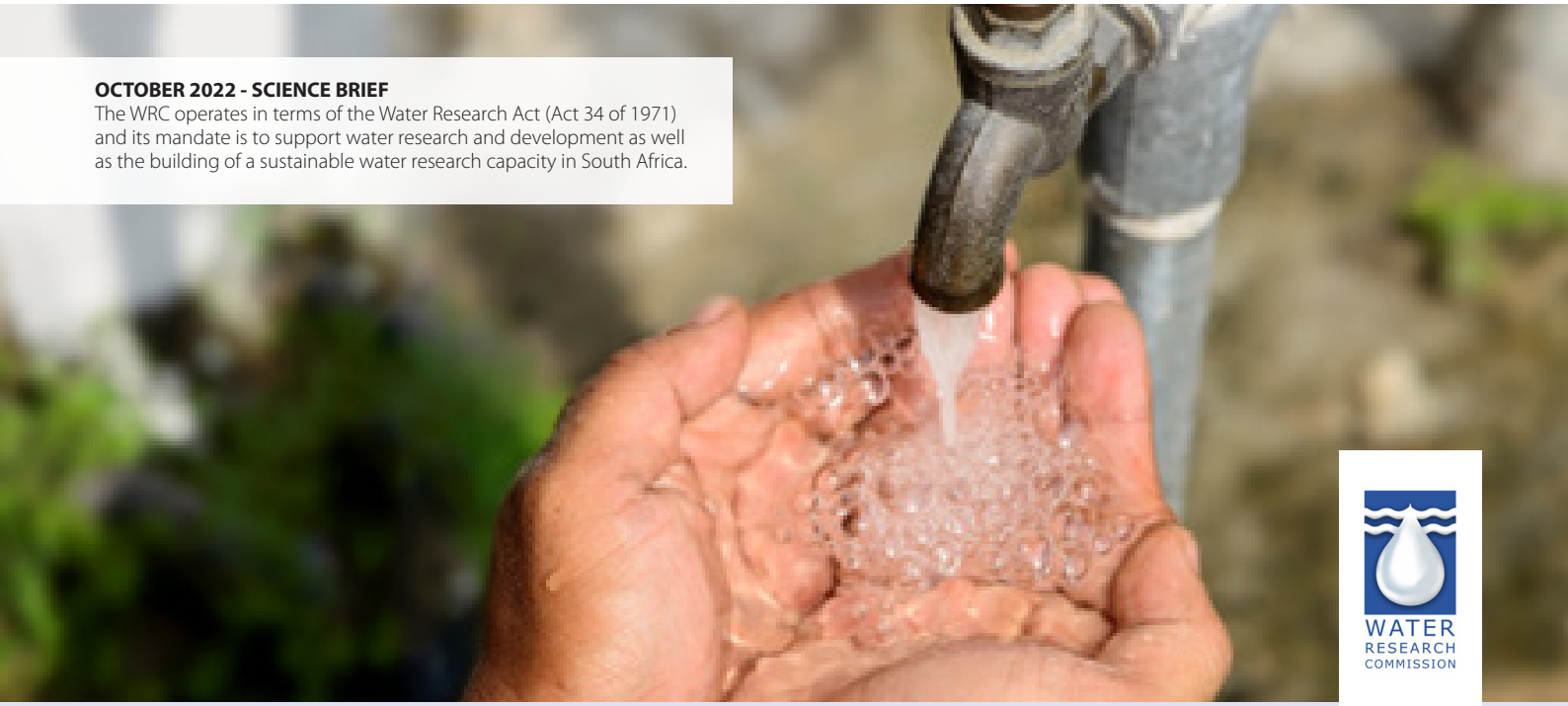

OCTOBER 2022 - SCIENCE BRIEF
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

SCIENCE BRIEF: THE CURRENT POLICY SITUATION AS AN ENABLER FOR WATER SECTOR CLIMATE CHANGE RESPONSE TO INCREASE RESILIENCE[1]

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Here we investigate whether a policy environment would be enabling for the South African Water sector to effectively respond to the climate crisis. The limited water resources face increasing pressures attributed to fast growing population, economic development, and urbanisation. These pressures are projected to be further exacerbated by changes in climate. Together the pressures, coupled with gaps in government policies, and the lingering past-apartheid institutionalized segregative water allocation and rights policies, together with the chronic gender disparity calls for an urgent response to climate crises. The approach employed in this assessment was to review the water governance framework and past experiences on the policy environment in responding to prevailing challenges and this was used to infer if the sector is likely to respond to climate change based on current policy environment. The challenges owing to increasing pressure and climate change as said are to be addressed through adequate governance of the available water resources. The water governance is driven by the political, social, economic, and administrative systems that influence the use and management of water. This is essentially about equitable allocation of water resources and other rights to it, its related services, and their benefits. These challenges require a paradigm shift in approaches employed by water managers and planners that consider complexities, introduced by highly variable and unpredictable conditions, in addressing water resources management. South African governance's framework aligns with international and regional best practices, and it is said to have some of the world's best policies; however, the main challenges to their success stems from low adaptive capacity and limited translation of good policies into practice. These lead to lack of implementation and investment in the development of the water systems to meet the growing demands. This chapter demonstrates the importance of not only good water policy environment but also good governances to meeting the demands.

Keywords: Policy environment; governance; climate change; resilience; systems; adaptive capacity

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Introduction

Climate change is no longer a projection, and its impacts to some extent on systems are evident and well documented in the recent Inter-governmental Panel of Climate Change (IPCC) Assessment Report. The report calls for urgent action on water and climate. Moreover, the report confirms that people around the world are experiencing devastating consequences – climate change is intensifying the water cycle, including its variability, global precipitation and severity of heat and cold as well as dry and wet events [1]. Most of scientific evidence is based on field observations from long-term monitoring networks that shows [2] that climate change is occurring. Climate change has altered the already highly variable weather patterns, leading to more incidents of extreme weather events, unpredictable water availability, exacerbating water scarcity and contaminating water supplies. The extreme weather events associated with climate change reveal existing underlying threats to water security [1]. Some of the most noticeable impacts result from the way climate change intensifies the water cycle, bringing more intense rainfall and associated flooding, as well as more intense drought in many regions. In South Africa, climate change poses a significant threat to the already highly variable and erratic rainfall patterns, high temperature with associated double evaporative demand as opposed to rainfall received, and the limited and unevenly distributed water resources.

Water is the primary vehicle through which we feel the impacts of climate change. Water is crucial for development, especially in a region such as Southern Africa where water access remains a challenge and tops local leader political agendas [1]. This is evidently demonstrated by the fact that water is a catalyst and essential for all developments and sustain livelihoods. Water management under the changing climate is a serious challenge facing water managers and decision makers worldwide. Over the years water managers and planners have been contending with climate variability and its impact on water resources and supply. The water policy practices with respect to climate have and still markedly are such that predictions on future status of water assume stationary climatic conditions [3]. However, intransient conditions typically prevail under climate change.

In South Africa, climate change poses significant threats to the country's water resources, food security, health, infrastructure, as well as its ecosystem services and biodiversity. These plausible impacts are exacerbated by an already vulnerable system, characterised by high levels of poverty and inequality, thus posing critical challenges for national development [4]. These projected impacts are alarming and are of immediate societal relevance. For example, a change in available water supply and its predictability in South Africa would have major implications in most sectors of the economy, especially for urban and agricultural demands. The economies of developing countries including South Africa depend on climate sensitive sectors [5] such as agriculture and water. However, South Africa is a water scare country with almost half the World's average in rainfall [6] and very high evaporation rate due to high temperature under natural conditions (i.e. prior to factoring climate change effects). The country is also highly variable in terms of climate. Various stress factors such as water pollution, unsustainable water use and climate change exacerbate the water situation. To address a number of these and other water related challenges it is necessary to ensure enhanced adaptive capacity and access to the means of adaptation.

The strategic plan of the Department of Water and Sanitation (DWS) asserts that for South Africa to achieve water security, a strong regulation in terms of water quality, balancing demand and supply, ensuring the safety of dams, and being resilient to climate change impacts [7] are imperative. The second edition of the National Water Resource Strategy and the Water and Sanitation Sector Policy on Climate Change are both strategic documents of the DWS that underpin policies and strategies for mainstreaming climate change in the operational plans [8,9]. However, to guide and inform the implementation of policies the Climate Change Response Strategy for the Water Sector was developed. This chapter therefore assess and review the policy environment as an enabler to the resilient response to the changing climate over and above practical and physical measures that improves the adaptive capacity.

Review and Analytical Approach

The review follows a desktop study based on information that is available in the public domain. As a point of departure, water related governance frameworks were reviewed, that is, both National and International best practice are considered to develop an understanding of how the policy environment enables or act as a barrier to climate change adaptation in the water space. That climate is changing is no longer a debate since evidence of change is observable and encountered in various situations. Much of scientific evidence is based on field observations from long-term monitoring networks that show [2] that climate change is occurring. This is further endorsed by several researchers [10,11,12,13,14] who acknowledge the fact that climate change impacts will mostly be realized and felt through water. This is evidently demonstrated by the fact that water is a catalyst and essential for all developments and sustain livelihoods.

Water Governance and Policy

The South African water governance framework includes the Constitution of the Republic of South Africa [15], legislation; national, regional and global policy directives; governance structures in national, provincial and local spheres of government, as well as the country's regional

and international commitments in the water sector. The Department of Water and Sanitation is mandated to ensure that the country's water resources are protected, managed, used, developed, conserved and controlled through regulating and supporting the delivery of effective water supply and sanitation. To this end, the work of the Department is funded through the national budget (Vote 41). The purpose of the Vote is to ensure the availability of water resources, facilitate equitable and sustainable socio-economic development, and ensure universal access to water and sanitation services.

Legislation

In South Africa, the legislative framework that regulates access to and availability of water resources includes the Constitution; the National Water Act (NWA; Act No. 36 of 1998); and the Water Services Act (WSA; Act No. 108 of 1997). These pieces of legislation aim to enable Government, through the work of the Department of Water and Sanitation, to deliver on citizens' right to sufficient food and water, grow the economy and eradicate poverty.

- Constitution – Section 27(1)(b) guarantees for everyone the right to have access to sufficient food and water. It obliges Government to take reasonable legislative and other measures, within its available resources, to ensure the progressive realisation of this right.
- National Water Act – The purpose of the Act is to ensure that the country's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account factors such as promoting equitable access to water; meeting the basic human needs of present and future generations; and promoting the efficient, sustainable and beneficial use of water in the public interest.
- Water Services Act – Some of the main objectives of the Act are to provide for the right of access to basic water supply and the right to basic sanitation necessary to secure sufficient water and an environment not harmful to human health or well-being; the accountability of water services providers; and the promotion of effective water resource management and conservation.
- Climate Change Bill – The Bill is currently undergrounding the Parliamentary review process before it is sent to will be enacted into law. In its draft form is seeks to enable for the development of an effective climate change response and a long-term just transition to a low-carbon and climate-resilient economy and society for South Africa in the context of sustainable development, through provision of legislative mandates for different climate sensistive sectors, Departments and across the different spheres of government.

Policy

South Africa's approach to ensuring access to and availability of water resources is underpinned by the strategic imperatives relating to water and sanitation at national (National Development Plan 2030 and Medium-Term Strategic Framework 2019-2024); regional (African Union Agenda 2063: The Africa We Want); and global (2030 United Nations Agenda for Development (SDGs)) levels. The relevant provisions contained in these documents are summarised in Table 1 below.

Section 24 (b) of the Constitution of South Africa, stipulates that everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that among other, to secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development [15]. In order to give effect to the Constitutional prescripts in this regard, the State is obliged to act to achieve the intended result, and the legislative measures will invariably have to be supported by appropriate, well-directed policies and programs that are reasonable both in their conception and their implementation [5]. The Constitution also stipulates that everyone has the right to sufficient food and water, while the state must take legislative and other measures within its available means to ensure attainment of these rights.

The legislative and financing instruments and institutions should synergistically be put it into practice to achieve sustainable, equitable and climate-resilient water management the policy [16]. In this regard, strong policies backed by sound technical understanding and operational capacity would yield the best form of adaptation to climate change [17] to deal with the general development challenges in sectors. The South African Water Policy was developed prior to the Water Law. That is appropriately in line with good international practice since the policy development represents the first aspect of an enabling environment [16]. The South African National Water Policy (adopted in 1997) hinges on the three (3) fundamental objectives; namely: achieving equitable access to water, sustainable use of water as well as efficient and effective water use. These objectives underpin the National Water Act (Act No. 36 of 1998) for management of water resources in South Africa. The Policy and the Act together with the National Water Resource Strategy created an enabling environment for sustainable management and use of water, thus ensuring resilience building of the resource against various stress factors including climate change.

The second edition of the National Water Resource Strategy (NWRS 2) is among other outlined strategic actions that need to be taken to ensure climate change considerations in water management and planning. The actions primarily entail water governance, infrastructure development, operation, and maintenance as well as sustainable water management. These are important ingredients for creation of the enabling environment for transformation of the water sector into resilient and adaptive institutions.

The set of environmental policies and guidelines (Table 1) enables a low carbon transition within the context of the NDP, SDGs and Agenda 2063, with a focus on water

resources. The policy framework links together South Africa's international commitments, national policies, and legislation.

Table 1. A set of environmental policies and guidelines

National Development Plan 2030	Medium Term Strategic Framework 2019-2024	Agenda 2063 Goals	Sustainable Development Goals (SDGs)
Chapter 4 Economy infrastructure – The foundation of social and economic development: □ Access to water and sanitation □ Water resources and services **Chapter 5. Environmental sustainability:** An equitable transition to a low-carbon economy: • Sustaining South Africa's ecosystem and using natural resources efficiently • Building sustainable communities • Responding effectively to climate change: adaptation • Managing a just transition • Enhancing governance systems and capacity	**Priority 1:** Economic transformation and job creation **Priority 4:** Spatial integration, human settlements and local government	**Goal 7:** Environmentally sustainable and climate resilient economies and communities. **Priority Areas:** • Bio-diversity, conservation and sustainable natural resource management. • Water security • Climate resilience and natural disasters preparedness	**SDG 6:** Ensure availability and sustainable management of water and sanitation for all.

Various countries worldwide took various policy positions to ensure enhanced resilience to climate change. [14] Resilience is expected to transform the social-ecological systems to shift to a socially desirable and sustainable regime in the European Union [14], thus calling for societal shifts from greenhouse gas intensive economy to a low-carbon one. In a similar vein South Africa's National Development Plan 2030 [17] also called for a transition from carbon intensive technology dependency to low carbon economy. The National Development Plan (NDP) aims to ensure that climate change is effectively addressed and mainstreamed in every department, as an essential component of a broader national development strategy. The national aspiration is that by 2030 South Africa's transition to an environmentally sustainable, climate-change resilient, low-carbon economy and just society would be well under way. In this regard, the country's approach [17] will essentially be strengthening the economic and societal resilience to climate change that include decreasing poverty and inequality, creating employment, improving education and promoting skills development, improving health care and maintaining the integrity of ecosystems.

The National Climate Change Response Strategy for the Water Sector aims to guide and inform the mainstreaming of climate change considerations into water management and planning. The overall objective of the Strategy is to ensure effective management of climate change impacts as well as extreme events on the country's water and sanitation through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity. The recently developed Climate Change Bill, under consideration in Parliament, seeks to translate policies and associated response frameworks at local scale, and through sector specific approach to ensure that no vulnerable groups or sectors are missed in the strategy and implementation.

International and regional commitments

South Africa is party to a number of international agreements that provide for, among others, the protection and sustainable utilisation of freshwater resources. These include:

- Conventions – South Africa ratified the Convention on Biological Diversity (CBD) on 2 November 1995. The Convention promotes the conservation and sustainable use of biodiversity, especially through the protection of ecosystems, whilst respecting countries' sovereign rights over biological resources within their own territories.
- Furthermore, the United Nations Convention to

Combat Desertification (UNCCD) requires States to promote the restoration, conservation, and sustainable management of land and water, and to cooperate with each other for the protection of those resources. It also requires neighbouring countries to work together in developing action programmes, which may include the joint sustainable management of transboundary water resources. South Africa ratified the UNCCD on 30 September 1997.

- Paris Agreement 2015 – is an agreement within the United Nations Framework Convention on Climate Change (UNFCC) that addresses greenhouse-gas-emissions mitigation, adaptation, and finance. The agreement was negotiated at the UNFCC's 21st Conference of Parties talks in France on 12 December 2015, and South Africa ratified it in 2016. The agreement entered into force on 4 November 2016. The agreement is a legally binding instrument that guides the process for universal action on climate change. It strengthens the global response to the threat of climate change by bringing all nations into a common cause of acting collectively, within the context of sustainable development and efforts to eradicate poverty, to hold the increase in global average temperature to well below 2°C and pursuing efforts to limit global temperature increase to 1.5°C [18].
- Southern African Development Community (SADC) Protocol on Shared Watercourse Systems, 2000 – SADC initially passed its Protocol on Shared Watercourses on 28 August 1995, and thereafter revised it on 7 August 2000. The Protocol aims to foster closer cooperation among Member States for protection, management, and use of shared watercourses in the region. Member States agreed to cooperate on projects and exchange information on shared watercourses, consulting with each other and collaborating on initiatives that balance development of watercourses with conservation of the environment [19]. For example, the Lesotho Highland Water Project, which gets its water from the Senqu/Orange river, a shared river between Lesotho, South Africa and Namibia.
- African Ministers' Council on Water (AMCOW) – was formed in 2002 in Abuja Nigeria, primarily to promote cooperation, security, social and economic development and poverty eradication among member states through the effective management of the Continent's water resources and provision of water supply services. In 2008, at the 11th ordinary session of the AU Assembly in Sharm el-Sheikh, Heads of State and the AU agreed on commitments to accelerate the achievement of water and sanitation goals in Africa. They mandated AMCOW to develop and follow up with an implementation strategy for these commitments. AMCOW has also been accorded the status of a Specialised Committee for Water and Sanitation in the African Union.

National, sub-national and local government structures

In South Africa, the Department of Water and Sanitation is the custodian of water resources, with the primary responsibility for the formulation and implementation of policy governing the sector. The Department ensures that all South Africans gain access to clean water and dignified sanitation. It also promotes effective and efficient water resources management to ensure sustainable economic and social development. The National Government manages water resources through the 15 Water Boards. The three Largest Water Boards are Rand Water in Gauteng Province, Umgeni Water in Kwazulu Natal Province and Overberg Water in the Western Cape. They operate dams, bulk water supply infrastructure, some retail infrastructure and wastewater systems. Some also provide technical assistance to municipalities. Through their role in the operation of dams, they also play an important role in water resource management. The Water Boards report to the Department of Water and Sanitation. Municipalities are responsible for the delivery of water and sanitation services to communities and must develop plans for delivery. These plans take into account effective delivery of services to informal communities, as stipulated in the National Water Act of 1998 and related regulations that ensure that every citizen is entitled to receive a minimum of 25 litres of water per day within a 200-meter walking distance.

Water resource access and availability

Water access in South Africa should be considered within the context of the various factors that shaped it, most notably separate development under the system of Apartheid, which resulted in levels of water inequality. For example, Apartheid spatial planning and governance created a system that ensured certain groupings in communities and sectors enjoyed priority to the limited water resources. The spatial architecture of the Apartheid government policies, characterised by marginal agricultural land, uneven distribution of resources and access to water is still reflective and has influenced the industry, national parks, population groups and agricultural sectors [20] .

The pre-democratic water laws were directed towards allocating and regulating water use for commercial farming as key water user, in particular irrigation, while subsistence farming had no official rights, as the land was under communal laws [21]. The growing demands or competition for the limited water resources, even with reforms in water laws, makes it difficult for additional water users to be allocated in the current water system, thus making irrigation unattainable for subsistence farmers, thereby contributing to their inability to cope with climate-related risks. The post-Apartheid Government, in redressing past injustices through policy reforms and expanding services, failed to review the available water resources and implement the necessary water infrastructure for the growing water demands. Further, informal settlements and new water users (such as farmers, industry, amongst others) across the landscape are still excluded from water access.

South Africa has access to surface water (77% of total use), groundwater (9% of total use), and recycled water (14% of total use). However, the population's dependence on water is not evenly distributed. Due to a lack of water infrastructure in rural settlements, 74% of all rural people are entirely dependent upon groundwater (i.e. local wells and pumps [22]). In South Africa the scarce fresh water is decreasing in quality because of an increase in pollution and the destruction of river catchments, caused by urbanisation, deforestation, damming of rivers, destruction of wetlands, industry, mining, agriculture, energy use, and accidental water pollution. As the human population increases, there is an increase in pollution and catchment destruction. South Africa needs to reduce water demand and increase supply for a growing population and economy to ensure water security by 2030. This is envisaged through the National Water and Sanitation Master Plan, which details the requirements for appropriate investment in water resources and services and sets targets for adequate water conservation and demand management.

Climate change and water

Projected change in precipitation

South Africa's climate is highly variable under natural conditions with relatively low rainfall (of about 500 mm per annum on average) and high temperature with resultant high evaporation rate. This high degree of spatial variation in rainfall across southern Africa is attributed to the influence of the ocean currents and prevailing winds [23]. The rainfall is also projected to decrease [1] in the Mediterranean, the Western parts of West Africa, and Southern Africa, regions which are already prone to droughts. Additionally, in recent studies [23] for South Africa decreases in rainfall and the number of rainfall days over parts of the country have been detected. Also, evidence from other studies indicates that inter-annual rainfall variability over southern Africa has increased since the late 1960s and that droughts have become more intense and widespread in the region. These climatic changes are most likely to impact negatively on water availability in South Africa, particularly as a developing state with water related challenges already. On one hand, nature remain unsympathetic with only 9% of rainfall feeding rivers as runoff while only 4% recharges groundwater storage, while on the other unsustainable use of water country wide remains a high risk.

Projected change in temperature

Southern Africa has a warm climate, with the greater part of the region experiencing an average annual temperature above 17°C, and studies are also indicative of drastic increases in surface temperature [23], in the order of twice the global rate of temperature increase. The downscaled climate change projections projected the increase in annual-average surface temperature to range between 4 and 6 °C in the African and between 3 and 5 °C in the African tropics [24]. This future further increase in temperature is likely to exacerbate the water scarcity in the country.

Water sector implications

South Africa is indeed a water is a scarce country under natural conditions, due to among other, low rainfall and high temperature. The situation is exacerbated by unsustainable use of the limited resource, the escalating demand due to economic and population growth, urbanisation and rising standards of living, unsustainable use and high levels of wastage and loss, and increasing pollution which renders water not fit for use [6]. Additionally, the degradation of wetlands, climate change driven variation in rainfall patterns and increasing temperatures are also contributing to reduced security of supply. Undoubtedly, the non-climatic stress factors overshadow the climate change impacts. In other words, climate change is most likely to aggravate the already dire water situation.

The water sector in response need to develop additional water sources to make up for the shortfall in supply. However, it is quite clear that although surface water is South Africa's major source contributing about 77% of the total water use, this water resource mix type is oversubscribed, and development potential thereof is somewhat limited albeit it is still an economically viable option as well. On the other hand, other alternative yet relatively unconventional sources such as groundwater, return flows and desalinated water have great potential subject to appropriate assessment. Hence, the National Water and Sanitation Master Plan requires the diversification of the water resource mix [6] wherein surface water contribution will progressively reduce to 63% by 2040 while other alternative sources increase. For instance, groundwater contribution to water resource mix is planned to increase from the current 9% to 12% by 2040. Water conservation programs that seek to improve water use efficiency through education and awareness campaigns also need to be strengthened to reduce the need for water restrictions during drought, to delay the need for developing new water supplies that are relatively more costly. The nonrevenue water, particularly for domestic use in Local sphere of Government also need to be reduced. It is also crucial to manage demands for water among users, by various innovative approaches.

The strategic plan of the Department proposed adapting to climate change imperatives as well as taking advantage of the technological advances in line with the 4th industrial revolution [7]. In fact, to ensure water security the strategic plan calls for regular balancing of water requirements and supply, to inform reduction in water demand, and augmentation of supply for a growing population and support the economy. The Planning division of the Department currently undertakes reconciliation studies that entail water balances taking climate change into account.

Policy recommendation and adaptive strategies

To address these challenges the systems and tools as well as appropriate adaptation measures are necessary and essential. In other words, it is worthwhile to enhance

capacity of implementing institutions and to ensure availability of requisite tools to those responsible for implementation. The poorer countries are not able to manage their current climate variability, due to lack of the means of implementation rather than lack of clarity regarding requisite strategies [25]. Indeed, making adaptation strategies available to vulnerable communities without necessary funding or even prior training on how tools can be used is a futile exercise. A case study in South Africa revealed that a shortage of capacity to deal with climate change and related policies within the Government stems from limited human and financial resources, and a shortage of relevant expertise and skills [26]. The other findings in the study were that growing complexity of work involved in designing and implementing sectoral and multisector decarbonisation and resilience policies made matters worse.

Hydrological and climate monitoring data and information underpin all analysis, modelling, projections, and decision-making processes in water management and planning. For instance, [2] emphasised that data from long-term monitoring networks is required to detect hydrologic changes for establishing baseline conditions and then record any changes over time. Additionally, good water management hinges on long-term hydrological and meteorological monitoring networks that provide sound, accurate, timely, and consistent data that can be used readily to develop and assess decision making tools needed to quantify uncertainty, forecast change, and create the multiphase, multilevel climate scenarios that will provide reasonable and relevant management [2]. This demonstrates the importance of monitoring data and information in the adaptation process. In South Africa, however, the typical scenario encountered is invariably patchy data observation coverage in time and space. To address this challenge, the National Water and Sanitation Master Plan requires that hydrological monitoring network should be improved to ensure that the climate change impacts are evaluated and considered in the analysis of water resources [6]. This directive has since been taken up; and plans are afoot to initiate the process of enhancing the national water monitoring network.

South Africa has developed through coordinate efforts the National Climate Change Adaptation Strategy (NCCAS). NCCAS provides as a strategic policy, a common vision of climate change adaptation and climate resilience for the country, drawing from the National Development Plan, the National Strategy for Sustainable Development, the adaptation commitments included in its Nationally Determined Contributions, sector adaptation plans, provincial adaptation plans and municipality adaptation plans. It acts as a common reference point for climate change adaptation efforts in South Africa in the short to medium term, providing guidance for all levels of government, sectors and stakeholders affected by climate variability and change. It provides a policy instrument which articulates South Africa's national climate change adaptation objectives to provide overarching guidance to all sectors of the economy and facilitates the degree to which development initiatives at different levels of government and business integrate and reflect critical climate change adaptation priorities, and thus inform resource allocation by the various stakeholders towards climate change resilience. It also guides a strong, coherent and coordinated approach to climate change adaptation activities between different institutions and levels of government while supporting South Africa's efforts in meeting its international obligations by defining the country's vulnerabilities, and its plans to reduce these vulnerabilities and leverage opportunities. NCCAS further recognises that adaptation to climate change presents South Africa with an opportunity to transform the health and the economy, in order to strengthen the social and spatial fabric, and to become more competitive in the global marketplace. This would however require systematic changes that would require important considerations of social and economic changes together with technological adjustments amongst others in order to make the significant change that would improve the resilience and minimize risks. The National Climate Change Adaptation Strategy (NCCAS) therefore provides a common vision of climate change adaptation and climate resilience for the country, and outlines priority areas for achieving this [27].

Impediments and barriers in the water sector

The South African Water Sector faces compounding challenges, wherein water availability is often not spatially well distributed to meet the growing demand and needs, or of the quality not conducive for use, due to unpredictable rainfall, limited infrastructure, the misuse of financial resources, and poor management – aggravated by corruption. The corruption watch report [28] gives examples of the corruption in South Africa's sector, its consequences, and a way forward, while the State Capture Report [29] provides more details on the systemic mechanisms behind corruption in the water sector. This led to the failure in the systems to provide basic services, as contracts for planned projects were not completed – owing to poor workmanship, budgetary constraints as money had been channelled out of the system and deployment of unskilled individuals, amongst others.

The impact of corruption in the water sector can be measured by the number of failed water projects, growing water supply and sanitation issues related to poorly maintained and inefficient infrastructure to support the growing population – crosscutting throughout the three spheres of government. It can also be attributed to failure to enforce laws meant to protect water sources from encroachment and pollution, resulting in discriminatory outcomes in water flows and irrigation patterns, leading to poor quality water and impacting the infrastructure that affects access to water. Moreover, the programme of water

allocation and management reforms had been carried out since 1994 with institutional changes in the policy, legal and organizational dimensions. This was at some stage hailed as one of the world's best. However, these reforms are still not realised owing to institutionalized misappropriation of funds and inequitable water distribution as some of the barriers. All these impediments coupled with a low adaptive capacity, make climate change a significant threat to the water sector. However, current policy interventions, leadership, reprioritization of infrastructure development and addressing immediate past failures promises a revival of the sector and actions towards resilience despite a rise in extreme events.

Conclusions

Water is one of the pathways through which climate change and its associated risks (such as floods, drought, erratic rainfall, and others) will affect people, ecosystems and socio-economic activities. Climate change, within the South African context, with ongoing challenges around water availability and access to all users, adds more complexities for water resource management. This has been shown in the recent IPCC report, which points to projected intensification in the water cycle. This in addition to the already unequal access to and distribution of water resources across South Africa, thus translating into peoples' livelihoods being under threat. This particularly affects the poorest and most vulnerable of societies who rely on rain-fed agriculture and who live in areas that have limited resources for adaptive activities.

Over the years water managers and planners have been contending with climate variability and its impact on water resources and supply. For South Africa, a water scare country with highly variable climate under natural conditions climate change is likely to exacerbate an already vulnerable system that needs enhanced adaptive capacity and access to the means of adaptation. To address challenges, the Department developed tools such as the National Water and Sanitation Master Plan to guide and inform appropriate response and to ensure water security and safe sanitation for the country. The fact that everyone has the right to sufficient food and water, while the state must take legislative and other measures within its available means to ensure attainment of these rights is South Africa's Constitutional mandate makes the policy environment conducive to increasing the resilience and improving the adaptive capacity.

In addition, the South African national water policy hinges on the three (3) fundamental objectives; namely: achieving equitable access to water, sustainable use of water as well as efficient and effective water use. Yet, due to among other lack of requisite resources, the State does not always have the means adequate and fit for use to make water available and accessible to everyone who needs it. The other tool is the National Climate Change Response Strategy for the Water Sector that aims to guide and inform the mainstreaming of climate change considerations into water management and planning. In terms of climate, the rainfall is projected to decrease in the Southern Africa, region while temperature is predicted to increase thus exacerbating the water situation in the country. These tools are currently being implemented to address water, climate and sanitation related challenges. A potential game changer in the policy landscape is the introduction of the Climate Change Bill, which seeks to coordinate and harmonize climate change efforts across all organs of state, through their various policies, plans, programmes, decisions and decision-making processes. This Bill has potential to guide South African effort towards sustainable development pathways through systems approach and reducing conflicting interventions and thus maladaptation.

South Africa seems to have among the world's best policy and governance frameworks which align well with international governance frameworks and treaties. However, challenges persist in efforts to address water related challenges. The recent Zondo commission reports point to decay in state governance and control systems of which were attributed to lack of political will and institutionalisation of corruption. These two issues need to be addressed to ensure that South Africa is prepared and has the necessary tools and measures to address the growing water demands, owing to climate crises and growing population (development). Attempts to correct this structural and system failures in the current situation shows a promising future.

References

- Intergovernmental Panel on Climate Change. (2021). Climate change African Perspective 6th IPCC Special Report on Africa
- Brekke, L.D., Kiang, J.E., Olsen, J.R., Pulwarty, R.S., Raff, D.A., Turnipseed, D.P., Webb, R.S., and White, K.D., (2009) Climate change and water resources management—A federal perspective: U.S. Geological Survey Circular 1331, 65 p.
- Pittock, J. (2011). National climate change policies and sustainable water management: conflicts and synergies. *Ecology and Society* **16**(2): 25. [online] URL: http://www.ecologyandsociety.org/vol16/iss2/ art25/
- Department of Environmental Affairs, DEA (2011). South Africa's Second National Communication under the United Nations Framework Convention on Climate Change. Pretoria, South Africa: Department of Environmental Affairs, Republic of South Africa (RSA).
- Van der Bank, M. and Karsten, J. (2020). Climate Change and South Africa: A Critical Analysis of the Earth-life Africa Johannesburg and Another v Minister of Energy and Others 65662/16 (2017) Case and the Drive for Concrete Climate Practices. Air, Soil and Water Research Volume 13: 1–11
- Department of Water and Sanitation (2018). National Water and Sanitation Matter Plan, Volume 2 – Plan to Action Version 4.2
- Department of Water and Sanitation (2021). Revised

Strategic Plan (2020/21 – 2024/25)
- Department of Water Affairs (2013). National Water Resource Strategy 2nd Edition. South Africa
- Department of Water and Sanitation (2017). Water and Sanitation sector policy on climate change
- Water and climate coalition (2010). Placing water resources management at the heart of global policy responses to climate change. Water and Climate Roadmap: Securing a Work Programme on Water and Climate Change under the UNFCCC.
- Calow, R.; Bonsor, H.; Jones, L.; O'Meally, S.; MacDonald, A. and Kaur, N. (2011) Climate change, water resources and WASH: A scoping study. Working Paper 337. ODI; British Geological Survey. ISBN 978 1 907288 50 0. 59p
- Asia-Pacific Water Forum (2012) Framework Document on Water and Climate Change Adaptation. For Leaders and Policymakers in the Asia-Pacific Region. tkoike@hydra.t.u-tokyo.ac.jp
- Stuart-Hill, S.I. (2015). Mainstreaming adaptation to climate change into decision making in the water sector: Concepts and case studies from South Africa. Unpublished PhD thesis in the School of Agricultural, Earth and Environmental Sciences, Discipline of Hydrology; University of KwaZulu-Natal Pietermaritzburg. 235p
- Puharinen, S.-T. (2021). Good Status in the Changing Climate? —Climate Proofing Law on Water Management in the EU. Sustainability 13, 517. https://doi.org/10.3390/su13020517
- Constitution of the Republic of South Africa, No 108 of 1996
- Capnet (2020) Climate change adaptation and Integrated Water Resource Management www.cap-net.org
- National Planning Commission of RSA (2011) National Development Plan 2030 Our Future – Make it Work ISBN: 978-0-621-41180-5
- United Nations Framework Convention on Climate Change, UNFCC. (2022).The Paris Agreement. Available from: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement [internet]
- Southern African Development Community, SADC. (2000). Revised Protocol on Shared Watercourses Southern African Development Community. Available from: Revised_Protocol_on_Shared_Watercourses_-_2000_-_English.pdf (sadc.int) [Internet]
- Lévite, H. Sally, H., van Koppen, B. and Cour, J. 2003. Olifants River Basin, South Africa. IWMI Africa Regional Program, [Internet]. South Africa, Available from http://portal.unesco.org/.
- Turton, A. and Henwood, R. 2002. Hydropolitics in the Developing World: A Southern African Perspective. African Water Issues Research. Pretoria, RSA. Unit. ISBN: 0-0620-29519-8.
- United Nations Water (2006). Water a Shared Responsibility. Retrieved from http://unesdoc.unesco.org/images/0014/001454/145405e.pdf#page=519
- Davis-Reddy, C.L. and Vincent, K. (2017): Climate Risk and Vulnerability: A Handbook for Southern Africa (2nd Ed), CSIR, Pretoria, South Africa.
- Francois Engelbrecht, F., Adegoke, J. Bopape, M-J., Naidoo, M., Garland, R., Thatcher, M., McGregor, J., Katzfey, J., Werner, M., Ichoku, C. and Gatebe, C. (2015). Projections of rapidly rising surface temperatures over Africa under low mitigation. Environmental Research Letters
- Muller, M. (2007) Adapting to climate change: Water management for urban resilience. Environment & Urbanization Copyright © 2007 International Institute for Environment and Development (IIED). Vol 19(1): 99–113. DOI: 10.1177/0956247807076726 www.sagepublications.com
- Averchenkova A, Gannon KE, Patrick C (2019) ***Governance of climate change policy: A case study of South Africa***. London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science
- Department of Forestry, Fisheries and the Environment (2020) National Climate Change Adaptation Strategy: Republic of South Africa. Department of Forestry, Fisheries and the Environment, Pretoria.
- Erasmus, J. (2020). Money down the Drain: corruption in South Africa's water sector. Available from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.corruptionwatch.org.za/wp-content/uploads/2020/03/water-report_2020-single-pages-Final.pdf. [Internet]
- Zondo, R.M.M Justice. 2022. Judicial Commission of Inquiry into allegations of State Capture, Corruption and Fraud in the Public Sector including Organs of State.