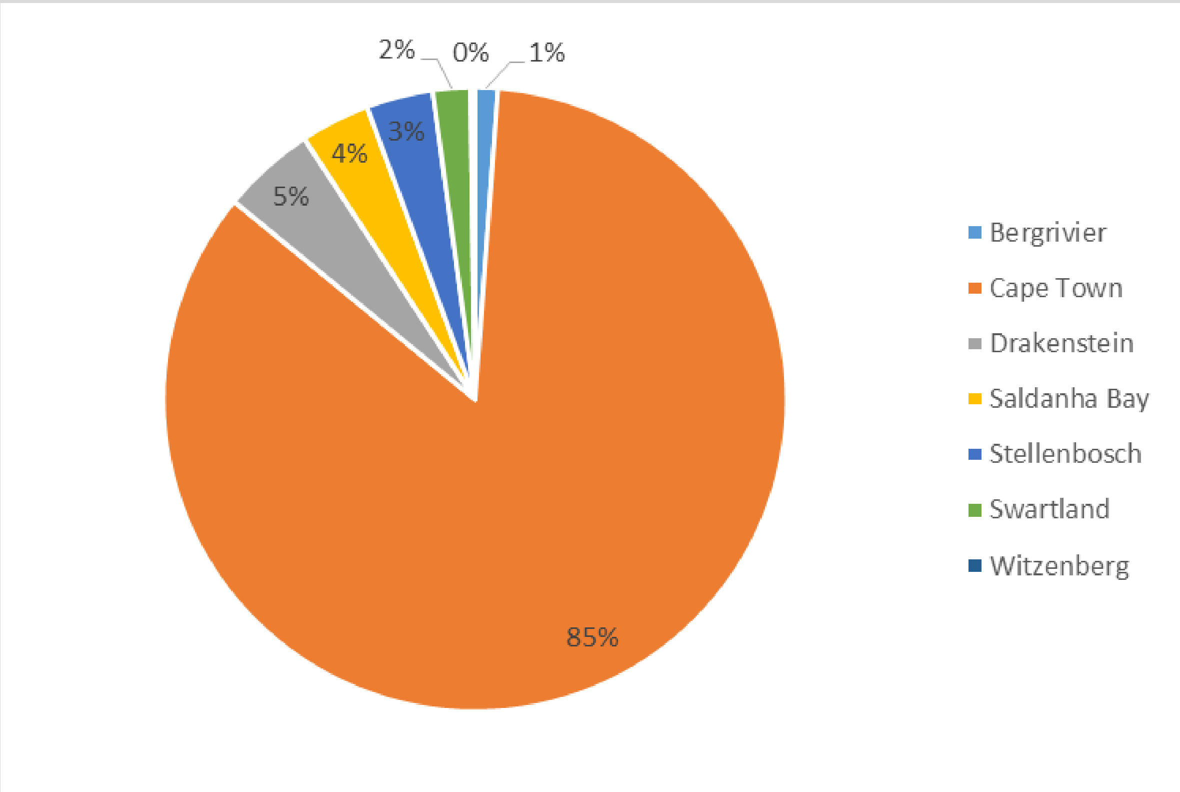

Figure 10: Urban water usage by municipalities in the Berg WMA

The estimation of future water requirements in 2025 and 2040 was simply based on an extrapolation of population growth rates, with an assumption that per capita usage would remain constant. The results show that water requirements for the City of Cape Town grow at the slowest rate, yet still accounts for 80% of regional usage by 2040, down from 85% in 2011. Swartland, Drakenstein, and Saldanha Bay are highlighted as rapidly growing municipalities (Figure 11).

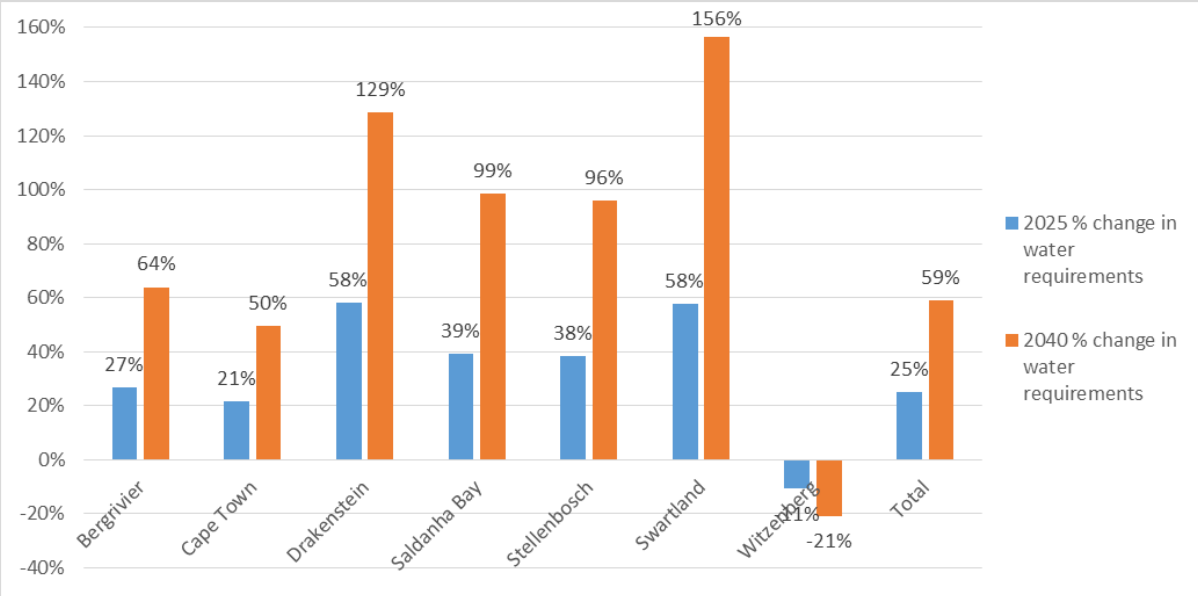

Figure 11: % change in urban water requirements in 2025 and 2040 per municipality according to historical population growth rates

2.2.3. Total water demand

Current total water requirements were calculated by adding the urban and irrigated agriculture requirements with urban making up 54% and irrigated agriculture 46% of the total water required. When broken down by municipality, as discussed previously, there is great variance in the water intensity of the economy (Figure 12).

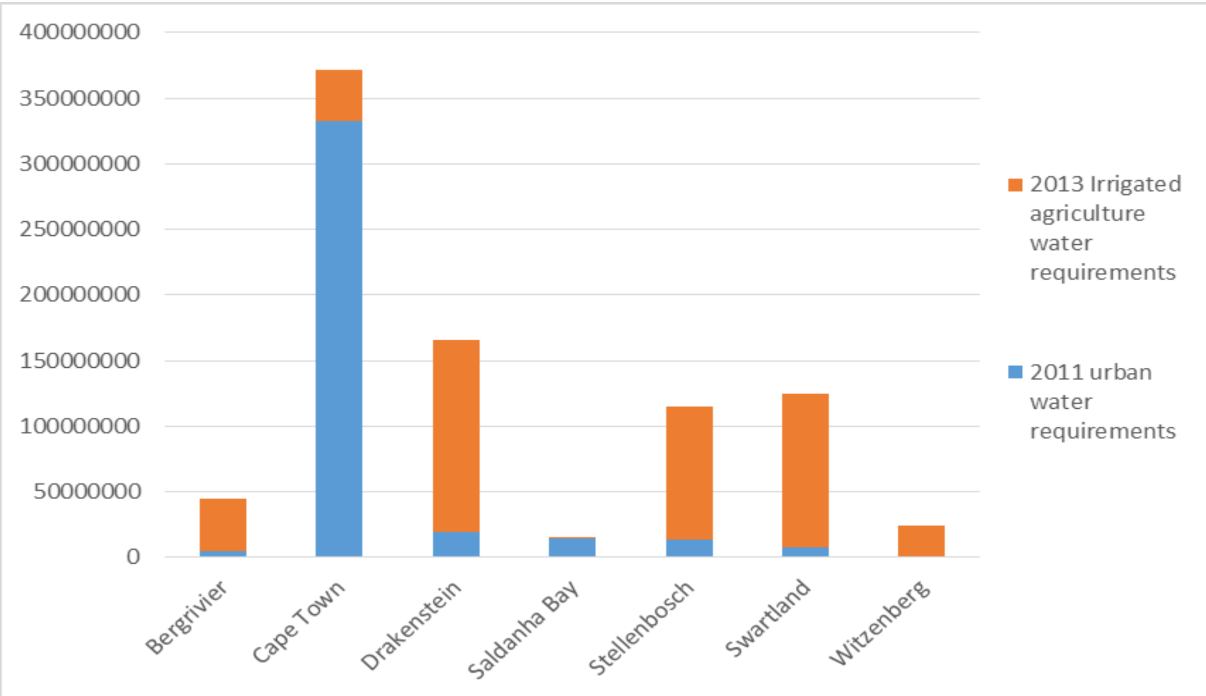

Figure 12: Total water requirements by municipality in m^3/a

In the future, the City of Cape Town continues to demand most of the water in the region, with the local municipalities of Swartland, Drakenstein and Stellenbosch demanding increasingly more water from the region (Figure 13).

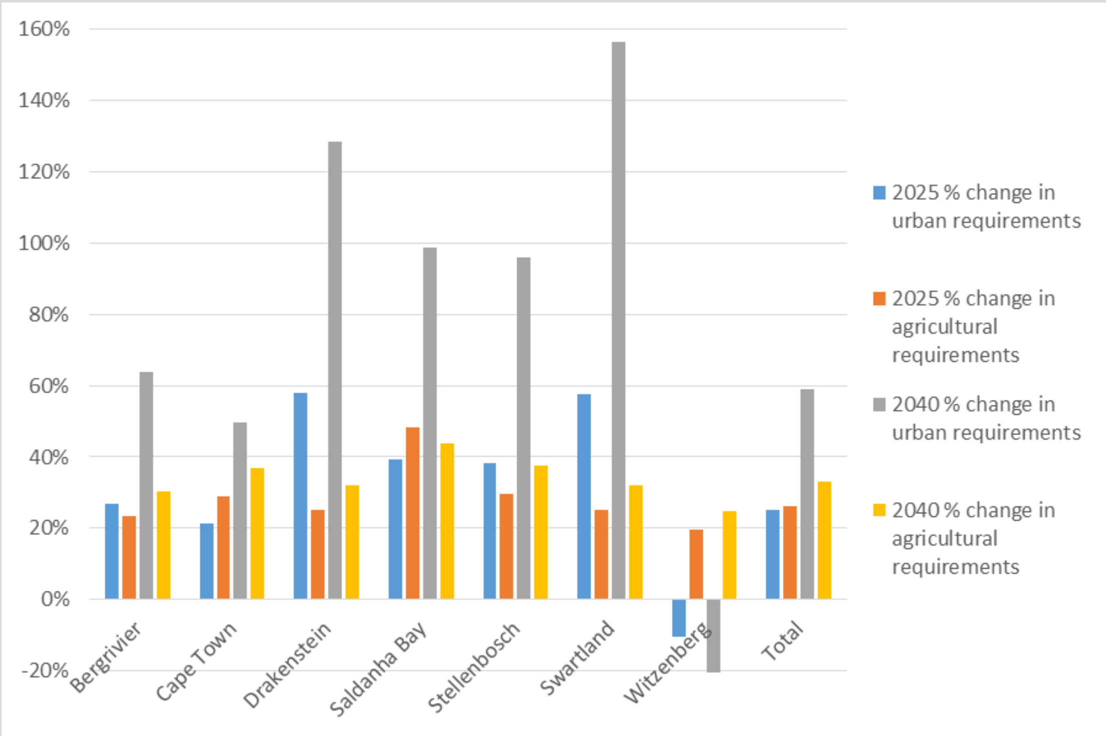

Figure 13: Comparison between urban and agricultural water requirements growth rates in 2025 and 2040 by municipality

Important Insights

- **As the driver of economic growth in the region, securing water for the City of Cape Town is going to be crucial.** Upward pressure on water demand is going to be from urban growth, not agriculture, despite the concerning climatic predictions for the region.
- **However, Cape Town alone should not be the entire focus of in water conservation or water supply interventions.** Rural economies, particularly Swartland, Drakenstein, and Stellenbosch, require substantial volumes of water for irrigation and growing populations.
- **Switching to crops with high economic value, but low water intensity, could provide a solution in the face of increasing water scarcity.** The most important crops in the region—grapes, stone fruit, and citrus fruit—are expected to increase water requirements by 34%, 29%, and 35%, respectively.
- **Water conservation and demand measures will become increasingly important.** In the absence of significant new supply options, reducing per capita consumption is necessary in fast growing municipalities like Swartland, Drakenstein, and Saldanha Bay.

2.3. What will be the magnitude and cost of the future supply deficit in the Berg WMA?

The future **water supply deficit** was calculated assuming that no water augmentation schemes are implemented and the current **water supply** levels remain the same.

The results indicate that, barring any additional allocations or augmentation schemes, the supply deficit is most keenly going to be felt in the agriculture sector in 2025, with the supply deficit for urban users only 13% of the total deficit. However, this picture changes dramatically by 2040, with an almost even split between the supply deficit of the urban and agricultural requirements, driven largely by the City of Cape Town (Figure 14).

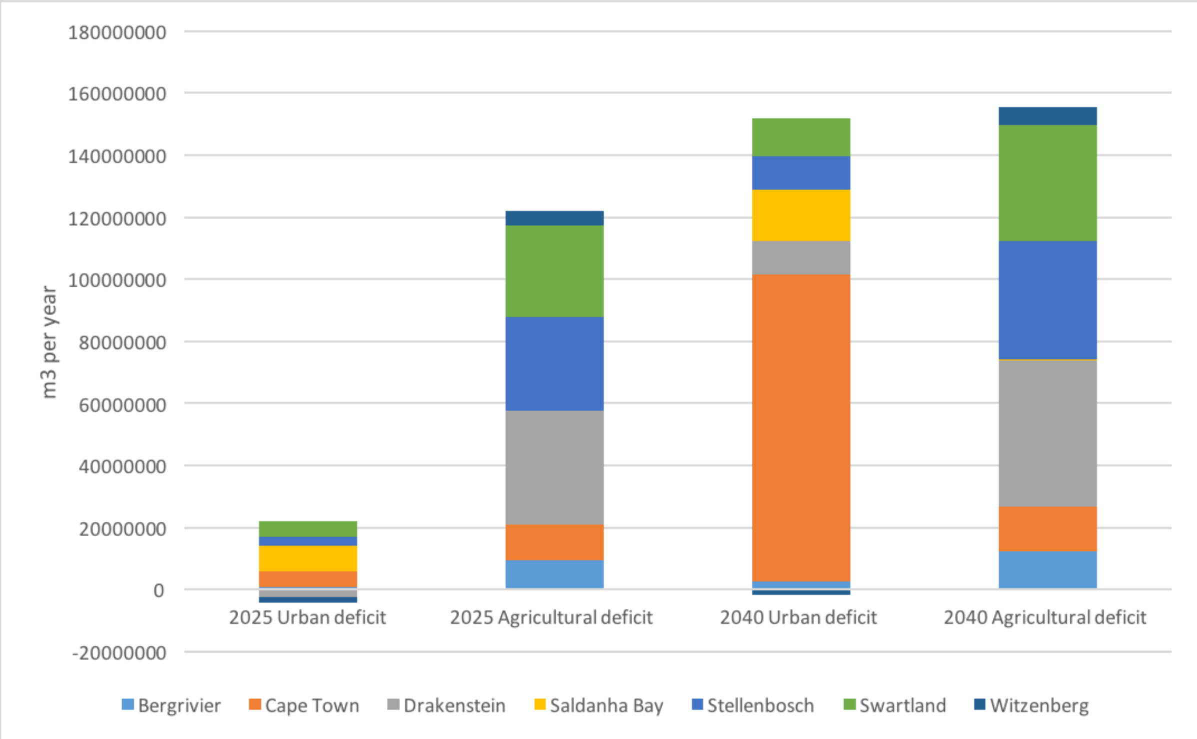

Figure 14: Urban and agricultural supply deficit in 2025 and 2040 m3/a

The resulting **water supply deficit** for 2025 and 2040 was then linked to the economic (GVA) and social (employment) value of water (Box 3) to highlight the **opportunity cost** of the water supply deficit and pinpoint where water constraints have the most significant implications (Figure 15).

The aim of this information is to highlight which municipalities and which sectors will experience the greatest loss of economic and social value due to water constraints in order to prioritise interventions that will have maximum impact for the region as a whole and for specific local economies.

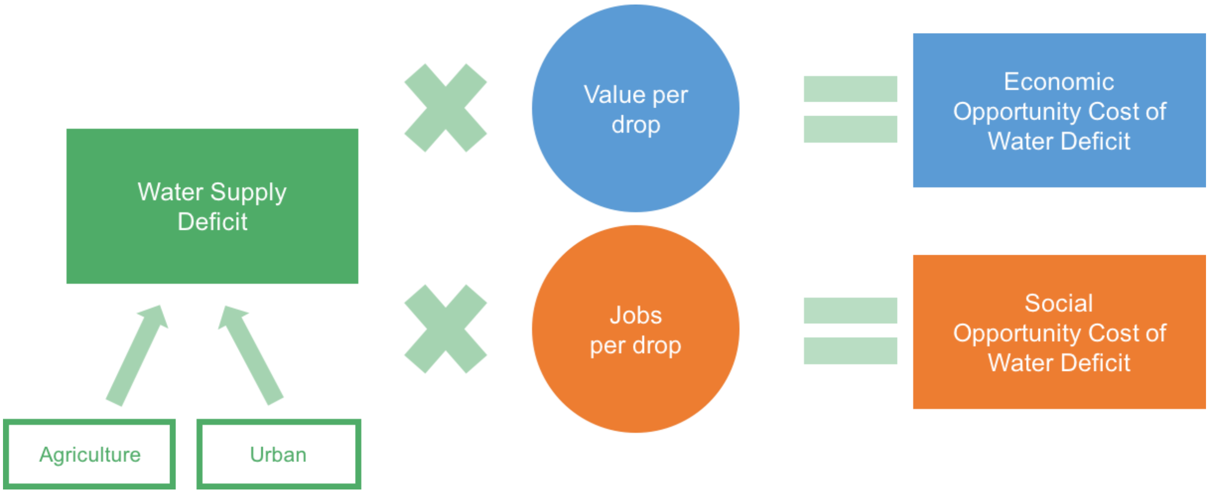

Figure 15: Simplified representation of the hydro-economic model (B)

Due to the vast difference in value per drop between urban and agricultural water use (Box 3), the value of the opportunity cost of the urban water deficit, in both economic and social terms, eclipses the value of the opportunity cost of agriculture (Figure 16). Again, this value is driven largely by growth in Cape Town's non-agricultural sectors.

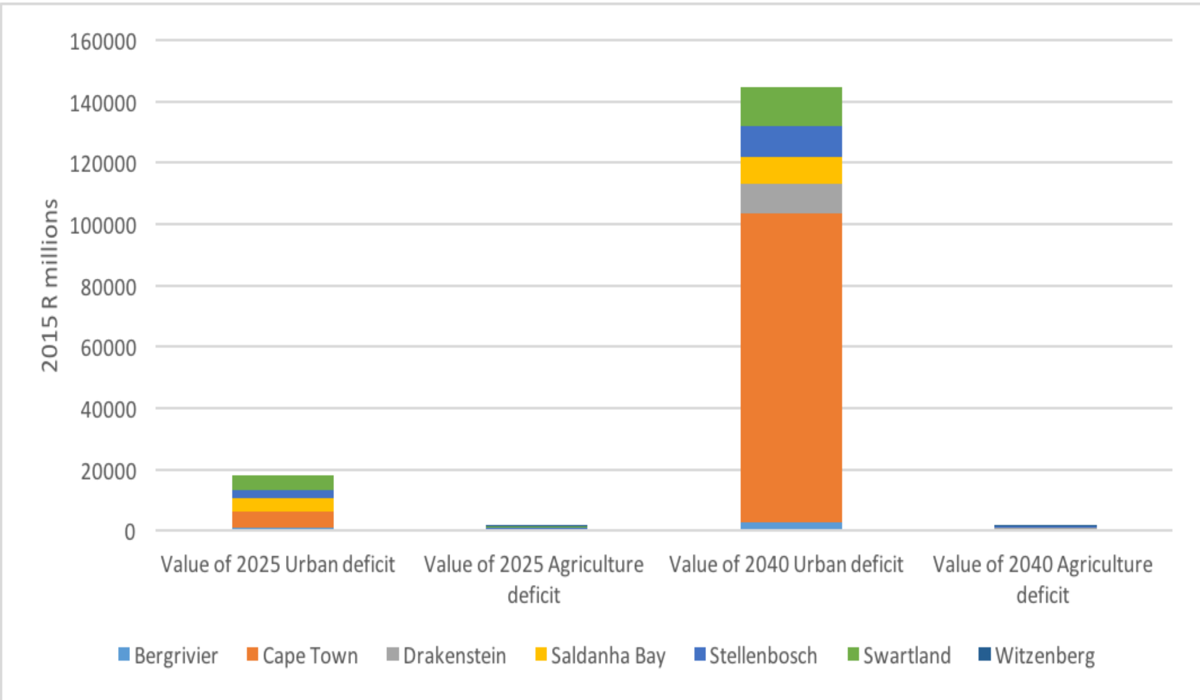

Figure 16: Value of water supply deficit in 2015 R millions for agriculture and urban sectors in 2025 and 2040

While the agriculture sector will require more and more water for irrigation to remain sustainable in the future (Figure 14), the social and economic value generated by irrigated water use cannot compare to the value generate by urban water use. As the primary generator of economic growth and employment in the region, water augmentations schemes will likely be prioritised for urban uses, especially within the City of Cape Town. The comparison between Figure 14 and Figure 16 illustrates that the tension felt during the current drought between agricultural and non-agricultural sectors and, by extension, urban and rural economies is likely to continue into the future.

While the City of the Cape Town is predicted to experience the largest opportunity cost, it is also the largest economy in the region, which means the municipality is better positioned to absorb the economic shocks caused by a water supply deficit. For smaller municipalities, the opportunity cost of the water supply deficit in 2025 and 2040 rises to a significant percentage of (and in some cases surpasses) the size of their current economy (Figure 17). Of particular concern are the West Coast municipalities of Bergrivier, Saldanha Bay and Swartland. The lack of water availability in these areas will be a significant constraint to their economic development and ability to generate jobs.

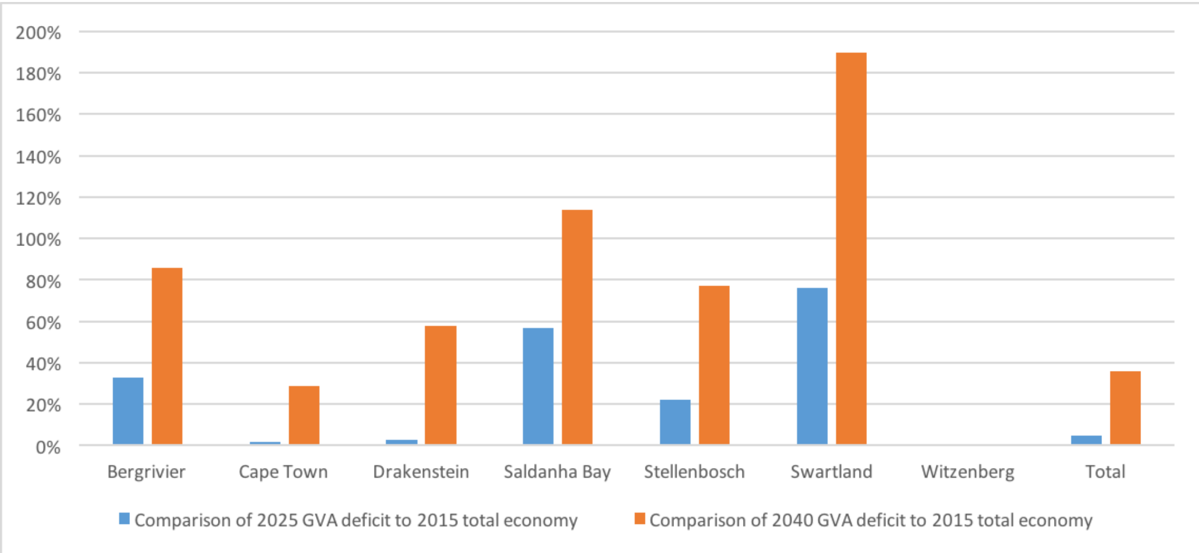

Figure 17: Comparison of the opportunity cost from a water supply deficit to the current size of the local economy in 2025 and 2040

Important Insights

- **The opportunity cost of the urban water supply deficit, in both social and economic terms, is massive, totalling R145 billion per year by 2040**. Irrigated agriculture water requirements increase most substantially in 2025 in comparison to urban requirements, but are still valued lower due to the much higher value created by urban economies. Even when employment is considered, the comparison still largely values urban water usage.
- **The magnitude of Cape Town's opportunity costs justifies the focus for WCWSS supply augmentation in the city.** In 2025, Saldanha Bay, Swartland, Stellenbosch, and Cape Town all have similar opportunity costs, but, by 2040, Cape Town's opportunity costs far outstrip any other municipality, resulting in severe economic and social impacts for the overall region.
- **Smaller economies will be less able to absorb the cost of the deficit and will, therefore, require urgent water resource development.** When viewing the opportunity cost in comparison to the size of the current local economy (and therefore their ability to withstand or absorb that cost), Bergrivier, Saldanha Bay, and Swartland face opportunity costs that range from 77-190% of the size of their current economy. This will have a considerable impact on local economic growth and employment prospects.

3. Water resource and development planning processes in the Berg WMA

Box 5: Key messages from the governance and planning systems analysis

- **Planning processes function in a top-down manner.** National development goals inform local planning but are not necessarily compatible with the local municipality's (LM) available resources, budgets and capacity. There are few feedback loops for LMs to voice their constraints, ask for support or to call for changes in overarching plans and strategies.

- **Projects are assessed on a first-come, first-served basis.** If a water use licence application or an environmental impact assessment meets the required criteria, it cannot be declined in favour of an application, not yet submitted, which may produce a more socially or economically favourable outcome. There is no holistic weighing of the proposed socio-economic benefits, associated water requirements, and cost of proposed economic developments or water resource interventions.

- **The timing both *within* planning processes and *between* planning processes is not aligned**. *Within* the development planning process, the top-down approach results in a slow trickle down of information from national to local level planning process. Similarly, timescales differ *between* the Integrated Development Plan (IDP) process (5 year intervals) and the Water Master Plan process (15 - 20 year intervals), which often results in a repetition of outdated Master Plan information in the IDPs.

- **Water Service Authorities (WSAs) are often unable to develop local bulk water resources due to lack of capacity, resources and effective coordinating platforms.** WSAs are responsible for local bulk water resource development, but this is a role that they have struggled to perform. In the absence of a water board or regional water utility, WSAs turn to the Department of Water and Sanitation (DWS) to solve water supply issues through the development of regional bulk water schemes, which often do not adequately address local water development needs.

- **The IDP is not required to consider water availability and demand, nor does the IDP process demand a discussion of how development will impact natural resources.** The IDP simply includes a recognition of currently available water resources and potential future water availability, often by repeating information that is available in the WSDP. It does not provide meaningful considerations of future water resource or supply interventions. Therefore, high water-demand development is often planned without assessment of available water resources

- **Stakeholder input processes are typically box-ticking exercises.** Both private and public sectors are involved in the IDP process through stakeholder participation processes. However, in reality, these processes provide little meaningful contribution, resulting in an IDP, and associated water resource planning, that does not accurately reflect sectoral plans and needs.

- **Municipalities lack the capacity to raise off-budget finance for water infrastructure projects.** Because grant funding from the state is only relevant for water infrastructure projects that fulfil a social objective, if a project is deemed "commercial" or a mixture of the two, a percentage of cost will need to be raised by the municipality (or off-takers). This presents a major challenge for LMs whose limited funding is tied up in maintaining and rehabilitating existing infrastructure. Access to funding is further complicated due to the fact that municipalities often lack the capacity and creditworthiness required to raise off-budget project finance.

3.1. Overview of the planning processes

A governance and planning process assessment and mapping exercise was undertaken to determine (a) how decisions regarding water use and economic development are made on-the-ground; and (b) what misalignments and barriers exist within this process that prevent the "smart" use of limited water resources. This section provides an overview of decision-making process and identifies points of misalignment.

The following sections provide brief summaries of the institutions and procedures involved in relevant planning processes—development planning, water allocation, water resource water services development, and financial planning. A simplified representation of these how they relate to one another, is illustrated in
Figure 18.

3.2. Development planning

Development planning currently functions in a top-down manner, with the key planning process occurring at the **local municipal (LM)** level, through the **Integrated Development Plan (IDP).** The LM's development strategies must be aligned with national and provincial sectoral plans and planning requirements, including the Environmental Management Framework and the Spatial Development Framework (Box 6). However, the top-down nature of the planning process often results in overarching national development goals that inform planning at lower levels, but are not necessarily compatible with LMs' available resources, budgets and capacity.

The IDP is, simply put, a coordination and amalgamation of sector development plans, including the integration of the **Water Services Development Plan (WSDP),** which is the key plan for water services in the municipality. This makes the IDP the primary planning tool within which any water infrastructure interventions would have to be outlined.

In the legislation, the importance of the IDP in water resource planning is clear: sectoral departments and agencies are responsible for checking the alignment of the IDP with the relevant sector's plans and priorities during its drafting, while the national sector agencies should provide a framework for the development of the sector plans. However, in reality, the IDP simply includes a recognition of currently available water resources and potential future water availability, often by repeating information that is available in the WSDP, which does not adequately account for water resources (see 3.5). Therefore, high water-demand development is often planned without assessment of available water resources.

This has major budgetary implications, as the budget planning for the LM and the IDP go hand-in-hand i.e. projects within the IDP are voted for at council level, and the required budget is set aside (See 3.6). With no clear feedback loop from low to high levels of governance, municipalities often struggle to gain support and budget for the local translation of objectives and strategies set at the highest levels of governance.

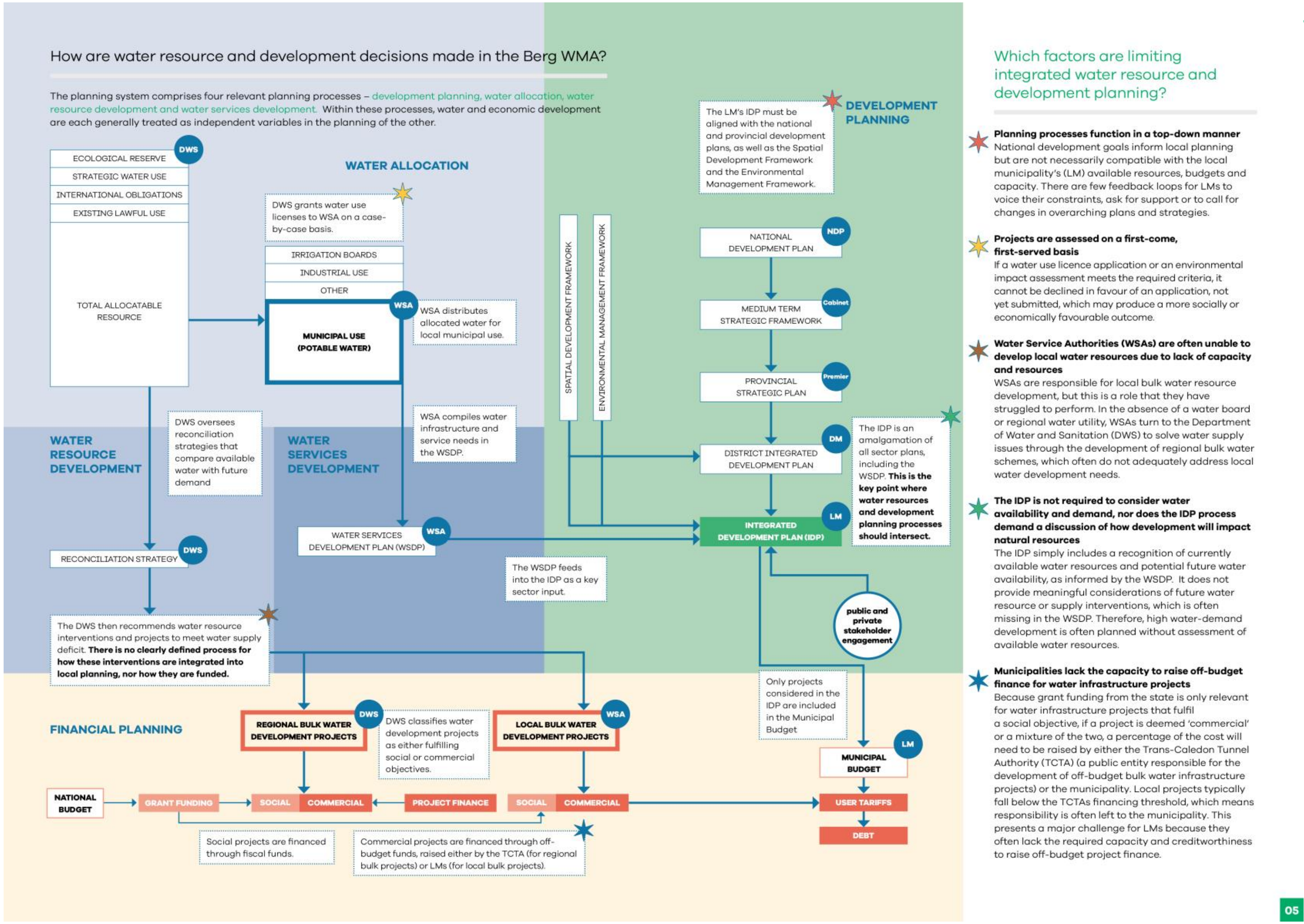

Figure 18: Relevant water resources and economic development planning processes

Box 6: The Spatial Development Framework process

The **Spatial Development Framework (SDF)** is regarded as the key input into the IDP, and is often elevated to the same importance as an IDP. The development of the SDF is regulated through the Spatial Planning and Land-Use Management Act (SPLUMA), and follows the same top-down approach as the IDP process—SDFs are completed at the national, provincial, regional, DM, and LM level (RSA, 2013).

The Provincial SDF aims to guide land use, bulk infrastructure development, and sustainable development initiatives. The LM SDF is more detail oriented, focused on the spatial planning of the LM's jurisdiction. It identifies land suitable for future development projects that are described in the IDP (DPLG, 2000).

The SDF marks a key juncture for water and development integration because is usually the point at which the **private sector** interacts with the municipality's development planning process. Because water sector plans and the SDF must both be integrated into the IDP, the IDP process provides a potential platform for the economic development projects outlined in the IDP to be aligned with water resource and services development.

3.3. Water allocation planning

How water is allocated for use is dictated by the National Water Act (NWA). The total water resource is determined through water resource yield models. The allocable resource is what is remaining after legal obligations are met. After all the legal obligations (such as existing lawful use) have been subtracted from the total water resource, the **Department of Water and Sanitation (DWS) or Catchment Management Authority (CMA)** is responsible for granting licenses or authorisations for the remaining raw water to individuals and **Water Service Authorities (WSAs**) (municipalities).[5]

Significantly, because the DWS does not make *allocation decisions*, but rather *authorisation decision*s, they must authorise a water use if it meets the licensing requirements. The DWS has no reason (and no mandate) to withhold an authorisation on the hope, or even knowledge, that a more socially or economically productive use of the water resource will be applied for at a later date.

Water **allocation priorities** are dictated by the NWA, and are clearly mapped out in the second National Water Resources Strategy (NWRS). However, these priorities are only considered when competing applications are received. The only priority that is considered in the process is whether a minimum of 30% of the allocated water will go to, or benefit, historically disadvantaged people. Beyond this criteria, it is not clear how completing applications from WSAs are compared.

Engagement with various stakeholders highlighted the fact that water allocation priorities are not used in practice. The very nature of awarding water use licenses, i.e. licenses are awarded on a case-by-

[5] Whether the DWS or CMA acts as the responsible authority for allocation of the remaining water depends on the catchment. The NWA provides for a water to be allocated by the relevant CMA, but since only two are currently operational, the DWS remains the allocating authority in those catchments where CMAs are not yet established, as in the case of the Berg-Olifants.

case basis if the licensing requirements are met, prevents these priorities from being applied in any meaningful way.

The lack of transparency of this process leaves potential water users with a great uncertainty over the allocation process and the amount of water available for allocation. This lack of transparency has a significant impact for those in the planning sector. The lack of information on how much water is available, and how this will change due to climate change, creates a significant barrier to informed decision-making for local development and water resource planning.

3.4. Water resources development planning

As DWS became aware of the fact that the water requirements in South Africa's major metropolitan areas and major schemes were soon to outstrip availability, the department initiated the development of **reconciliation strategies** for all major schemes in order to guide the necessary water resource planning (DWAF, 2007). In the reconciliation strategies, available water supplies are compared to current and projected future water requirements. Where there are shortfalls between future water requirements and current available supplies, water resource interventions are proposed, such as demand reduction or increasing availability, in order to reconcile supply with demand.

The **All Towns Reconciliation Strategy Study** is a compilation of all reconciliation strategies for towns, villages, and clusters of villages. The study was intended to provide DWS with oversight of and guidance for the LMs in their planning of the water resource interventions.

While DWS has led the effort to coordinate water resource interventions at the national, regional, and local level, it is technically the responsibility of each WSA to ensure enough water is supplied to its water users, i.e. **water resource development**. Within water resource development, there is a distinction between **regional bulk water schemes** and **local water schemes.** DWS has historically been responsible for implementing regional schemes due the coordination and planning necessary for infrastructure supplying multiple users. WSAs are then responsible for implementing local water schemes to supply their municipality (e.g. desalinisation, water reuse, groundwater).

In the Berg WMA, the lack of viable regional water schemes (excluding the Voelvlei, which is currently under development), places the considerable responsibility on the WSAs to develop their own water resources. However, in reality, WSAs often focus solely on **water services provision and development** (Section 3.5) largely due to the fact that WSAs do not have the capacity or resources to implement bulk water interventions. This confusion of responsibilities often results in delayed action or inaction when it comes to water resource development planning and implementation (Box 7).

Box 7: The conflict between WSAs and DWS, or municipal and national lines of responsibility, in the current water crisis

The current water crisis has highlighted the confusion over the responsibilities of the WSAs and DWS to supply adequate water. Despite the reported[6] clarity in the legislation relating to bulk water provision, this is not how bulk water provision occurs in practice, particularly in regions where there is no water board.

In the current drought, emergency supply schemes have been developed by the WSAs to secure their own water sources. The City of Cape Town, in particular, is implementing several bulk augmentation projects. However, there is no expectation that the WSA schemes will recoup any funding from DWS. The City of Cape Town and provincial government have argued that DWS should contribute financially to these projects as bulk water infrastructure is under the mandate of DWS.

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3.5. Water services development planning

The WSA is responsible for ensuring that enough water is supplied to its water users, which entails both water resource development and water services development, i.e. all planning and implementation necessary to ensure sufficient delivery of safe water.

The WSA outlines future water services development in the **Water Services Development Plan (WSDP),** which is then submitted as a sector input into the IDP process. The IDP must be aligned with the plans and projects outlined in the WSDP—**this is the main point where the development and water planning processes intersect.**

In practice, there are several challenges that make this process ineffective:

- The WSA is responsible for checking alignment of the IDP with sector plans and priorities during IDP drafting. In reality, this step often serves as a box ticking exercise as little time and resources are dedicated to ensuring meaningful commentary.
- Furthermore, the WSDP mainly deals with infrastructure and water service needs. The document does not provide meaningful considerations of future water resource or supply interventions.
- The IDP is not required to consider water availability and demand, nor does the IDP process demand a discussion of how development will impact natural resources.
- The lack of local capacity is an issue that underpins this entire process. In practice, under-capacitated WSAs often look to DWS for water resource planning support, which defeats the purpose of have decentralised water services planning and confuses mandates and lines of responsibility.

The sum of these misalignments translates to development decisions made without accurate reflection of future water supply. Water intensive development may be approved without enough water resources available and, conversely, water intensive developments may be refused without consideration of future water resource development. This has significant implications for both private and public sector development—if developments are not aligned with IDP, they will not be approved.

[6] http://www.politicsweb.co.za/news-and-analysis/urgent-resolution-needed-on-funding-for-water-supp

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3.6. Financing water resources and services development

The current funding process for water resources and services development is overseen by DWS, who coordinates input from WSAs on municipal infrastructure needs. The process on how these projects get accepted or prioritised is unclear. Once an infrastructure need has been established by the WSA and the WSA has applied for funding from DWS, the Minister of Water and Sanitation will determine whether the project is classified as social and commercial infrastructure, or both.

If a project is classified as fulfilling a social objective, it is funded by grant funding from the state and implemented by the Water Trading Entity (WTE) under the umbrella of DWS. For commercial projects, infrastructure is funded using off-budget project financing (user charges, rates levies, capital funds, or loans) and is implemented either by the Trans-Caledon Tunnel Authority (TCTA) or the WSA. If a project is deemed a mixture of the two, as is often the case, a percentage of the total cost will be funded through government grants, while the remainder of the funding will need to be raised by the municipality or TCTA.

TCTA is a public entity responsible for the development of off-budget bulk raw water infrastructure development and specialises in project finance, implementation and liability management (DWA, 2013b). TCTA usually works on larger projects on the directive of the Minister and is mandated to raise funds from domestic and international funders.

For smaller off-budget projects, it is the responsibility of the WSA to raise financing. This raises a major challenge for municipalities whose limited funding is tied up in maintaining and rehabilitating existing infrastructure. Municipalities often lack the capacity, resources, and creditworthiness to raise off-budget project finance.

The inability of most municipalities to raise commercial project financing means that, for most projects, the off-takers (the end users) will effectively finance the project through increased tariffs. This raises a challenge for municipalities where the end users may not be able to support the necessary increase in tariffs, meaning some essential water resource development projects are never able to get off the ground.

4. The way forward

Projected water supply deficits in the near future threaten to significantly derail economic development in the region, impacting the livelihoods and wellbeing of the Berg WMA population. Difficult trade-offs will need to be made in order to ensure that limited water resources are used equitably, and new water resource are developed in a prioritised manner in order to make the most of development opportunities.

The current planning system is not structured or equipped to undertake this level of integrated decision-making and planning. The economic impact of water resource decisions, and the water resource implications of economic decisions, are not fully considered. Water is taken into account in economic planning (and vice versa), but generally as independent variables rather than accommodating the co-dependence of water and economics.

In order to ensure the smartest use and development of water resources, integrated planning approaches should be adopted by local and regional institutions. The following recommendations are provided for government planners, consultants, and associations involved in water services, water resource, and economic development in the Berg WMA:

Demand-side management

- **Agricultural users should implement crop-switching and invest in water-saving technology.** Barring any additional allocations or augmentation schemes, agricultural users must reduce their water consumption. Farms should be encouraged to switch to crops that offer high economic and social value, but low water intensity, such as pome fruit, stone fruit, and herbs and essential oils. Investment in water efficiency technology (shade cover, remote sensing, etc.) should be encouraged. This is especially true in Swartland, Stellenbosch and Drakenstein, the municipalities with the highest irrigated water requirements, currently and into the future

- **Municipalities with with high per capita consumption should implement water conservation and demand management (WC/WDM) measures.**
  The average per capita consumption for the Berg WMA is 90 m^3/capita/a. This is 16% higher than the national average (Cole et al., 2017). All municipalities in the Berg WMA should implement WC/WDM measures in order to lower per capita usage. This is especially true in Saldanha Bay, where the municipality's per capita water consumption to considerably higher than the rest of the region primarily due to industrial water consumption from steel manufacturing and fisheries.

Institutional support

- **WCG should support WSAs in coordinated water resource development planning.**
  The WSAs in the Berg WMA need support for water resources planning. In the absence of a Regional Water Utility or water board, this support is best provided by the Western Cape Government (WCG). Involvement of provincial government is the most obvious way to provide a feedback loop within planning processes from local to national levels of governance, as well as to incorporate water resources challenges into regional development decisions. Provincial government's Sustainable Water Management Plan (SWMP) is the "best fit" existing forum to adopt integrated planning.

- **WCG and LMs should advocate for the development of a Regional Water Utility or water board for the region.**

A regional authority would coordinate regional water supply needs and consider economies of scale between WSAs to prioritise the most cost-effective and resource-efficient water resource development interventions prior to being submitted to DWS for consideration. A facilitated discussion over mandate and the potential for the formation of a separate entity is recommended between WCG, the WSAs and DWS.

Planning support and process reform

- **Municipalities should apply a strategic, comparative approach to prioritise water uses.** Municipalities should make decisions regarding the approval of development projects based on a comparative assessment of potential projects and associated water usage. The decision-making process should consider the economic benefit and water intensity of different water uses, as well as the ability of future development to fund water resources interventions. This does not necessarily require an additional or separate study to be conducted, it rather requires coordination, tools for weighing trade-offs (Box 8), a platform, and information sharing.

- **DWS and WCG should integrate hydro-economic modelling into decision-making.** DWS should utilising hydro-economic modelling to prioritise water augmentation interventions in areas where the water deficit will most constrain economic growth. WCG should use hydro-economic modelling to help assess the appropriateness of development plans and to identify which municipalities need targeted support.

- **WCG should support WSAs and LMs to integrate water resource planning inputs into the IDP process.** Considerations of water availability, water demand, and how these factors will be impacted by future water resource interventions and economic development should be integrated into IDPs. Provincial government should provide support WSAs in this process.

Box 8: Local Multi-Criteria Decision Analysis tool

A Multi-Criteria Decision Analysis (MCDA) tool, specifically for the Saldanha Bay municipality, was designed to guide the municipality in prioritising new development applications on the basis of socio-economic outcomes in comparison to the water required for the project, rather than just allocating water on a first-come-first-served basis. The tool allows decision-makers to evaluate alternative options based on a diverse range of criteria, which can be assigned varying levels of importance or weigh, allowing for differing levels of prioritisation.

While developed for Saldanha Bay for the purposes of this project, the tool can be applied to any municipality that is in need of transparent and collaborative decision-making with the ultimate aim of improving the productivity of water in the local economy.

For more information on the MCDA tool, please visit: https://www.greencape.co.za/content/focusarea/water-for-sustainable-development.

Implementation support

- **WCG should support LMs to build off-budget financing capacity.** LMs need support in the preparation of project finance applications to DWS and other funding mechanisms, including commercial financiers. The establishment of a Regional Water Utility would relieve LMs of this responsibility. However, in the absence of a Regional Water Utility, the Western Cape Government should provide support to LMs for these applications and/or the establishment of a regional water fund to assist in the financing of water resource infrastructure.

Find out more

This brief covers key findings from a three-year study, “Managing water as a constraint to development with decision-support tools that promote integrated planning: the case of the Berg Water Management Area”, funded by the Western Cape Government and Water Research Commission and conducted by GreenCape, with support from the University of Cape Town (UCT) African Climate and Development Institute (ACDI). The aim of the study was to better understand the interdependent relationship between the Berg WMA economy and current and future water availability. It also aimed to develop actionable tools and insights for decision-makers to integrate water resource and development planning.

For the full project report and the decision-making tools developed, visit: https://www.green-cape.co.za/content/focusarea/water-for-sustainable-development.

For support on taking further action, contact: Claire Pengelly, claire@green-cape.co.za.

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