NATIONAL WATER SECURITY FRAMEWORK FOR SOUTH AFRICA

Summary, Principles and Recommendations

July 2020 | 1st Edition

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2030 NDP

NATIONAL WATER SECURITY FRAMEWORK

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This report was first released in June 2019 by the National Planning Commission (NPC) in its draft form intended for discussions and consultations. It forms part of the implementation framework for the National Development Plan: Vision 2030 (NDP) who's overall strategic objectives is to eradicate poverty, reduce inequality and address unemployment.

The report responds to the cabinet decision during the fifth administration to address the national water challenges and subsequent request to the NPC to assess the water security situation in the country.

The National Water Security (NWSF) of South Africa forms part of the on-going work of the NPC in its task to consult and advise on the implementation of the NDP. It is a result of extensive consultation process across the country aimed at guiding the implementation of the NDP in as far as the national water security is concerned.

Please send enquiries and feedback to NWSF-Summary@dpme.gov.za | Date June 2020

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FOREWORD

The National Planning Commission (NPC) releases this report on framing water security for South Africa at a time when the country, like the rest of the world, is grappling with the ravages of the COVID 19 pandemic where the challenges of poverty, inequality and unemployment have become more pronounced than ever before. Being the first of its kind, the framework will remain a reminder that when all is not well, we must all do something about it. This year marks the tenth anniversary of the United Nation's (UN) declaration of access to water as a human right. By that time as South Africa we had already raised our hand by ensuring that that right is enshrined in the constitution in the Bill of Rights and the legislation to implement the policy move from 'water rights' to 'water use rights'.

We entered the democratic era in 1994, armed with policies like the Reconstruction and Development Programme (RDP), raring to tackle the ills of Apartheid ideology and past colonial constructs. The country went through various cycles of challenges and came up with various intervention strategies along the way. Today we are speaking of the National Development Plan (NDP) which is meant to help us bring down the inequality levels, eradicate poverty and decrease unemployment through among others inclusive economic growth and development. Yet South Africa remains among the most unequal societies in the world. From the early days of the Late Professor Kader Asmal, the first minister of the then Water and Forestry, who led the process of developing one of the most recognisable pieces of legislation globally, to the different Ministers to date, a lot has indeed been achieved. However, we must be realistic that more than 25 years later a lot could have been done and that we must as a country continue to soldier on.

With this National Water Security Framework (NWSF) on the table we must rededicate ourselves to the commitment, drive and resilience that as South Africans we are known for – never to give up. We must test ourselves to the limit and commit to ensuring that whatever opportunities we may have lost along the way, COVID 19 or not, we are committed to achieve in the next few years what we had intended to achieve by 2030 and perhaps even more. If there is anything different that this framework brings, let it be that the paradigm shift that is required for radical course-correction starts now, and all hands will be on the deck, henceforth. Water has to be enabler and not a limiting factor to our socio-economic development. We must build on the progress so far.

PREFACE TO THE FIRST EDITION

Water security as a concept has become pervasive in scholastic and public and private spaces alike. Many experts have mushroomed over the recent past coming with new ideas on how to deal with this 'monster' characterized by deprivation and lack of this or the other opportunity. At the end of the term of the second National Planning Commission (NPC), it is timely that the National Water Security Framework (NWSF) for South Africa is released as part of a series of interventions so badly needed to ensure the achievement of the goals of the NDP. It is hoped that being the first of its kind, it will provide the launching pad to '*upping the ante*' so-to-speak, by taking the water project for South Africa beyond the 'access' mantra to enabling the hydro-social and economic development levels with an acknowledgement that as expected in the NDP vision 3030, that '… *each and every one of us is intimately and inextricably of this earth with its beauty and life-giving sources; that our lives on earth are both enriched and complicated by what we have contributed to its condition*.' Water is seen within the lens of its various dimensions in life systems.

This first edition has been developed with a clear mind of a process in its formative stages towards a cyclic and living framework to be reviewed from time to time whenever, new information and insights become available. South Africa's commitment to progressive realisation of the ultimate goal of complete emancipation from the shackles of the past to a prosperous future remains a significant part of who we are as a nation founded on the Bill of Rights and a Constitutional democracy.

Mistakes and missteps will always be made, however, this framework is there to ensure that we catch up and ensure that the commitment we made to be in a better state by 2030 still occurs, at least to an extent that water security becomes part of enabling us to get there. We are aware and must accept that planning for water security is a long term project, hence, the vision and interventions that take us through to 2050 and beyond.

The principles and focus areas are there to get us to focus at all times and not get derailed due to illicit activities and other manifestations.

EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND

Water security has been an issue of concern in South Africa for quite some time, however, it has recently been increasingly under very serious threat. The National Water Security Framework (NWSF) responds to the question of the extent of the threat and the actions required in the short, medium and long term to mitigate or offset the threat. It frames a national pathway to a water secure country up to 2050 to enable inclusive economic growth, poverty eradication and reducing inequality, in line with the National Development Plan (NDP) imperatives.

Water security circumscribes the entire water sector, and has far-reaching implications for the entire economy of the country. It can be a significant hurdle for the ongoing sustainable growth and development of all sectors of our economy. The NWSF acknowledges the importance of water security for our country and addresses issues at national, regional and local levels. It touches on many facets, including

- identifying future water sources for the growing population, economic development and the attendant future water resources development and waste-water management (including sanitation) options;
- the development, operation and maintenance of water and sanitation infrastructure;
- the management of water quality and water supply services, as well as the resilience of our country to climate change and its associated impacts; and
- water conservation and water demand management as a consistent national paradigm.

The current circumstances and policy directives such as the NDP impel the NWSF. It is underpinned by international agreements and commitments to which South Africa is a signatory, such as the United Nations Sustainable Development Goals (SDGs), the African Union's Agenda 2063 for the socio-economic transformation of the continent and the Southern African Development Community (SADC) Regional Strategic Action Plan. The NWSF guides, complements and dovetails with existing national policies and strategies. It enhances the water security component of the National Water Resources Strategy II (NWRS2), South Africa's blueprint for the management of its water resources, as well as the National Water and Sanitation Master Plan (NWSMP) of the Department of Water and Sanitation (DWS), which is the positioned as an implementation plan for the NWRS2 and NWSF.

South Africa has a long history of engaging on issues of water security, albeit from the perspective of managing scarcity and availability. Intervention examples include the

previous 1956 Water Act (Act 54 of 1956), the 1966 drought and industrial expansion of the country that resulted in the Commission of Enquiry into Water Matters that presented its findings and recommendations in 1970. Key recommendations from the enquiry included the creation of the Water Research Commission (WRC) and related internal Department of Water and Sanitation, some of which are still in operation. Like South Africa's other socio-economic sectors at the time, the context was in accordance with Apartheid institutional and political arrangements and earlier colonial constructs that excluded the majority of the population in the country. This also included the Irrigation and Conservation of Waters Act, No. 8 of 1912, the Natives Land Act of 1913 and related policy and legislation, all prior to the 1994 democratic dispensation, which formed the basis of the water sector inequality in the country. However, these measures ensured the security of water supplies to the minority beneficiary population at the time and were the key drivers of the economy - then mainly agriculture, mining and industrial development with the primary focus on water supplies through the development of water resources infrastructure (dams, canals and irrigation schemes).

Post 1994, the water sector in South Africa has made progress to substantially advance water supply extension in rural areas and previously under serviced areas of the country. Statistics South Africa (Stats SA), in its 2017 general household survey, reported that an estimated 46.7% of households had access to piped water in their dwellings. A further 27.5% accessed water on site while 12.2% relied on communal taps and 2.1% relied on neighbours' taps. This confirmed that the number and percentage of households with access to piped water had increased since 2006, showing that 13.5 million households had access to piped water in 2017 compared to 9.3 million in 2006.[1]

Among world firsts has been the country's recognition and legislation of water resources management within the entire hydrological cycle, the provision of ecological (environmental) water needs and its (social) free basic water policy. South Africa is a pioneer in environmental flow determinations, with highly regarded methodologies developed for this purpose and its work on the quantification and implementation of environmental flow requirements[2] in some of the country's river basins. There is a strong social component in the methodology that describes the implications of

[1] Stats SA GHS 2017

[2] An environmental flow is the water regime provided within a river or wetland to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated. Environmental flows provide critical contributions to river health, economic development and poverty alleviation. They ensure the continued availability of the many benefits that healthy river and groundwater systems bring to society.

It is increasingly clear that, in the mid- and long-term, failure to meet environmental flow requirements has disastrous consequences for many river users. Addressing the water needs of aquatic ecosystems will often mean reducing the water use of one or more sectors. These are tough choices, but they have to be made to ensure the long-term health of the basin and the activities it encompasses. Source: IUCN

management interventions, not only on ecosystems, but also on common-property subsistence users. In the Limpopo River Basin (shared by Botswana, Zimbabwe, South Africa and Mozambique), interest in environmental flows has been prompted by the South African water law, which requires the prioritisation of water allocation to meet the basic needs of people and of ecosystems (the concept of the 'Reserve'[3], which is the only right to water in the legislation).

Since the 1998 when the National Water Act (No.36 of 1998) (NWA) was promulgated, the water sector has faced several implementation challenges which included, among others:

- the establishment of Catchment Management Agencies (CMAs) and Water User Associations (WUA) that are responsible for managing water resources at catchment and local levels;
- race and gender equity redress of water allocations through the Water Allocation Reform (WAR) programme; and,
- programmatic implementation of water conservation and demand management initiatives nationally,

yet to be fully completed.

Recently, challenges to water supply in the Western Cape, Eastern Cape and KwaZulu-Natal raise concerns about the robustness of water planning, management and implementation strategies. The NDP reflected on the incomplete actions required to achieve the 2030 goals and included the following:

- A review of the NWRS2 as the sector master-plan;
- Finalising the implementation plan for institutional establishment and rationalisation for water resource management, with full implementation as per policy and legislative provisions. The institutional arrangements include:
  - A national water-resource infrastructure agency to develop and manage macro infrastructure systems (national and regional);
  - CMAs and WUAs to undertake resource management on a decentralised basis, with the involvement of local stakeholders;
  - A national facility for research, development, innovation and testing, with a focus on water reuse and desalination.

[3] The NWA defines the 'reserve' as the quantity and quality of water required to satisfy basic human needs and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

  - Creation of regional water and wastewater utilities, including the consolidation and expanding existing water boards mandates;

- Initiating a comprehensive financing and investment programme for water resource development, bulk water provision and waste water management; and,
- Poor progress with Water Allocation Reform to address equity in water allocations and enhance water resources management.

The water sector has not significantly transformed[4] as was envisaged when the policies and legislation were developed in the mid to late 1990s. Challenges remain with the poor implementation of policy for a number of reasons including an erosion of sector capacity, competence and leadership and a lack of collaboration and effective coordination among jointly responsible and implementing entities. This is exacerbated by the depletion of competence and capacity in the line-function Department, which has had an adverse effect on its ability to provide effective sector leadership. The reactive approach to change or amend policy it has not implemented has further compounded systemic problems.

Despite having been at the forefront of several water sector initiatives in the region, South Africa has struggled to implement some of the policies it advocates. The root causes of many of its implementation problems are known; however, its repeated inability to timeously address these has resulted in an aggregation of the problems to the extent that they have progressively and cumulatively become systemic. There now has to be a deliberate and concerted effort to address the challenges described above to ensure water security for South Africa's current and future socio-economic development needs. The NWSF must focus on national priorities underpinned by a thriving economy. It must also incorporate the SDGs and international obligations, including the Africa development agenda and SADC water and development protocols. The building blocks must emanate from local, regional, provincial, national and various economic sector development plans and strategies, the integration of which will provide high-level direction and performance and require accountability from all role-players for its implementation. The NWSF implementation sequence is simplified to allow progress tracking and identification of areas needing intervention. Accordingly, its institutional framing allows seamless planning, management and monitoring at national level.

WHAT IS WATER SECURITY, AND WHY THE FRAMEWORK?

Water security, as a concept, has evolved in recent years and the various nuances of its definition often make water security analyses difficult. It is therefore critical to focus

[4] Transformation defined as fundamental deconstruction and reconfiguration of the entire system of water management and provision of services as envisaged in the national policy and legislation.

on elements that are important for South Africa's positioning in respect of the notion of water security.

UN Water defines water security[5] as

> '*the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability*'.

Several other definitions have been put forward and all are characterised by common strands that include a focus on:

- Access to a reliable source of potable water for basic human needs or domestic use that ensures resilient communities. In South Africa this is enshrined in the Bill of Rights of the Constitution and forms part of the definition of the Reserve[6] in South Africa's NWA;
- Provision of adequate water supplies for productive activities and livelihoods;
- Environmental sustainability, preservation of ecosystems to deliver their services upon which nature and people rely, including the provision of freshwater. This also forms part of the Reserve and is a Constitutional human right; and
- The risks associated with the presence or absence and reliability of water supply.

The above resonates with the ultimate vision espoused by the NDP of rising living standards, falling poverty and inequality as well as restoring the dignity of the people of South Africa. It is recognised that this will be achieved if water is accorded its rightful place of being central to all aspects of life. In this context recognition is given to the argument that *water security should be less about obtaining water, and more about fostering human capabilities as they relate to water beyond simply a state of adequate water – to be achieved, but rather a relationship that describes how individuals, households, and communities navigate and transform hydro-social relations to access the water that they need and in ways that support the sustained development of human capabilities and wellbeing in their full breadth and scope*[7]

Since the dawn of democracy, water is governed by a legislative framework that is complex and dynamic, aimed at managing water with significant participation by the

[5] https://www.unwater.org/publications/water-security-infographic/

[6] National Water Act, 1998 (Act 36 of 1998) (NWA), Government of South Africa

[7] Jepson, W., Budds, J., Eichelberger, L., Harris, L., Norman, E., O'Reilly, K., Pearson, A., Shah, S., Shinn, J., Staddon, C. and Stoler, J., 2017. Advancing human capabilities for water security: A relational approach. *Water Security*, *1*.

people[8]. It promotes a coordinated approach to the management of water, land and related resources in order to maximize the resulting economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

The basis of the NWSF is the constitutional imperative relating to water, which gives every person a fundamental right to an environment that is not harmful to his or her well-being, and requires the environment to be protected for the benefit of the present and future generations – here in lies the sustainability argument. The water policy, legislation and other measures provide protection of the environment while promoting justifiable economic and social development. Water management, as a discipline, has grown in complexity with the recognition of its interconnected and diversified nature to meet the challenges of climate variability, climate change, population growth and socio-economic development needs. Practitioners, managers and decision-makers across the entire water sector spectrum need to ensure that operating rules for water systems satisfy multiple objectives, such as maximising water security, flow reliability and meeting environmental flow requirements; and minimising operational cost, flood risk and energy use.

Framing of water security has become more comprehensive, expanding from an initial focus on quantity and availability of water for human uses to include water quality, human health and ecological concerns[9]. A broad and integrative conceptualisation of water security has emerged as a major framing template[10]; and the utility of the approach in water governance, while recognising constraints that arise in the context of implementation and management, has become critical in the planning for water management and the provision of services. The focus is on livelihoods (beyond basic or subsistence) and, as articulated/implied elsewhere, the key issue is socio-economic development. An argument around "water for growth and development" or simply how water can contribute to economic growth is now even more essential.

The evolution of water security has seen the refinement of earlier conceptual framing as evident from the report of the Global Water Partnership (GWP) and the Organisation for Economic Co-operation and Development (OECD) Task Force on Water Security and Sustainable Growth[11]. The framing has evolved over time and takes into account key

[8] Thompson, H. 2006. Water Law – A practical Approach to Resource Management and the Provision of Services. Juta and Co. Ltd.

[9] Cook, C and Bakker, K. (2012). Water security: Debating an emerging paradigm. Global Environmental Change 22 (2012) 94–102.

[10] Gerlak, A. K., House-Peters, L,Varady, R. G., Albrecht, T., Zúñiga-Terán, A., Routson de Grenade, R., Cook, C., Scott, C.A. (2018). Water security: A review of place-based research. *Environmental Science and Policy 82 (2018) 79–89.*

[11] Sadoff, C.W., Hall, J.W., Grey, D., Aerts, J.C.J.H., Ait-Kadi, M., Brown, C., Cox, A., Dadson, S., Garrick, D., Kelman, J., McCornick, P., Ringler, C., Rosegrant, M., Whittington, D. and Wiberg, D. (2015) Securing

issues of risks associated with water insecurity and links to socio-economic development (growth, wealth and wellbeing). Risks would include climate and poor water governance – leading to scarcity, which in turn has an impact on national security. Scarcity or supply and demand are no longer the main drivers of water security for sustainable development, but rather a complex set of elements such as human/community security (vulnerability), national security, water resources, ecological security, social (health, spiritual and religious) usage security, food security, energy security and climate security[12].

The recently developed National Water and Sanitation Master Plan (NWSM)[13] is recognised as intended to guide the water sector with investment planning for the development of water resources and the delivery of water and sanitation services until 2030, and beyond. Its core purpose is to provide an overall perspective of the scope of the water and sanitation business to provide a comprehensive schedule of actions needed to address present challenges, to estimate the investments required to ensure effective water resources and water and sanitation services delivery, as well as to facilitate effective integrated investment planning, implementation of actions and evaluation of achievements. It is not expected to replace the existing legislative framework but to enhance implementation thereof.

WHY ARE WE HERE?

The NPC's assessment confirms the analyses by the World Bank, Asian Development Bank, United Nations and the World Economic Forum (WEF) which rates water security as one of the risks and strategic challenges confronting humanity. This is primarily due to a serious and worsening supply/demand imbalance and declining reliability of water supply caused by rapid population growth and industrialisation, over-extraction of water, widespread pollution and climate change. Water security provides greater consideration of human values, ethics, power and complement the concept of integrated water resources management (IWRM)[14] which in South Africa is done at catchment level. From a water security perspective, water resources should not be treated in isolation, as if independent of the food, climate or energy security of

Water, Sustaining Growth: Report of the GWP/OECD Task Force on Water Security and Sustainable Growth, University of Oxford, UK, 180pp

[12] Halmatov et al. 2017. Water security for productive economies: Applying an assessment framework in southern Africa. Physics and Chemistry of the Earth 100. 258-269.

[13] DWS, 2019

[14] A.K. Gerlak, F. Mukhtarov, 'Ways of Knowing' water: integrated water resources management and water security as complementary discourses, Int. Environ. Agreements: Politics Law Economics 15 (3) (2015) 257–272.

individuals, communities and the country. Currently South Africa is battling to ensure that these approaches are fully implemented.

South Africa is water insecure due to an acknowledged backlog in water infrastructure, insufficient maintenance and investment, inequities in access to water, and deteriorating water quality as well as climate change. Assessments have shown that, despite South Africa's successes and world-renowned water policy and legislation, transformation and implementation have remained a serious challenge and the framework brings a fresh and objective look at gaps and provides an opportunity for continuous evaluation and interventions.

The framework focuses on flow dynamics – in terms of finance, knowledge and other drivers of planning such as population. For example, instead of overemphasising population growth, the focus is on population dynamics; whilst on financing, absolute figures are de-emphasised and the focus is on financial flows and impact. Similarly, environmental flow requirements are inclusive of water conservation needs. The NWSF intention is to direct an integrated holistic approach towards water security. It seeks to guide, complement and incorporate other national, strategic water sector strategies and plans such as the NWRS, the NWSMP, Integrated Development Plans (IDPs), the Water Services Development Plans (WSDPs) as well as National Spatial Development Framework (NSDF) among others. It sets out a framework for national, regional and local water security and reflects South Africa's focus on water for basic human needs, while acknowledging the importance of other water uses. It provides a set of concepts, approaches and commitments that the country can use to safeguard the water supplies of poor and marginalised communities as part of an integrated approach to improving water, sanitation and hygiene.

The framework is the first of its kind in South Africa in being key to addressing the country's water security challenges in a holistic and decisive manner. With the framework being at the highest level, it must guide the execution of roles and responsibilities and ensure accountability as expected from all mandated institutions towards achieving the goals of the NDP. It will, among others:

- Guide all water-related policies across the governance system in terms of short-medium- and long-term planning and support;
- Strengthen implementation and ensure that it is managed at a level that allows for holistic oversight and fosters cross-departmental and sectoral integration;
- Ensure national accountability linked to mandates across the governance system to address the challenge of department-specific mandates that impact on water and sanitation; and,

- Provide cross-sectoral water security through full engagement of stakeholders at all levels.

It is vital that all key role players in the water and sanitation sector develop the NWSF collectively, and that it enjoys their full support, acceptance and agreement.

Water security will not be achieved by actions in the water sector alone. The NWSF outlines the sources of water and the systems on which it depends. It considers the management of the country's wastewaters, how industrial activities such as mining, the performance of local municipalities and includes emerging challenges that face the country if it is to achieve, and then sustain, its water security.

WATER SECURITY FRAMEWORK CONTEXT

Given its limited water resources and the constraints that these have placed on its development alternatives, South Africa has a long history of innovation and investigation in water resource management, albeit skewed to the benefit of a minority of the population in its pre-democracy era. The 20th century saw the advent of mining and industrialisation along with an extensive programme of infrastructural development in South Africa, including water infrastructure.

Since 1994, there have been particular efforts to address the legacy of inequality and the additional challenges that the transition to democracy has brought. Importantly, during this period, South Africa crossed the 'hydrological transition' and moved from a focus on water resource development for expanding supply, to one of water resource management. The transition was confirmed through post-1994 policy initiatives and legislation. These fundamentally changed the focus from infrastructural development to a more balanced approach, with an equal emphasis on measures for 'soft' water resources management. The shift was accompanied by an explicit emphasis on managing water to derive optimum benefit from its use ensuring that water is used optimally in support of sustainable and pro-poor growth and development. This approach has guided government programmes since 1994.

Water resources across the globe are under increasing pressure as a result of economic and social development. Conventional management methods are unable to cope with these ever increasing demands; hence a shift towards an integrated approach to water resources management. If managed in a sustainable manner, incorporating the three pillars of sustainability (the environment, society and the economy), water availability and access to it can enhance the development of a country.

Whilst acknowledging the significant progress made in the post-apartheid era a historical context is provided to acknowledge the challenges and lessons learnt to ensure that the new approach is built on a solid foundation. In parts of the country,

development choices are already being determined by water resource constraints. In many others, poor management of municipal infrastructure and other sources of pollution are causing a decline in water quality. There is also growing competition for, and the potential for conflict over limited water resources, both within the country and with its neighbours. In order to address potential unintended consequences of the policy and legislative reform of the democratic period, the positioning of the NWSF must articulate critical issues and provide a guide that will ensure that the benefits of the transformation project are realised within a reasonable period.

South Africa's water crisis can be attributed to insufficient water infrastructure maintenance and investment, recurrent droughts driven by climatic variability and change, inequities in access to water and sanitation, deteriorating water quality, deteriorating condition of water-related ecological infrastructure, including Strategic Water Source Areas (SWSA), as well as lack of skilled and competent professionals to address these water challenges. The crisis is already having significant impacts on economic growth and on the well-being of people in the country and these impacts will be exacerbated if the crisis is not addressed, hence the justification and rationale for a national water security framework.

Water is severely under-priced and cost recovery is not being achieved. To achieve water security, the current capital-funding gap, estimated at R33 billion per annum for the next 10 years, is required. However, this figure must be reviewed to align to fiscal constraints and to stimulate innovative financing and investment models, including a combination of improved revenue generation and a significant reduction of costs.

In planning for water security, the NWSF takes into account the demand for transformation and national strategic goals by reflecting on the quality and quantity of water available taking into account the demand required for transformation and national strategic goals, by reflecting on the processes and institutional mechanisms for implementation and ensuring national accountability and systematic programme implementation. It focuses on achieving water security in South Africa in the context of the two overall targets in the NDP, which are: (i) elimination of poverty; and (ii) reduction of inequality to acceptable levels

Inclusive economic growth is seen as an enabler that must form part of continuous assessment. The intention is for the NWSF to be a living document, to be revised as new information and knowledge is obtained and as the NDP is progressively implemented. In addition, a stakeholder engagement strategy will ensure synergy in communicating water security from the line-function Department(s) and at NDP level.

CHALLENGES AND KEY WATER SECURITY ISSUES

Flowing from the definition of water security and framing thereof, some key gaps relating to planning for water security can be discernible, such as:

a) Inadequate understanding of the bio-geophysical environment largely due to lack of sufficient regular assessment, including as a result of using old or out-dated information or spatial planning models that are not necessarily responsive to new and complex demands.

b) Water governance and leadership issues

These refer mainly to adequacy of legal regime, institutional arrangements, infrastructure and capacity required for implementation and management -

i. Lack of follow through on policy and legislation – reflected in many decisions being aborted, slowed down or reviewed unnecessarily;

ii. Functional instability and lack of continuity resulting from change in leadership of the Department and some water entities over the years since 1994;

iii. Failure to implement the basic institutional framework espoused in the post-Apartheid water policy and legislation;

iv. Inadequate emphasis on the new water management model and consistent stretching or even extrapolating old strategies without analysis based on empirical evidence;

v. Incapacity resulting from incompetence and ineptitude – many decisions appear to have been either delayed or aborted due to this, including officials lacking confidence or being afraid to make decisions.

vi. Incomplete restructuring and re-organisation processes that is exacerbated by start-stop processes since 1999.

c) Inadequate enforcement of data and information ownership and curatorship resulting in moving away from the notion of the knowledge commons – large consultancy companies appear to have a hold on critical data and information required for national planning needs.

d) Consistent under-expenditure and qualified audits by the sector leader – a serious concern that requires closer examination and decisive intervention. One of the most critical factors contributing to risks to water security is corruption and misappropriation of funds and lack of accountability and consequence management.

e) Inadequate financing and investment exacerbated by too much wastage in the system resulting mainly from how the function is done.

The DPME's 2015 diagnostic report identified and delineated six key thematic areas that remain critical for water security, namely,

- The water demand and supply situation;
- Impact of extreme climatic events and climate change;
- Infrastructure asset management and functionality;

- Infrastructure planning and development;
- Institutional and regulatory framework; and
- Human capital and institutional capacity.

The diagnostic report recognised the significant strides made in confronting the daunting legacy of apartheid, and in particular in addressing serious backlogs in water services. It raised a wide range of issues that cut across the various themes and that are seen as exhibiting *wicked* attributes showing problems that comprise complex interdependencies – where there is often little consensus on the precise problems to be addressed or the approach to their resolutions. It is stated that moving forward, the continued ability to ensure water security for the country will only be certain if a number of critical choices are prioritised and implemented to urgently confront the challenges and limitations facing the water sector. The report proposed a suite of opportunities and recommendations for sector-wide migration into water security strategies that included:

- Scaling-up non-traditional water augmentation;
- Enhancing demand-side management and conservation;
- Innovatively pursuing universal service coverage;
- Proactively planning for strategic water infrastructure;
- Increasing attention to water resource protection;
- Strengthening human and institutional capacity; and
- Establishing quality assurance protocols for the front-end phase.

Consultation processes during the development of the NWSF have confirmed many of the findings from the diagnostic report and subsequent assessments. The following broad issues were among the those raised during the consultation process in the area of integrated planning; water and agriculture; governance and institutions; infrastructure asset management and functionality; communication and stakeholder engagement; research, monitoring, assessment and information; water financing and investment; human capital and institutional capacity; and water use and unaccounted for water.

The core argument advanced in the framework is that water security is essentially 'beyond abundance and scarcity' which over the years has been about the development of storage capacity. This approach has since been challenged by an ecosystems based approach to water resource management and reflected in South Africa's post-1994 water policy and legislation. To this end, the challenges of water security are generally clustered around five key areas of human wellbeing, environmental, political, production and water related hazards and extremes.

SCOPE AND APPROACH TO WATER SECURITY

At a national level, the overall vision of the NDP is that of rising living standards and falling poverty and inequality by 2030. Key aspects of the NDP vision are reduced inequality by 2030; eradication of poverty; and significantly reduced unemployment through inclusive economic growth. This vision resonates with the 2015 World Water Development Report (WWDR)'s vision on water security[15] which states that *"By 2050, humanity has achieved a water secure world, where every person has access to adequate quantities of water of an acceptable quality and from sustainable sources, to meet their basic needs and sustain their wellbeing and development.* :

The UN's 2016 WWDR[16] estimates that three out of four jobs in the global workforce are heavily or moderately dependant on water, and has highlighted three issues related to water and economy, water and inequality as well as water and poverty[17]:

❑ **Water, economy and jobs -** critical functional categories recognised in value chain	• Water resource management and ecosystems restoration and remediation; • Building, operating and maintaining water infrastructure; and • Provision of water related services including water supply, sanitation services wastewater management.
❑ **Water and inequality**	• Access to safe water and sanitation services is a human right. • Balancing act – increasing access reduces inequality but increase demand
❑ **Water and poverty eradication**	• Water is key to poverty eradication and health. • Balancing act – supply can be increased but at steeply increasing costs and interdependency

[15] WWAP (United Nations World Water Assessment Programme). 2015. *The United Nations. World Water Development Report 2015: Water for a Sustainable World.* Paris, UNESCO.

[16] World Water Assessment Programme, 2016. *Water and Jobs: The United Nations World Water Development Report 2016*. UNESCO.

[17] See also Ward, M and Mudombi, S. 2018. Protecting and unlocking jobs through water stewardship: a case study linked to the Umbogintwini industrial complex, Ethekwini.

To achieve the NDP articulates the national development goals articulated in the NDP, water must be made central to socio-economic growth and development, to address the above priorities.

The NWA and NWRS provide the framework for the protection, use, development, conservation, management and control of water resources for the country as a whole. They also provide the framework within which water is to be managed at regional or catchment level, in defined water management areas. It is binding on all authorities and institutions exercising powers or performing duties under the National Water Act, 36 of 1998, and must be formally reviewed from time to time[18].

The NWRS2 analyses the role of water in the economy and identifies the specific challenges, development opportunities and actions that inform an agreed framework for priority areas of focus for the country. It is meant to address concerns about socio-economic growth and South Africa's development potential, which may be restricted if water security, resource quality and associated water management issues are not resolved efficiently and effectively. The NWRS2 aims to ensure that water serves as an enabler for inclusive economic and social development and not a bottleneck. However, as stated above, implementation remains an enduring challenge. The NWSF is contextualized to address these gaps.

The NWSF must provoke thinking so that the country looks at the medium to long-term horizon (2030 and beyond) and ensure that current actions are always aligned with desired outcomes and impacts. It cannot simply elevate the outputs and programmes, as listed in the Departmental plans, as the trustee of water resources and overseer of water services and sanitation in the country.

A radical paradigm shift is needed if the implementation of the NDP goals and aspirations is to be realised. It is critical that at the highest level the Water Security Framework's achievement must be tested against two key aspects of the country's development, namely, per capita growth and reduction in inequality. It must be able to connect all aspects of water's contribution to social and economic development which has proved to be difficult, if not impossible, for the line Department, especially in recent times and given that it is not necessarily mandated to control or manage the total value chain of national development.

In defining the end state for the water sector a radical view is essential to address the spatial equity and examine why there are gaps between the intent of policy and legislation on one hand and the implementation on the other. Systems and processes must be compatible with the goals and some issues need to be revisited such as:

[18] National Water Act, 36 of 1998, Government of South Africa

- Poor quality, quantity and relevance of data;
- Poor regulation and enforcement;
- Lack of reform and transformation of the water institutions as envisaged during policy and legislative development;
- Lack of integration and common goals;
- Lack of accountability and unclear roles and responsibilities; and
- Arguably sufficient legislation, but poor implementation and lack of decision-making or follow through, as earlier presented.

It is also evident that the silo paradigm and approach in the water sector has persisted into the democratic dispensation, which results in a tendency or risk of focusing on the lowest common denominator and not focusing on interdependencies. Spatial planning has not managed to break the former homeland boundaries, which deprives many communities of the required economies of scale when it comes to water for livelihoods and economic development. The allocations for irrigation use must be reformed and structured to be informed by the quantified livelihoods benefit per volume allocated.

Irrespective of the actual figures that are agreed once assessments have been done, the fact remains that radical changes, such as raising the minimum up to 150 litres (depending on local conditions) per person per day, need to be considered in areas where this is possible. This would include but not be limited to, employment created by revenue from produce, food security and achieved efficient water use efficiency index, and contribution to GDP. In this context the nexus approach should be clearly articulated and implemented.

In considering the radical changes, the mutual interconnections between land, water, energy and food (the W-E-F nexus) must as a matter of course be taken into account. It can no longer be seen as an isolated issue as a result of a lack of understanding and complexities of the relations between the component parts[19]. For instance, if the demand for water for energy and the associated impact on water quality is reduced significantly by 2030, the water allocated for energy will become available for other uses. The interdependencies with agricultural requirements for both water and energy need to be strategically determined in order to maximise the benefit to society.

The NWSF takes cognisance of the fact that unlike other resources, **WATER CANNOT BE SUBSTITUTED** with anything. It is finite and must be conserved and protected for future generations.

[19] Mpandeli *et al*. 2016

The scarcity of fresh water or water fit for use is driving the world towards innovative technologies which look into more efficient ways or treating water and also reducing pollution of our water resources. Desalination of sea water into potable or industrial grade water is common practice around the world where surface water is depleted. These technologies demand huge investment costs together with high level skills sets which South Africa should have. The fourth industrial revolution (IR4.0) brings with it opportunities to address various aspects of water management and provision of services.

In recent years, a *fatigue* resulting from start-stop regarding issues of water governance can be discernible. The advent of Local Government legislation made the governance of water services even more competitive. An understanding and alignment of legislation is a critical process that must be undertaken. It should be noted that legislation is one of the critical tools at our disposal for the governance and management of water in South Africa. Legislation should be clear on the allocation of responsibilities and mandates across the water value chain, and across the various role players. Of outmost importance is the enforcement of regulation, where accountability is demanded.

The OECD[20] in addressing the question of why water security matters, after assessing the common challenges of water security globally and in the context of OECD countries, recommended that a risk-based approach to water security is essential. Achieving water security means maintaining acceptable risk levels for four water risks, namely:

- Physical shortage (including drought): Lack of sufficient water to meet demand in short, medium and long-term for beneficial uses by all water users;
- Inadequate quality: Lack of water of suitable quality for a particular purpose or use;
- Excess: Overflow of the normal confines of water system or the destructive accumulation of water over areas that are not normally submerged; and
- Risk of undermining the resilience of freshwater systems: Exceeding the coping capacity of the surface and groundwater bodies and their interactions (the "system"); possibly crossing tipping points, and causing irreversible damage to the system's hydraulic and biological functions.

In the context of South Africa and her relatively new transformational policies the above risks are exacerbated by the lack of skills and capacity in general. Assessment of the risks needs to be done conjunctively as they impact on each other given the nature as a hydrologically interconnected resource linked to nutrient cycle. Effective management of the risks is central to achieving the objectives of the NWSF.

[20] OECD (2013), Water Security for Better Lives, OECD Studies on Water, OECD Publishing. http://dx.doi.org/10.1787/9789264202405-en

Key aspects of the framework include the fact that it must:

- Remain a high-level national guide that is long-term in nature but that determines immediate decisions and actions based on empirical evidence and best available information and knowledge.
- Be sufficiently instructive to ensure that all mandated institutions and organisations draw from it with the line Department sufficiently capacitated to play its sector leadership role properly;
- Provide an analysis of why the sector seems to be in a stagnant state with decisions either not being made or if made they are not executed or followed through;
- Reflect urgent and immediate decisions to be made to ensure sector functionality such as institutional framing and establishment as well as high level roles and responsibilities and financing;
- Put together a basket of analytical tools such as foresight methodologies, systems analysis, etc.;
- Recognize and take into account that many water programmes are by nature long-term and that every effort must be made to decouple water security planning cycles from the geopolitical, financial and other cycles which are largely short-term in nature. Furthermore, bad planning whether due to wrong assumptions or a lack of requisite capacity can result in irreversible or devastating impacts in the long-term. For instance, on average a mega-project conceptualised in 2020 can produce first results in 2035 to 2040 (three to four political/administrative/governance cycles multiplied by three spheres of government and several economic cycles which may include recessions and so on); and
- Recognise the water situation in the country shows that the challenges faced are a result of cumulative effect over a long period which needed proper long-term, scenario-based planning and implementation on decision analysis.

Further,

- National spatial planning needs to be responsive to the redistributive needs of the country and not the *usual* economic zoning which by default leads to maintaining the *status quo*. Water should form an integral part of the spatial planning. It is an irreplaceable commodity and a national asset in Government's trusteeship;
- Water Security needs to be seen as key driver, especially in respect of sustainability and the nexus approach in general (water-food-energy-health etc.);
- Sector direction as dictated and led at the highest level with clear roles and responsibilities across the value chain is critical;

- Strengthening leadership, water governance and stewardship should be non-negotiable.
- Serious consideration is to be given to separating the technical functions through a structured process, starting immediately with those that will not need political or legislative changes;
- Tools and instruments exist to be used for co-implementation, state-owned enterprises, private institutions, and other spheres of government;
- As a country we must be looking at *end-to-end value chain* coverage that takes into account a holistic development agenda through ownership and beneficiation.

The scope of the framework is to position the need for key interventions at short, medium and long-terms with the objective of enabling an integrated and transdisciplinary approach to planning for water security, creating an enabling mechanism for implementation and clarifying roles and responsibilities. For instance, linking water issues with other aspects of the NDP such as spatial planning among others, and ensuring that the various role players at national level focus on the priorities of the NDP goals and objectives. In doing so, it is important to note the critical constitutional framing of trusteeship of all water resources which underscores the principle of "total value chain ownership" and the need to ensure water justice in all its manifestations taking into account historical injustice.

The framework segregates the various elements of implementation in terms of areas of focus and the respective roles and responsibilities. Most importantly, it provides a platform for monitoring implementation in a focused manner at the highest level in line with short-, medium- and long-term impact. To this end, two key areas will drive the monitoring, namely:

- Economic growth measured by GDP growth, contributed through water and associated activities;
- Reducing the inequality gap measured in terms of human development index (HDI) focusing on livelihoods locally through to national (bottom up) and reflective of past imbalances.

The above must be viewed in terms of the three apex priorities of reducing inequality, eradicating poverty and improved employment in line with the NDP's vision and enabling milestones of universal access to clean running water in the homes as well as the commitments made through the SDGs.

KEY NWSF RECOMMENDATIONS

Recommendations stemming from analysis done through the NPC process and reflecting a wide consultation across the country through direct and indirect engagement with experts and sector players are highlighted below.

Recommendation 1: Adopt NWSF as a national guide.

The NWSF needs to be adopted as a mechanism to ensure water security and an instrument to achieve the NDP goals in relation to all aspects of water security as they relate to the three apex priorities of

- Eradicating poverty;
- Reducing inequality; and
- Reducing unemployment (including inclusive economic growth).

Recommendation 2: Adopt a relational definition of water security for South Africa, in addition to the UN Water definition.

From a South African perspective, the relational definition of water security goes "beyond scarcity and abundance" thereby ensuring the focus on the 3 apex issues which to date has not been clear.

To achieve water security, all policy and strategic interventions must be planned and executed in a way that shows a measurable achievement of the three apex priorities.

Recommendation 3: Adopt the eight principles

The eight principles must form the bedrock and scope of the NWSF, namely,

i. Source to sea across the water value chain/water cycle
ii. Long-term view based on scenario planning and associated risks
iii. Policy and Legislation as starting point
iv. NEXUS approach to planning, implementation and management
v. Decision support from credible information and research results
vi. Mass balance approach to assessment and implementation
vii. Accountability and clear roles and responsibility
viii. Total value chain ownership concept in context of the trusteeship doctrine

Recommendation 4: Adopt the ten focus areas as guide to NWSF implementation to be responded to by all institutions and organisations implementing the NDP.

The ten focus areas represent the "hooks" from which all institutions attach/hang the interventions as they relate to National Water Security which must be adhered to at every level, across all sectors and sub-sectors interested and affected by water security as per their respective mandates or needs.

Focus Area 1 - Narrowing the inequality gap

Analysis of the extent to which post-94 reforms have succeeded in reducing inequality using modified development index supporting parameters.

Focus Area 2 - Water infrastructure & finance

Ensure sustainability through assessing financial flows in relation to water infrastructure and associated key conveyance parameters/variables. Also ensure innovative funding models across the value chain

Focus Area 3 - Diversifying water sources

Develop mechanisms to fully take into account the seven "non-traditional water sources" in addition to the usual surface water taking into account value and impact beyond simply scarcity and abundance.

Alternative/non-conventional water sources to be considered from a systems perspective and not only availability and scarcity. Emphasis should be on the impact of these on the three apex priorities and scale associated with that.

Focus Area 4 - Water research, monitoring & information

Consolidate and align research monitoring and information into one "national water intelligence facility" with characteristics of both physical and virtual institutions mainly funded from the fiscus (90%), water research levy (6%) and other such as internal and advisory revenue (4%). Included as the role of the facility would be the key issue of centralised and coordinated data curatorship that will ensure accessibility and reliability in much the same way as a typical centre for statistics or national meteorological services. This is what was generally envisage when Chapter 14 of the National Water Act, Act 36 of 1998 was conceptualised and promulgated; the Water Research Act, of 1971 was not repealed.

This recommendation is also meant to address the disparate water related intellectual capital currently undermining the country's capability to provide national support. Public institutions including universities among others have specific jurisdictional mandates and are expected from a policy perspective to work together.

Most importantly taking into account the business value chain of water generally, the funding of such a national facility and associated activities is estimated to be around 6%

overall (using the current annual operational budget allocation of R16 billion from the fiscus). It is therefore clear that even under financial constraints there is sufficient capacity which just needs to be redirected properly. No need for emphasis on donor funding if internal national institutions and industry can be properly aligned.

Focus Area 5 - Nexus aspects of water security

Energy-Food-Water-Land Nexus forms an integral part of IWRM and water security. This is also a key link to the just transition to low carbon and related climate change and variability concerns which need to be translated into sustainable development.

Mega-projects should form part of the medium to long term solutions to address the impact of climate change from a regional perspective

From South African perspective, the FAO's approach which is more relevant as it explicitly links the issues of land, labour and capital as these relate to the resource base. This resonates with principle eight on value chain ownership.

Focus Area 6 - Ecological Infrastructure

In line with South Africa's water policy the recommendation looks at ecosystems from "goods and services" perspective - beyond just protection. Emphasis is to account for the ecological infrastructure in a measurable way in relation to the three apex priorities. Current accounting methods and tools excludes the socio-economic value of natural capital which if included can change the balance towards reduced inequality if properly configured.

In addition, the linkages with national spatial development framework is critical and so is the integrated catchment management with its focus on holistic land and water management for socio-economic development

Focus Area 7 - Water and spatial planning

Clear connection with National Spatial Development Framework and the need to systematically do national spatial planning and assessment across vertical, horizontal and temporal scales addressing the past legacies and ensuring sustainable future

Focus Area 8 - Enabling planning for water security

Anchor NWSF around NSDF and other jurisdictionally mandated frameworks such as NWRS, IDP, WSDF etc.

Immediate establishment of water institutions as per policy and legislation starting with those that will not need further consultations such as CMAs, WUAs, NWRIA, expanded water boards as regional utilities as well as streamlining the functions of the national lead Department by letting go the operational functions to ensure proper focus on national water security at policy and national planning level as well as the coordination of institutions.

Focus Area 9 - Managing water risks

Focus on risk proofing and building resilience especially in relation to water security and related risks.

This recommendation was found to be relevant for the NDP as a whole in that it has direct and indirect implications for the three apex priorities across the board, hence the need to strengthen the link with the National Disaster Management Framework (NDMF).

Focus Area 10 - Communication and Stakeholder empowerment

Develop a strategy based on overall needs of the NDP implementation as a whole. Water security is critically important as it also relate to behavioural issues of stakeholder empowerment and communication.

A conceptual framework on communication and stakeholder engagement based on SADC regional awareness and communication strategy is proposed. This resonates with the drive for active citizenry in that it will ensure implementation as communities become engaged.

Recommendation 5: Establish an NWSF implementation oversight, monitoring and evaluation

Oversight and performance monitoring of the implementation of the framework needs to take into account the fact that the role played by NPC is outside the current M&E within the government machinery.

Focus area on water research, monitoring and information has highlighted the challenges related to data and information on the status of the country's water resources in support of the various aspect of water security from the hydrologic environment, socio-economic environment, risks and opportunities, through to administrative and institutional dimension. Appropriate analysis at national level is required that is primarily focussed on the oversight and performance evaluation from a water security perspective to ensure long term focus and continued adaptation to the best possible solutions.

The current M&E system as configured for the government needs to be strengthened and that an M&E system targeted at the level of NPC/NDP implementation be developed.

A metrics needs to be urgently developed which focuses on direct national responsibility such as that played by NPC through the Secretariat with support from Stats SA and the proposed national water intelligence centre. A transitional mechanism may be needed to get the "virtual dimension" of the latter to begin to operate through a single agreement with a network of relevant institutions accordingly.

Immediate need includes development of M&E tools with national water security parameters and reports in line with the proposed M&I already developed by the NPC

Whilst data analytics and other planning and operational needs will remain in the purview of the various entities in accordance with their respective jurisdictional mandates, the M&E at NDP/NPC level needs to focus on issues mainly outside the 'water box'. Assessment of the challenges on water security has shown that most of the decisions that impact the water security are outside the "source-to-tap" on the value chain and that the Framework focus will ensure that these issues are dealt with effectively.

Given the strategic nature of water security in the country, it is recommended that the oversight on this be lifted in comparison to other forms of M&E. Water needs special attention and cannot be diluted by being placed in a basket. This is one of the reasons why the previous regime came up with the Commission on water matters that led to the current configuration.

ACRONYMS AND ABREVIATIONS

ACRONYM/ ABBREVIATION	DESCRIPTION
AIS	Administrative and institutional system
ARC	Agriculture Research Council
AU	African Union
CGS	Council for Geoscience
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
Covid-19	Coronavirus disease 2019
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DPME	Department of Planning Monitoring and Evaluation
DST	Department of Science and Technology
DWA	Department of Water Affairs (superseded DWAF)
DWAF	Department of Water Affairs and Forestry (superseded DWS)
DWS	Department of Water and Sanitation
EIFE	Expanded Inclusive Fairer Economy
FAO	Food and Agriculture Organization
FETWater	Framework Programme for Research, Education and Training in the Water Sector
GDP	Gross domestic product
GWP	Global Water Partnership
HDI	Human development index
IDP	Integrated Development Plan
IHP	International Hydrological Programme
IWM	Integrated water management
IWRM	Integrated water resource management
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MES	Monitoring and evaluation system
MUS	Multiple use water system
NBI	National Business Initiative
NbS	Nature-based Solutions
NCPC	National Cleaner Production Centre

ACRONYM/ ABBREVIATION	DESCRIPTION
NDMC	National Disaster Management Centre
NDP	National Development Plan
NIWIS	National Integrated Water Information System
NIWS	National Integrated Water Strategy
NPC	National Planning Commission
NRS	National resource system
NSDF	National Spatial Development Framework
NWA	National Water Act
NWMRIC	National Water Monitoring, Research and Information Centre
NWPDR	National Water Plan Diagnostic Report
NWPDR	National Water Plan Diagnostic Report
NWRIA	National Water Resources Infrastructure Agency
NWSF	National Water Security Framework
NWSMP	National Water and Sanitation Master Plan
OECD	Organisation for Economic Cooperation and Development
ORASECOM	Orange-Senqu River Basin Commission
RDP	Reconstruction and Development Programme
RWP	Regional Water Policy
RWS	Regional Water Strategy
SADC	Southern African Development Community
SAEON	South African Environmental Observation Network
SAEOS	South African Earth Observation Strategy
SANBI	South African National Biodiversity Institute
SAPP	Southern Africa Power Pool
SCOPA	Standing Committee on Public Accounts
SDG	Sustainable Development Goal
SES	Socio-economic system
SWSA	Strategic Water Source Areas
UN	United Nations
USA	United States of America
USEPA	United States Environmental Protection Agency
USGS	United States Geological Service
WAR	Water Allocation Reform

ACRONYM/ ABBREVIATION	DESCRIPTION
WEF	World Economic Forum
W-E-F	Water-Energy-Food
WFD	Water Framework Directive
WfGD	Water for Growth and Development
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WUA	Water User Association
WWAP	World Water Assessment Programme
WWDR	WWDR: World Water Development Report
WWF	World Wide Fund for Nature
WWF4	World Water Forum Four

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1.
INTRODUCTION AND BACKGROUND

If you want to know the end, look at the beginning.

African Proverb

1.1. BACKGROUND

South Africa has a long history of engaging with water security, albeit primarily from the point of view of scarcity and availability. Even before the promulgation of the 1956 Water Act (Act 54 of 1956) agriculture accounted for most of the water use. A key historical milestone was triggered by the 1966 drought and the industrial expansion of the time which culminated in the Commission of Enquiry into Water Matters which reported its findings and recommendations in 1970. Some of the recommendations such as the creation of the Water Research Commission (WRC) and related internal Department of Water and Sanitation (DWS) functioning are still in operation to date. Like many aspects of South Africa's socio-economic sectors, the context was largely determined by the Apartheid institutional and political arrangements which excluded the majority of the population which was also highly influenced by colonial constructs; from the Irrigation and Conservation of Water Act, No. 8 of 1912 and the Natives Land Act of 1913 to related policy and legislation, leading to the 1994 democratic dispensation which formed the basis of inequality. The key drivers of the economy then were mainly agriculture, mining and industrial development which saw the high focus on water resource development to ensure security of supply, albeit leaving the majority outside the economic development. The attachment of water rights to land ownership has meant that the majority of the people did not have access to water.

Post 1994, the water sector in South Africa has made clear progress in the last two and a half decades in terms of substantial advances in water supply extension in rural areas. In its 2017 general household survey, Statistics South Africa (Stats SA) reported that an estimated 46.7% of households had access to piped water in their dwellings. A further 27.5% accessed water on site while 12.2% relied on communal taps and 2.1% relied on neighbours' taps. The report confirmed that the number and percentage of households with access to piped water had increased since 2006, showing that 13.5 million households had access to piped water in 2017 compared to 9.3 million in 2006.[21]

[21] Stats SA GHS 2017

Among the world firsts has been South Africa's recognition and legislation of water resources management across the entire hydrological cycle, provision of ecological needs and its social (fee basic) water policy. requirements identification and implementation of which has met with relative success in some of the country's river basins. South Africa is considered among the pioneers in flows environmental flows[22], and has developed highly regarded methodologies for this purpose. The country is recognised as one of the best examples of legislation being developed to address environmental flows and having introduced a strong social component to its methods that describes the implications of management interventions not only on ecosystems but also on its common-property subsistence users. In the Limpopo River Basin (Botswana, Zimbabwe, South Africa and Mozambique) interest in environmental flows has been promoted by the South African water law, which requires prioritisation of water allocation to meet the basic needs of people and the needs of ecosystems (the concept of the "Reserve", which is the only right to water in legislation).

Since the promulgation of the National Water Act (No. 36 of 1998) (NWA), the water sector has faced some challenges, including among other:

- the roll-out of CMAs and Water User Associations (WUA) that are meant to be responsible for managing water resources at catchment management and local levels where integrated water quality management and protection of natural resource base should be happening;
- race and gender equity redress of water allocations through the water allocation reform (WAR) programme;
- programmatic implementation of water conservation and demand management initiatives notionally yet to be fully implemented.

Recent challenges to water supply in the Western Cape, Eastern Cape and KwaZulu-Natal raise concerns about the robustness of water planning, management and implementation strategies. The NDP reflected on the incomplete actions required to achieve the 2030 goals and included the following:

- Review of the National Water Resource Strategy (NWRS) as the sector master-plan to guide the development of the sector;

[22] An environmental flow is the water regime provided within a river or wetland to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated. Environmental flows provide critical contributions to river health, economic development and poverty alleviation. They ensure the continued availability of the many benefits that healthy river and groundwater systems bring to society.

It is increasingly clear that, in the mid- and long-term, failure to meet environmental flow requirements has disastrous consequences for many river users. Addressing the water needs of aquatic ecosystems will often mean reducing the water use of one or more sectors. These are tough choices, but they have to be made to ensure the long-term health of the basin and the activities it encompasses. Source: IUCN

- Finalising the implementation plan for institutional establishment and rationalisation for water resource management, with full implementation. The institutional arrangements included:
  - A national water-resource infrastructure agency to develop and manage large economic infrastructure systems (national and regional);
  - CMAs and WUAs to undertake resource management on a decentralised basis, with the involvement of local stakeholders;
  - A national facility for research, development, innovation and testing, with focus on water reuse and desalination; and
  - Creation of regional water and wastewater utilities, including the consolidation and expansion of existing water boards mandates.
- Initiating a comprehensive financing and investment programme for water resource development, bulk water provision and waste water management; and
- Poor progress with WAR to address equity in water allocations and enhance water resource management.

A key observation is that the water sector has not significantly transformed[23] as was envisaged when the policies were developed in the mid to late 1990s. Much of this could be attributed to the earlier emphasis on addressing the backlog of water and sanitation services provision to underserved communities during the Reconstruction and Development Programme (RDP), and subsequent weak implementation of key transformation programmes that thereby leaving the fundamental architecture of the old system largely intact. Challenges remain with the poor implementation of policy and legislation for a number of reasons, including an erosion of sector capacity, competence and leadership, and lack of collaboration and effective coordination among jointly responsible and implementing entities. This is exacerbated by the depletion of competence and capacity in the line-function Department, which has had adverse effect on its ability to provide effective sector leadership. The reactionary approach to change or amend policy that has not been implemented has further compounded the systemic problems.

South Africa has led policy debates on several water initiatives in the region, yet has struggled to implement some of the very policies it advocates. The root causes of the problems are generally known. What is apparent from Figure 1 below is that the repeated inability to timeously address these has resulted in an aggregation of the problems to the extent that they have progressively and cumulatively become systemic and to some extent structural. A time-lag of 13 to 15 years is estimated which need to be taken into account in reviewing all plans and as addressed in this framework. The

[23] Transformation defined as fundamental deconstruction and reconfiguration of the entire system.

1997 National Water Policy[24] states that "*…at national level, it is … necessary to address the problems … with respect to the management of the national infrastructure. Provision may be made to allow the functions of managing the national water infrastructure to be transferred to a public water utility established for that purpose. The functions of such utility could include the planning and development of infrastructure, its operation and financing.*" To date, for various reasons this has not been executed and at the rate things are going and unless something drastic is done, it does not appear to be going to happen soon give the new challenges that continue to dog the sector that have developed over time.

[24] Section 7.2.3 of the National Water Policy of April 1997

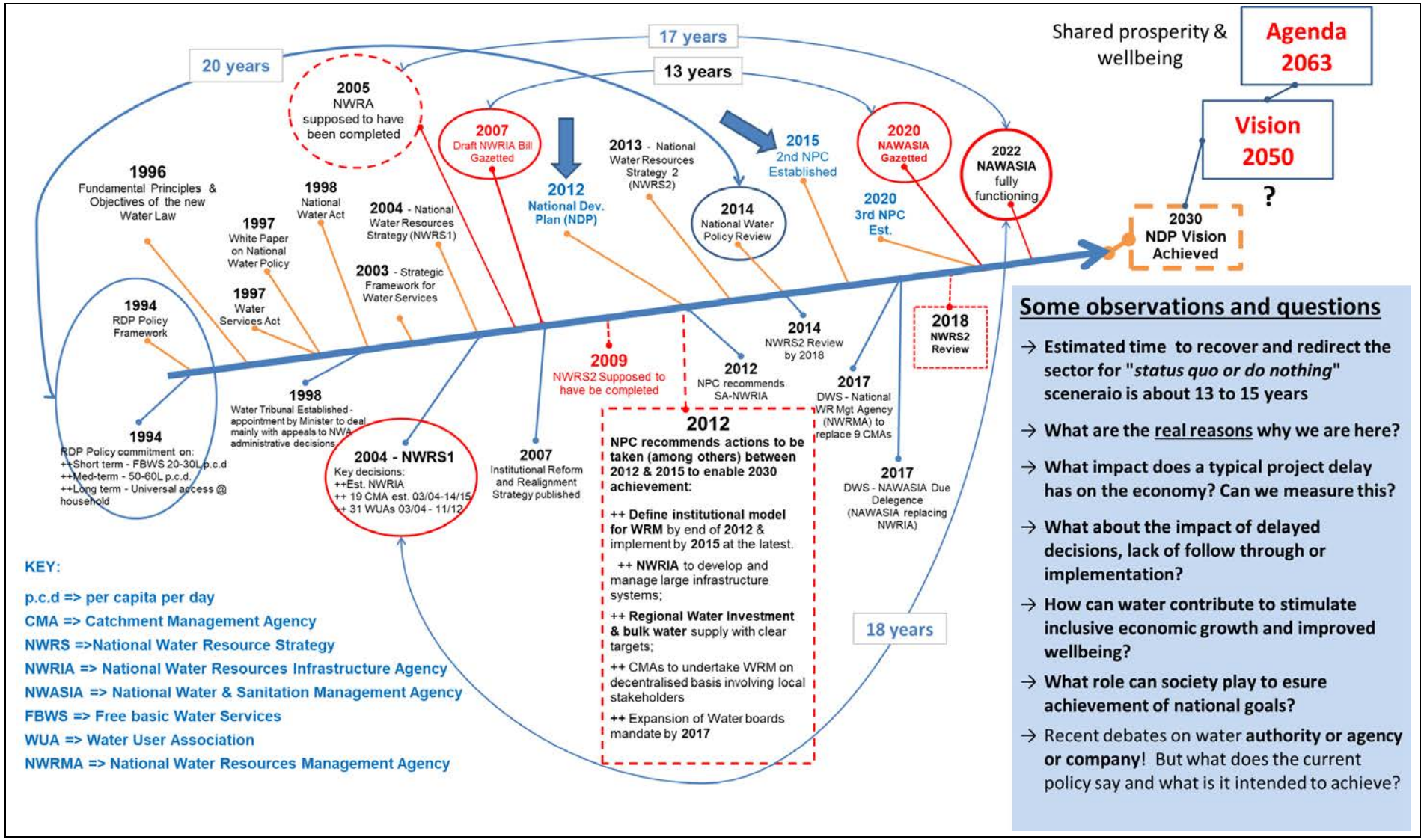


Figure 1. Decision analysis since the development of new water policy in 90s.

The RDP policy framework included the right of access to clean water as a fundamental policy principle to ensure "water security for all"[25]. It recognised the economic value of water and of the environment and advocated an economically, environmentally and politically sustainable approach to the management of water resources and the collection, treatment and disposal of waste. The policy identified the following as critical:

- Spatial planning and water to recognise the geographic limit to water availability, and encourage the creation of reserve;
- Long-term environmental costs, including as a result of interprovincial and transboundary water sources and transfers;
- Restructuring of the line department and its role in building local and provincial agencies as well as ensuring effective oversight.

South Africa has long recognised that we cannot neglect that, as in the past, the country's future is intimately bound to its natural resources and that decisions about the way these resource wealth is used, be it gold and diamonds, coal and liquid fuels, wildlife and parks; and land and water, will determine both the sustainability and stability of the society we leave to our progeny[26]. We cannot therefore, escape the dire consequences of neglecting that as a water scarce country with a highly polluting, energy intense economy, we face demands to adopt measures to internalise environmental costs, eliminate profiteering and establish a new rationality for using and distributing natural resource wealth that is equitable and just. As we transition to low carbon economy characterised by circular economic approaches among others, we must deliberately address the challenge of providing new social and economic opportunities for all our people, in particular, the vulnerable, the youth, women and rural families, who have continuously suffered the brunt of denied access and opportunity over the past decades.

The inability of the country to do five yearly assessments[27] at water management area level to inform the various plans and processes is serious cause for concern and is directly linked to deteriorating basic monitoring and assessment of water resources. This is a critical gap that is also related to the cost of treatment of water due to lack of effective catchment monitoring and management.

To date there has not been sufficient development of the regulatory regime as evident from lack of or limited capability for compliance monitoring and enforcement. The lack of establishment of institutions to address the demand side of the water management

[25] http://www.dwa.gov.za/Documents/Policies/nwpwp.pdf

[26] Kasrils, R, In Reed, D and de Wit, M. (eds.). 2003. Towards A Just South Africa: The Political Economy of Natural Resource Wealth

[27] National Water Act, 36 of 1998 Section 5(4) (b) states that the "*national water resource strategy must be reviewed at intervals of not more than five years.*"

is evident from weak assessment of actual use through the authorisation processes or monitoring of authorised use. The water use licencing process makes provision for users to provide certain information on water use as part of monitoring requirements, however, capability to put this in a national system and use it to assess the water use environment is evidently not sufficient - this is a critically important gap.

According to the DWS's National Integrated Water Information System (NIWIS)[28], only 63% of the water use by volume is measured, which begs the question of how then are we able to manage the demand or even properly plan if we are not measuring sufficiently. The issue of lack of reliable information whether due to lack of monitoring or ineffective monitoring systems design or lack of requisite capacity is extremely problematic given that based on the current allocation numbers, South Africa is regarded as having literally allocated all available water. This was done at high level of assurance. Again this is an illustration that the current planning and monitoring regime lacks the robustness required to ensure effective water security. It cannot be business as usual.

The fact that confirmation of lawful use has not yet been finalised (about two decades to date) as originally planned for around two years after the promulgation of the National Water Act, Act 36 of 1998, shows that the sector is at serious risk. Further the institutional reform that is meant to ensure that the model articulated in the post-Apartheid era is used has not yet been fully implemented resulting in a less than optimal water management. New capacity requirements have therefore not been properly addressed as the skills map has to change to be commensurate with these requirements and new developments.

The issue of inadequate measurement of water use has serious implications on revenue collection and management thereof. The water policy is largely based on the assumption that water use charges in various forms will be able to cover the cost of managing the water value chain with minor or limited contribution for indigent communities and addressing backlogs.

The country through the line-function Department and its entities are far from achieving the level of implementation that was envisaged when the NDP was developed and further deterioration is bound to occur if drastic and focused action is not taken urgently. This includes immediate need to stabilise decision making processes and create space for careful assessment before decisions are changed or carried out.

The water policy review that was approved by Cabinet in 2013[29] has recommended, among others, that the Minister be accorded the mandate to develop the National Integrated Water Strategy (NIWS) that deals with the full water value chain covering water resource management, water and sanitation services as well as required

[28] DWS, 2014

infrastructure investment. It also emphasised the issue of a multiple-water-use service (MUS) approach in planning and infrastructure which begins to address issues of socio-economic development, food security among others, at different scales. Overall the Water Security Framework must engage the NWRS and reflect how much water is available and in what quantity and quality for all. It must further articulate the demand dictated by transformation and national strategic goals, and reflect on the processes, tools and institutional mechanisms or tools for appropriate implementation. Key aspects of this is the required intelligence (empirically supported) not only to implement but to also deconstruct and reconfigure the institutional and implementation models to reflect the current and future needs. In viewing the water security from individual or household through to national and regional we must ensure that the NDP goals are achieved holistically. It is critical to note that modifying past institutional frameworks will not in itself sufficiently address the identified challenges and risks. There has to be a deliberate and concerted effort to deconstruct the institutional framework that is largely based on the legacy of apartheid and reconfigure the overall system to address the current and future needs. This does not in any way mean physical disestablishment of institutions *per se* but the models and assumptions upon which these were based; and deliberately ask difficult and uncomfortable questions regarding what works under the current and future scenarios. This report begins to address these questions.

There now has to be a deliberate and concerted effort to address the challenges described above to provide water security for South Africa's current and future socio-economic development needs. This NWSF seeks to ensure the water security of the nation, and considers all the water uses that are important from this perspective, as shown in Figure 2. The framework must focus on national priorities underpinned by a thriving economy. It must also incorporate the SDGs and international obligations, including the Africa development agenda and Southern African Development Community (SADC) water and development protocols. The NSWF building blocks must emanate from local, regional, provincial, national and various economic sector development plans and strategies, the integration of which will provide high-level direction and performance and require accountability from all role-players for its implementation. The NWSF implementation sequence is simplified to allow progress tracking and identification of areas needing intervention. Accordingly, its institutional framing allows seamless planning, management and monitoring.

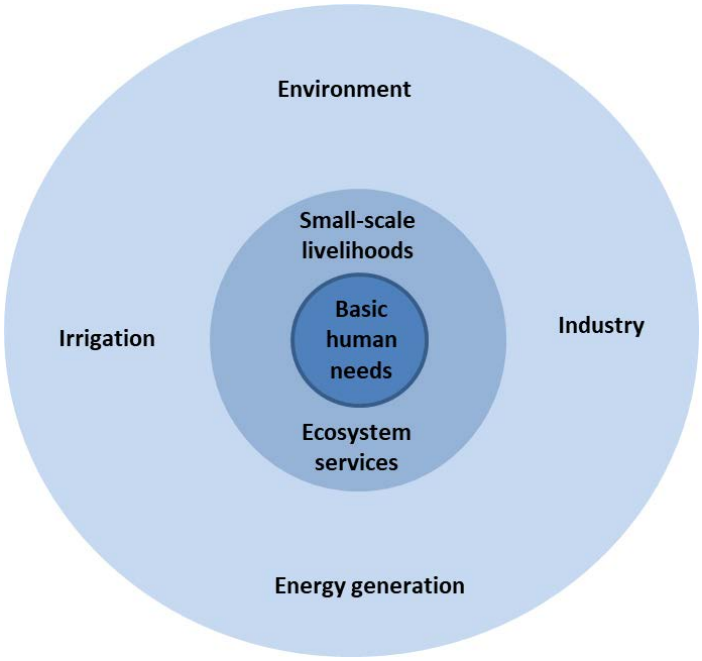


Figure 2. Important socio-economic water use requiring water security

1.2. KEY DEFINITIONS AND CONCEPTUAL CONSTRUCTS

1.2.1. Water security – an evolved concept

Water security has recently emerged as one of the most deliberated water concepts that is increasingly used to frame water related issues and to analyse our capacity to ensure the availability of and access to water. It does this by responding to various risks, vulnerabilities, insecurities, inequities and policy challenges that societies and ecosystems face due to variations and levels of either quantity or quality of water, as well as water related disasters[30].

Despite some variation in definition, water security relates to reducing water-related risks to a level at which water's benefits can be securely and sustainably realised.

UN-Water[31] (2013) defines water security as:

> *"the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability".*

[30] Olli Varis O, Keskinen M, and Kummu M. 2017. Four dimensions of water security with a case of the indirect role of water in global food security.

[31] UN-water, 2013

Figure 3 shows globally accepted core elements/dimensions necessary to achieving and maintaining water security which can be used to frame water security for national requirements.

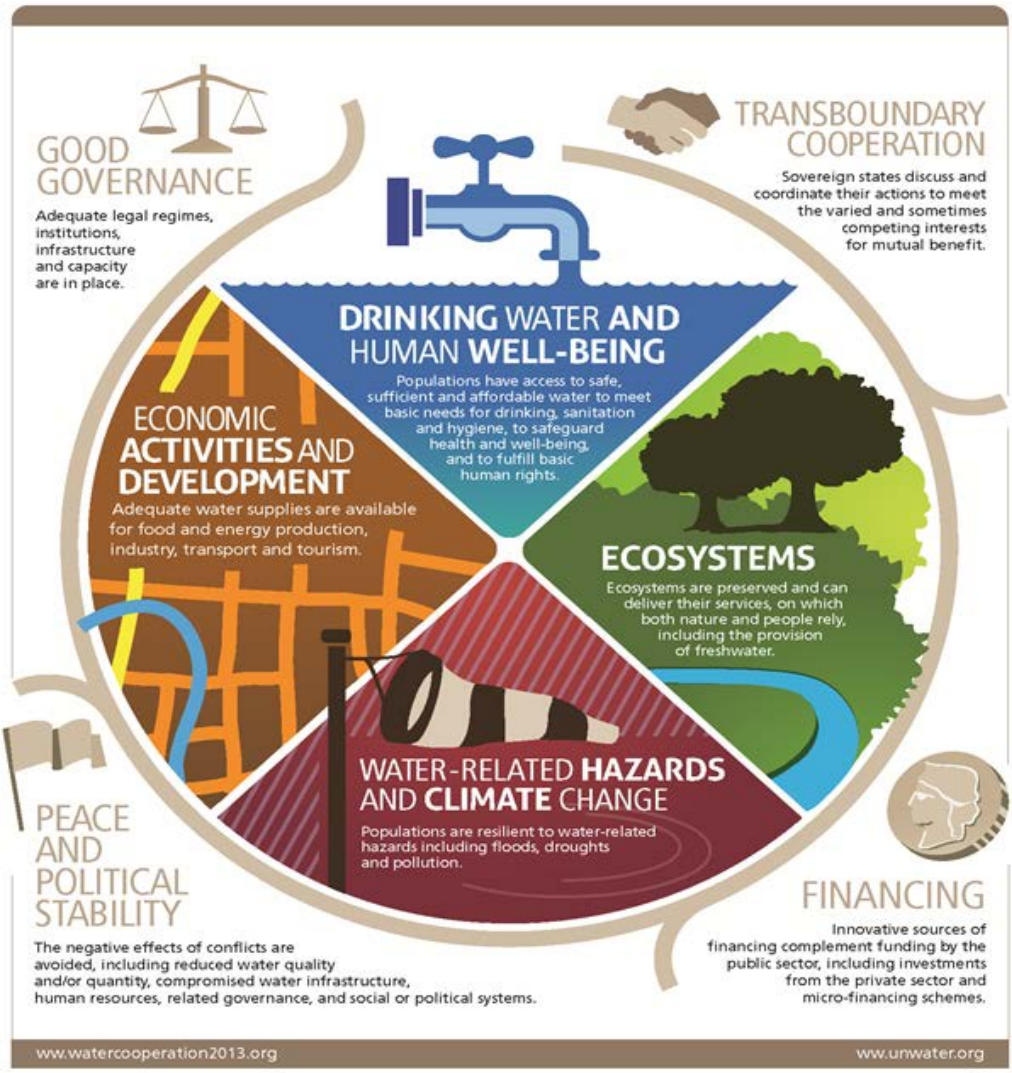


Figure 3. UN Water conceptual framework and core elements necessary to achieving and maintaining water security

Unlike food and energy security, water security needs to be considered in terms of both absence and presence having the potential to be a threat and thus uniquely bringing a destructive quality[32]. Access to water, healthy environment and food is a Constitutional human right, while access to energy is not.

[32] Grey, D. and Sadoff, C.W., 2007. Sink or swim? Water security for growth and development. *Water policy*, *9*(6), pp.545-571.

While many of the concepts embedded in water security are consistent with past water planning in the country, explicit formulation and use of water security framework for South Africa reflect a slight departure from past approaches as it advocates for a paradigm shift in recognition of developmental planning beyond simply balancing supply and demand as well as excessive focus on abundance or scarcity. This is informed by the developments over the years regarding focus on water security which takes into account increased global interconnectedness and the associated virtual water trade. Framing water security at national level is meant to capture in various ways our capacity to ensure availability and access to water by embracing sustainability and responding to various risks, vulnerabilities, insecurities, inequities and policy challenges that societies and ecosystems face (see also Box 1).

Box 1. Core elements to achieve water security

- Collaborative approaches to transboundary water resources management within and between countries to promote freshwater sustainability and cooperation;
- The ability to cope with uncertainties and risks of water-related hazards, such as floods, droughts and pollution, among others; and,
- Good governance and accountability, and the due consideration of the interests of all stakeholders through
  - appropriate and effective legal regimes;
  - transparent, participatory and accountable institutions;
  - properly planned, operated and maintained infrastructure; and
  - capacity development.

In this context for South Africa, the most suitable definition of water security[33] should reflect that it *"is less about obtaining water, and more about fostering human capabilities as they relate to water..."*. It must address the social, cultural and political relationships with water resources and flows that advance a life that fosters human dignity and how those relationships are secured to facilitate the freedom to achieve wellbeing, fulfilling social arrangements, and human flourishing. In this context,

> *"water security, is not simply a state of adequate water – however defined – to be achieved, but rather a relationship that describes how individuals, households, and communities navigate and transform hydro-social relations to access the water that they need and in ways that support the sustained*

[33] Jepson, W., Budds, J., Eichelberger, L., Harris, L., Norman, E., O'Reilly, K., Pearson, A., Shah, S., Shinn, J., Staddon, C. and Stoler, J., 2017. Advancing human capabilities for water security: A relational approach. *Water Security*, *1*.

development of human capabilities and wellbeing in their full breadth and scope"[34]

Considering water security in this way therefore, it is possible to contribute to achieving the ultimate vision espoused by the NDP of rising living standards, falling poverty and inequality as well as restoring the dignity of the people.

Post-Apartheid South Africa is widely recognised to be among the countries (e.g. Bolivia, Uruguay, and Ethiopia) that have a constitutionally recognised human right to water and embracing equity, justice and sustainability[35]. The focus on water security for human well-being and environmental sustainability is reflected in the concept of the reserve[36] and assumes the right to access water as a right inherent to the human condition. South Africa's water policy and legislation consider the right to water as a natural right, which, like any natural rights, is a usufructuary[37] right. It is a right to use water from a source which does not translate to the ownership of the source itself, i.e., water may be used, but not owned. As it will be argued in this framework, this is the basis of the principle of "full value chain or water cycle ownership" and the call for paradigm change (Box 2). This is among the main reasons why water security differs from energy, food, land and other basic needs such as transport, communication etc.

Box 2. Water security – a different paradigm

Water Security is not just about water but a mindset - a different paradigm.

The NWSF is a high level guide for implementation of the NDP focusing on water security. It provides clear achievable short, medium and long term actions that need to be implemented in order to achieve NDP targets

1.2.2. What is a framework for water security?

A simple definition of a *framework* is a particular set of rules, ideas or beliefs which are used in order to deal with problems or to decide what to do. It sets a scope and limits within which to systematically execute a programme or programmes or nationally agreed policies and strategies. It takes a long term view to inform the current actions, and can touch on:

[34] Ibid

[35] Jepson, W, Wutich, A and Harris, LM. 2019. Water security capabilities and the human right.

[36] **The Reserve** is defined in the NWA 36 of 1998 as the quantity and quality of water required to satisfy basic human needs by securing a basic water supply, and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

[37] **Usufruct** is a legal institution in which someone, who is not the owner, is given the right to use and enjoy the benefits and advantages of something belonging to another as long as the property is not damaged or altered in any way, for a certain period of time. It is by definition a limited right.

- identifying future water sources for a growing population and the attendant future water resources development options;
- the operation and maintenance of water and sanitation infrastructure;
- the management and restoration of ecological infrastructure;
- the proper management of water quality;
- water supply services;
- resilience of a country to climate change impacts; and,
- water conservation and water demand management.

In South Africa, the dawn of democracy brought about a process of developing and implementing a framework governing water that is complex and dynamic which was aimed at managing water with significant participation by the people[38]. The policy and legislation framework promotes a coordinated approach to management of water, land and related resources in order to maximize the resulting economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. A typical example of a framework is the European Water Framework Directive (WFD) which introduced a shift in water management, placing ecology at the centre of decision-making.

This framework is founded on the constitutional mandate relating to water which gives every person a fundamental right to an environment that is not harmful to his or her well-being, and requires the environment to be protected for the benefit of the present and future generations. The water policy, legislation and other measures provide protection of the environment while promoting justifiable economic and social development.

At the outset we must as a matter of course accept that water management networks have grown in complexity as they are expanded, interconnected and diversified to meet the challenges of climate variability, climate change, population growth and socio-economic development needs. Practitioners, managers and decision-makers across the entire spectrum need to ensure that operating rules for the systems from local to highest level satisfy multiple objectives, such as: maximising water security, reliability and environmental flows; and minimising operational cost, flood risk and energy use.

Framing of water security has become more diverse, expanding from an initial focus on quantity and availability of water for human uses to include water quality, human health and ecological concerns[39]. A broad and integrative conceptualisation of water security has emerged as a major framing template[40], and the utility of the approach in water governance, while recognising constraints that arise in the context of implementation

[38] Thompson, H. 2006. Water Law – A practical Approach to Resource Management and the Provision of Services. Juta and Co. Ltd.

[39] Cook, C and Bakker, K. (2012). Water security: Debating an emerging paradigm. Global Environmental Change 22 (2012) 94–102.

[40] Gerlak, A. K., House-Peters, L., Varady, R. G., Albrecht, T., Zúñiga-Terán, A., Routson de Grenade, R., Cook, C., Scott, C.A. (2018). Water security: A review of place-based research. *Environmental Science and Policy 82 (2018) 79–89.*

and management, has become critical key in the planning for water management and provision of service.

1.2.3. The Relevance of Water for Growth and Development and Sector Masterplan

Water security is much more than looking at basic needs – it takes into account other needs. Its focus is on livelihoods (beyond basic or subsistence) and, as articulated or implied elsewhere in this document, the key issue is socio-economic development. An argument needs to be made around "water for growth and development" or simply how water can contribute to economic growth that is inclusive and just.

South Africa's awareness and elevation of water security gained prominence following the 2006 Fourth World Water Forum (WWF4), which was reflected in the theme document "*Water for Growth and Development*"[41]. Ultimately, the then Department of Water Affairs and Forestry (DWAF) developed a framework for growth and development (WfGD)[42] aimed at guiding actions and decisions to ensure water security in terms of quantity and of quality to support South Africa's requirements for economic growth and social development – as required by the Constitution of the Republic of South Africa of 1996. The Development Bank of Southern Africa (DBSA) commissioned a number of papers on water security covering a number of aspects as interpreted at the time[43].

The evolution of water security has seen the refinement of earlier conceptual framing as evident from the report of the Global Water Partnership (GWP) [44] and the Organisation for Economic Co-operation and Development (OECD) Task Force on Water Security and Sustainable Growth[45]. The framing takes into account key issues of risks associated with water insecurity and links to socio-economic development (growth, wealth and wellbeing). Risks would include climate and poor water governance – leading to scarcity, which in turn has an impact on national security. Scarcity or supply and demand are no longer the main drivers of water security for sustainable development, but rather a complex set of elements such as human/community security (vulnerability),

[41]"Water for Growth and Development." David Grey and Claudia W. Sadoff in Thematic Documents of the IV World Water Forum. Comision Nacional del Agua: Mexico City. 2006.

[42] DWAF, 2009. Water for growth and development version 7.

[43] Muller, M., Schreiner, B., Smith, L., van Koppen, B., Sally, H., Aliber, M., Cousins, B., Tapela, B., Van der Merwe-Botha, M., Karar, E. and Pietersen, K., 2009. Water security in South Africa. *Development Planning Division DBSA: Midrand, South Africa*.

[44] Beek, E.V. and Arriens, W.L., 2014. *Water security: putting the concept into practice* (No. 20). Global Water Partnership.

[45] Sadoff, C.W., Hall, J.W., Grey, D., Aerts, J.C.J.H., Ait-Kadi, M., Brown, C., Cox, A., Dadson, S., Garrick, D., Kelman, J., McCornick, P., Ringler, C., Rosegrant, M., Whittington, D. and Wiberg, D. (2015) Securing Water, Sustaining Growth: Report of the GWP/OECD Task Force on Water Security and Sustainable Growth, University of Oxford, UK, 180pp

national security, water resources, ecological security, social (health, spiritual and religious) usage security, food security, energy security and climate security[46].

The National Water and Sanitation Master Plan (NWSMP)[47] on the other hand, is intended to guide the water sector with investment planning for the development of water resources and the delivery of water and sanitation services until 2030, and beyond. The core purpose of the NWSMP is to provide an overall perspective of the scope of the water and sanitation business to provide a comprehensive schedule of actions needed to address present challenges, to estimate the investments required to ensure effective water resources and water and sanitation services delivery, as well as to facilitate effective integrated investment planning, implementation of actions and evaluation of achievements.

The NPC's assessment confirms the analyses by institutions such as the World Bank, Asian Development Bank, United Nations and the World Economic Forum which rates water security as one of the risks and strategic challenges confronting humanity. This is primarily due to a serious and worsening supply/demand imbalance and declining reliability of water supply caused by rapid population growth and industrialisation, over-extraction of water, widespread pollution and climate change. An international journal titled "*Water Security"*, was launched in 2017 to publish papers that contribute to a better understanding of the economic, social, biophysical, technological, and institutional influencers of current and future global water security. This development underscores the fact that the issue of water security provides greater consideration of human values, ethics and power and complement the concept of integrated water resources management (IWRM)[48] which in South Africa is done at catchment level. From a water security perspective, water resources should not be treated in isolation, as if independent of the food, climate or energy security of individuals, communities and the country. Currently South Africa is struggling to get these approaches fully implemented.

1.3. PURPOSE AND RATIONALE - WHY A NATIONAL FRAMEWORK?

This document has been developed taking into account the current and past approach to water management in South Africa in order to foster better outcomes in the future. It provides a framework for water security at a national level that is meant to guide the sector implementation of the National Development Plan (NDP). This includes ensuring that the commitments made in the NDP vision and gaps identified in the National Water

[46] Halmatov et al. 2017. Water security for productive economies: Applying an assessment framework in southern Africa. Physics and Chemistry of the Earth 100. 258-269.

[47] DWS, 2019

[48] Gerlak, A.K., Mukhtarov, F. 'Ways of Knowing' water: integrated water resources management and water security as complementary discourses, Int. Environ. Agreements: Politics Law Economics 15 (3) (2015) 257–272.

Plan Diagnostic Report (NWPDR) [49] and subsequent assessments are addressed effectively, and efficiently. While many of the concepts used in water security are consistent with past water planning, the explicit formulation and use of a water security framework for South Africa reflects a slight departure from these approaches. The intention is not to repeat existing analysis and proposed solutions but that these are guided to ensure effective implementation while focusing on the long-term horizon beyond 2030. This framework carefully focuses on flow dynamics – in terms of finance, knowledge and other drivers of planning such as population. Instead of overemphasising population growth we focus on dynamics, whilst on the financing we de-emphasise absolute figures and look at flows and impact. Similarly, for environmental flows which are considered over and above water conservation *per se*.

The NWSF deliberately focuses on national priorities, which includes meeting the SDGs. The priorities must be underpinned by a thriving economy, and international obligations in terms of the Africa development agenda within the context of the SADC water protocols. The building blocks of the framework emanate from local, regional, provincial and national needs. The integration provides high-level direction and demands accountability from all spheres of government and social partners (including private sector, labour and civil society) for the implementation of this framework. It is meant to be simplified and properly timed in order to track progress and identify areas needing intervention in order to achieve national objectives. The institutional framing for water security is therefore couched in a manner that these aspects are seamlessly planned and managed taking into account the interdependencies.

The framework provides an approach to achieving water security in South Africa in the context of the two overall targets in the NDP, of elimination of poverty, and reduction of inequality - by 2030. To achieve this, the NDP highlights a number of enabling milestones and critical actions, the majority of which underscore the centrality of the water in planning for socio-economic development. These resonate with global plans and strategies such as Africa 2063 and UN's SDGs. This framework seeks to articulate the link between how achieving water security contributes to achieving the SDG targets and improved planning for delivery and sustainable socio-economic development. It identifies appropriate measures to reduce the risks to water security such as clearing backlog in water infrastructure (storage enhancement), diversifying water sources (conjunctive water use sometime referred to as "water mix"), improved access to water and sanitation, and improved water governance at all levels.

The NWSF is a perspective that provides several comparative advantages over approaches utilised previously. It is the first of its kind in South Africa in being key to addressing the country's water security challenges in a holistic and decisive manner. With the framework being at the highest level, it must guide the execution of roles and

[49] DPME, 2015. National Water Plan Diagnostic Report

responsibilities and accountability expected from all mandated institutions towards achieving the goals of the NDP, it will, among others:

- Guide all water-related policies across the system in terms of long-term planning and support;
- Strengthen implementation and ensure that it is managed at a level that allows for holistic oversight and fostering of cross-sectoral integration;
- Ensure national accountability linked to authority across the system to address the challenge of sector-specific mandates; and
- Provide cross-sectoral water security through full engagement of stakeholders at all levels.

Figure 4 illustrates the requirements to achieve water security in South Africa[50] as articulated in the NWSMP and the link to the NWSF's focus on three apex priorities of the NDP of inequality reduction, poverty eradication and inclusive economic growth.

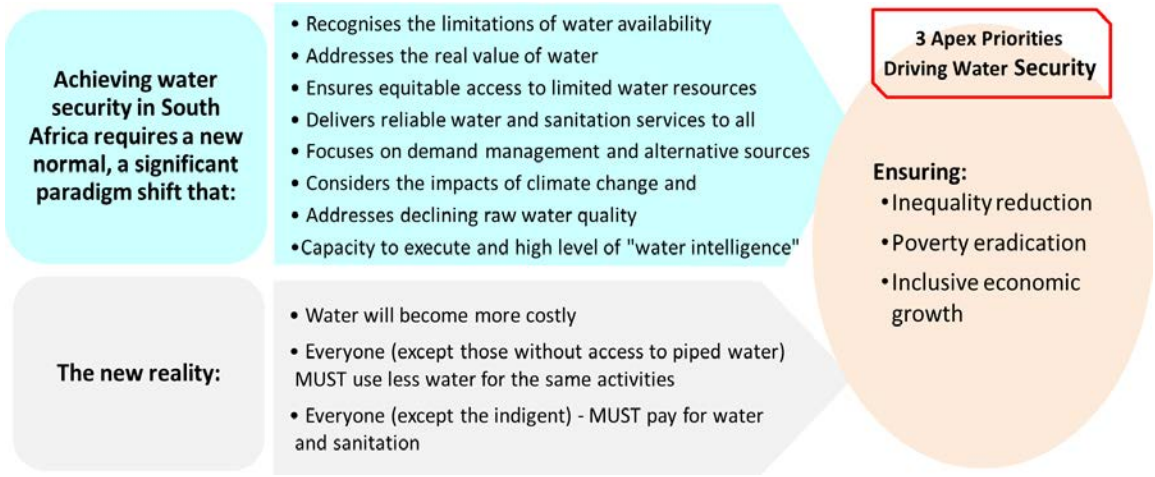


Figure 4. Achieving water security in South Africa

UN-Water[51] points out that achieving water security requires collaboration across sectors, communities, disciplines and political boundaries/borders, to reduce the risk of potential conflicts over water, between sectors and between water users or states. This can range from local in-country conflicting priorities to cross-border or even across continents or region. Of critical importance is to note that such view can be mapped (spatially and temporally) from the lowest level in a village (local scale) through to cross-border between nations or even continents though trade and other multinational activities. In this instance, the impact of virtual water becomes important aspect of development. Water needs to not only support economic development but must be

[50] Modified from DWS, National Water and Sanitation Masterplan. Vol.2. 2018. p 2-6

[51] Water security and the global water agenda. A UN-Water Analytical Brief. 2013

able to catalyse and in certain situations create economic development. The framework provides an opportunity to address these issues.

Addressing the sustainable development goal 6 (SDG 6), clean water and sanitation, water security requires transdisciplinary collaboration across sectors, communities and geopolitical boundaries, as well as competing priorities or potential conflicting demands or expectations. A transdisciplinary approach is a systems approach not based on a functional or silo approach and covers among others, ethics, politics, law, environmental flows, and economics.

Any framework or plan needs to be sufficiently comprehensive and integrated to cover all necessary bases. For instance, with respect to capacity it would be incomplete or even risky to focus only on infrastructure development if the paucity of engineers in the water sector is not addressed. At the same time, a balance of requisite skills sets covering a full spectrum of all the dimensions necessary to fulfil the implementation as expected or planned in context of policy, legislation and institutional setting is essential. This takes into account the globally accepted notion that most water ills are outside the "water box". Whilst it may be true that the framework should be comprehensive, it needs to be prioritised, clear and to the point. Further, it would equally be futile to use the same information and models that may have reached their limits in respect of robustness to respond to current and future challenges. These two areas of capacity and planning approach can be seen as among the most serious shortcomings of the current water and sanitation planning and management regimes within the sector in South Africa. These shortcomings are recognised in the draft NWSMP and detailed proposals for the development and implementation of a long-term plan (to be updated bi-annually) for the turn-around of water supply and sanitation services in the country is incorporated. The proposals include detailed actions, assigns roles and responsibilities and completion dates for better water planning and management; improved water information systems; as well as training for water managers.

From South Africa perspective it is important to note that firstly, water security at an individual or household or local community level means having sufficient water to meet basic needs. Household water security is an essential component in efforts to eradicate poverty and support economic development. Currently in South Africa, this is defined as 25 litres per person per day, but research has shown that when water is carried, consumption drops to less than half of this daily requirement. Even at this lower figure, it is dependent on water actually being available. Although infrastructure has been provided in many cases (approximately 30% of the schemes), they do not meet the functional criteria set out in the Strategic Framework for Water Services (2003). Invariably the non-functioning schemes are those with communal taps rather than in-house supply.

The challenges faced by these sections of the population with meeting the basic water needs impact on their ability to improve their standard of living and have water for productive purposes. The exclusion of certain sectors from access to water for

productive purposes results in the water sector promoting inequality, which is contrary to the principles set out in the National Water Act, (see Box 3). Water security at this level is the constitutional responsibility of local government sphere with national government playing an oversight and regulatory role.

Box 3. Preamble to the National Water Act, 36 of 1998

PREAMBLE TO NWA

- Recognising that water is a scarce and unevenly distributed national resource which occurs in many different forms which are all part of a unitary, interdependent cycle;
- Recognising that while water is a natural resource that belongs to all people, the discriminatory laws and practices of the past have prevented equal access to water, and use of water resources;
- Acknowledging the National Government's overall responsibility for and authority over the nation's water resources and their use, including the equitable allocation of water for beneficial use, the redistribution of water, and international water matters;
- Recognising that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users;
- Recognising that the protection of the quality of water resources is necessary to ensure sustainability of the nation's water resources in the interests of all water users; and
- Recognising the need for the integrated management of all aspects of water resources and, where appropriate, the delegation of management functions to a regional or catchment level so as to enable everyone to participate;

NWA, 1998

Secondly, water security at a national and sub-regional level. The inclusion of the sub-region is crucial as South Africa shares its river basins with neighbouring countries and, in accordance with the SADC protocol on shared watercourses, must jointly manage them.

The question that faces the Southern African region is; how after reserve for basic human needs and environmental considerations have been met' can it manage the remainder of the finite water resources available, to achieve sustainable economic growth. Since water is a finite resource it is not possible for demand to continue to increase *ad infinitum*; at some point it must plateau. As South Africa approaches that plateau or limit, the questions that need to be answered are:

- Is South Africa using water in the most efficient manner possible and, if not, how does the country achieve the required changes so that it does?
- If it is, which sectors are able to make the most productive use of the available water given the current use of water as per sector?

Water security at this level is the constitutional responsibility of National Sphere Government. The executive authority is assigned to the Minister responsible for Water

and Sanitation in terms of the National Water Act who ensures it takes place through the regulation of water services (efficient use of water and prevention of pollution of the resource from sanitation) and the overall responsibility for and authority over the nation's water resources and their use. Although national government (as public trustee of the nation's water resources) has overall responsibility for the nation's water resources, actual implementation often takes place at local (municipal and household) level with little or no direct input from national government. This particularly applies to water supply schemes that fall wholly within a municipal area and are operated by the municipality and household operated systems such as wells, boreholes and rainwater harvesting as well as sanitation services. To this end, these are the areas where local economy becomes highly significant.

Factors contributing to water security generally lie outside the "water sector box" which affects decisions on water.

Some key drivers of water security that are largely outside the "water box":

- Level of economic development;
- Financing, which is often supported by prioritization/recognition of water as key foundation to viability of related sectors;
- Strength of governance;
- Economic regional integration;
- Peace and political stability (may be similar to regional integration); and
- Socio-economic development.

The notion of decision making affecting water being outside the water box is illustrated in Box 4. This underscores the importance of the complex systems arrangement which demonstrate the interdependencies beyond scarcity and/or abundance in the context of water security.

This context informed the NWPDR which was structured around some of the following broad questions:

- How likely is South Africa to experience water shortages[52] in the same way that energy shortages were experienced in the recent past?
- How far are we from such a scenario?
- What form is the challenge likely to take?
- What would it take to avert the shortages and what are the key interventions required?
- State of planning: how prepared are we to respond to such a scenario should it arise?

[52] Noting that access to sufficient water is a fundamental Constitutional right whilst access to electricity is not a fundamental Constitutional right, although it might affect other rights such as a right to dignity.

- Where are the gaps in knowledge, planning and implementation?

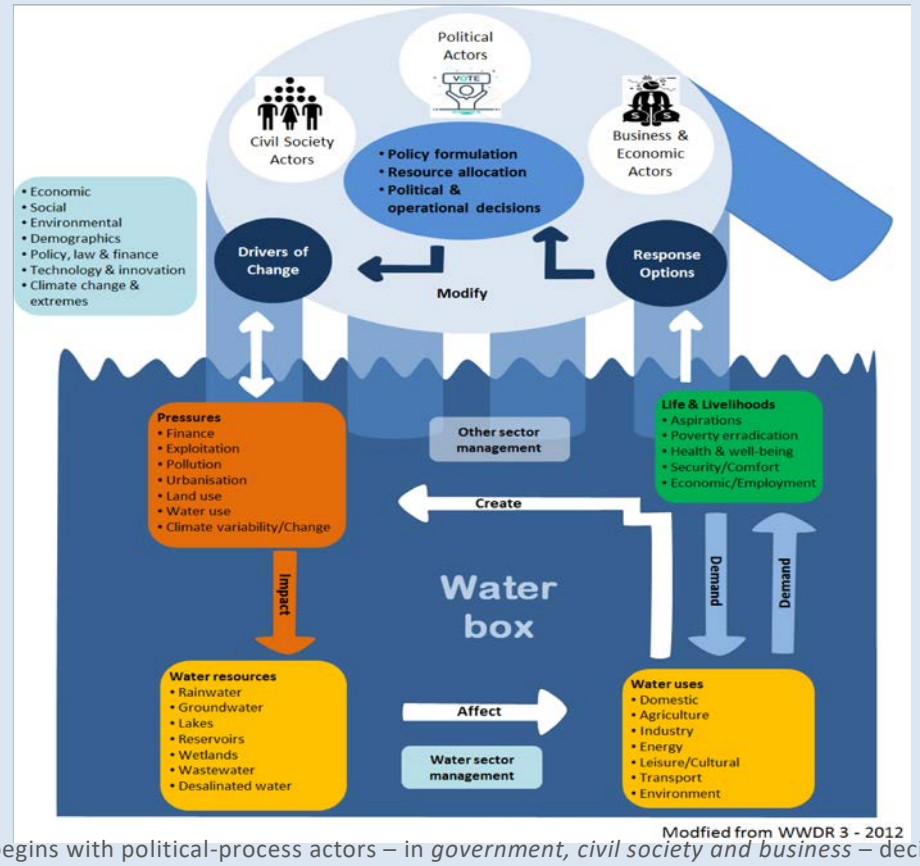
The NWPDR produced is a synthesis of the current situation in the water sector, although a number of nuances can be added which are critical to ensuring a workable turnaround towards a water secure South Africa. In developing the Water Security Framework in the context of the NDP, key questions that are frank need to be asked by re-emphasising and elaborating on areas that may not have been explicitly diagnosed or reflected. Such questions may include the impact of loss of apartheid based agricultural subsidy to the game farming and tourism industry on one hand and the agricultural landscape on the other. To this end, the consistent creation of employment in the tourism industry may need to be assessed against the backdrop of change in the agricultural landscape and real water use. It may be argued that the questioning of 63% agricultural water use[53] is not relevant given the economic footprint which that sector brings. Besides, this number tends to include only irrigated agriculture whilst the new policy regime is that every water use, direct and in direct is expected to be authorised, licenced and accounted for! In short there are questions of accounting for all water use that need to be had.

[53] DWA, South Africa 2015

Box 4. The water box as the realm of water sector management

Many paths to sustainable development are linked to water, but the decisions that determine how water resources are used or abused are not made by water managers alone. This was a central theme of *The United Nations World Water Development Report 3* as illustrated in the figure below.

The *Water box* is the realm of *water sector management.* *W*ater managers inside the water box and *managers of other sectors* oversee their own management–resource-use interactions. Above them are the actors who make or influence broad socioeconomic policies that affect water.



The cycle begins with political-process actors – in *government, civil society and business* – deciding on socio-economic development objectives and *formulating policy* and *operational decisions* to achieve them. Their decisions, which respond to *life and livelihoods* requirements, are implemented in a context of externalities – often beyond their direct control – that interact with and modify *drivers of change,* creating *pressures* on land and water resources (among others).

Water resources managers address the demands of *water uses* to meet the *life*-sustaining requirements of people and other species and to create and support *livelihoods.* In doing so, they may add to – or reduce – the *pressures* caused by these drivers. However, their actions may fall short of their objectives because of constraints related to inadequate water, financial or human resources or because the external forces are behaving in unforeseen ways. Making progress thus requires returning to the original political actors in the decision-making process for responses that take these constraints into account.

Needed in place of this discontinuous decision-making process is one in which water managers inform the initial decision-making and participate in planning the appropriate responses, interacting with the principal actors and with the managers of other sectors.

Source: WWDR 3 - 2012

The development of the national water policy and subsequent codification of water law and post-apartheid transformation has led to the development of what is regarded as among the best policies and legislative regimes in the world. The principles and objectives of South Africa's Water Policy and Legislation are still as relevant today as they were when they were approved by Cabinet more than two decades ago. More recently, South Africa through the NDP recognises the need to ensure universal access to clean water as a right which is given further impetus through its commitment to the SDGs, specifically SDG 6 (Box 5).

Box 5. SDG Goal 6 targets

Goal 6 Targets: (Ensure access to water and sanitation for all). By 2030:

- achieve universal and equitable access to safe and affordable drinking water for all;
- achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations;
- improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;
- substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity;
- implement integrated water resources management at all levels, including through transboundary cooperation as appropriate;
  - protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes;
  - expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies;

Support and strengthen the participation of local communities in improving water and sanitation management.

1.4. HISTORICAL CONTEXT

In South Africa, the linkage of schemes and systems enhances water security together as cost efficiency is achieved through economies of scale, however as a result of South Africa's history; this resulted in a paradoxical situation. As the demand grew in the urban centres and the centres of mining in the pre-democracy period, these areas had their water security enhanced by the national government, by being able to draw from a number of catchments and rainfall areas. The rural towns and rural areas with dispersed populations still continued to rely on local resources reducing their resilience in times of drought. However, the same infrastructure which gave the urban centres this resilience took water from and passed through the rural areas, which during

apartheid were the reservoirs of manual labour for the urban areas, without serving them. Numerous examples of this continue to exist such as the Tugela-Vaal Scheme which passes through the communities surrounding Woodstock Dam and the Vaal River Eastern Subsystem Augmentation Project (VRESAP) which passes through the Dipaleseng (Balfour and Greylingstad) Local Municipality, with an estimated population of 46 000 people and 38 % of whom receive piped water (Stats SA).

A reading of the 1956 Water Act (Water Act No. 54 of 1956), is instructive as it gave the Minister the power to establish both irrigation and water boards. They are clearly both national institutions, could both supply the same set of users, with either raw or potable water, what differed is how they functioned. In a water board, users generally had no restriction on when they could take water from the scheme; the board held the license with the Department and the users had no say in the appointment of the board.

In an irrigation scheme the users were restricted on the times they could extract water, generally held the license in their individual capacity and elected the board members. The different structure is a reflection of the more co-operative approach that is required in an irrigation scheme. Where national government has ownership of the common infrastructure the irrigation board acted as an agency for national government. In neither case was a distinction made between potable and raw water.

The 1956 Water Act also empowered the Minister to supply water and sanitation services outside of municipal area (wall to wall municipalities not existing at that time). The Minister was empowered to take a very holistic approach to the supply of water and the provision of sanitation.

Despite the apartheid policies, the former government did, in fact, treat water supply holistically, as can be seen in the construction of Welbedacht Dam and the southern Mangaung potable supply system in 1973 and the Vaal-Gamagara Scheme constructed in 1968. The construction of the Kouga Dam with the supply to Nelson Mandela Bay Municipality is also a good example of this integrated approach, albeit this time within an irrigation scheme.

However, this holistic approach was not expanded in 1994, and the current legislation in the form of the National Water Act, 36 of 1998 (1998 National Water Act) and the Water Services Act 108 of 1997 (1997 Water Services Act) made a distinction between planning for and implementing bulk raw water and water services. The National Water Act and Water Services Act then institutionalised this by putting water boards, which remained national government institutions in terms of the Public Finance Management Act, into the Water Services Act, legislation pertaining to Local Government, restricting their mandate to potable water and giving the impression that Local Government now exercised Executive Authority instead of the Minister.

The Water Services Act was superseded when the Municipal Systems, Municipal Structures and Municipal Finance Management Acts were passed and because it remained on the legislation, conflict was created. The conflict could have been easily avoided by recognising that the municipal acts take precedence and that the regulation

of municipalities is the Department of Cooperative Governance and Traditional Affairs and National Treasury's competency, not the Department of Water and Sanitation. For example, the intention to separate the regulation of water services from the provision, the Water Services Authority and Water Services Provider as set out in the Water Services Act, was undermined as Part 2 of Chapter 8 of the Municipal Systems Act did not mandate this separation thereby allowing a Municipality to be both poacher and gamekeeper. The result has been that municipalities remained completely in control of water service provision, either by keeping it in-house or as a wholly owned subsidiary with billing and revenue collection being retained by the municipality. This allowed political manipulation at municipalities for short-term political gain through allowing tariffs that are not sufficiently cost-reflective to allow for operation, maintenance and capital investment to the long-term detriment of water security, the City of Cape Town being a prime example of not investing sufficiently in water resource management.

The transformation of the Irrigation Boards into Water User Associations as articulated in the National Water Act, 36 of 1998 faced challenges with interpretation of their purpose and membership as well as a lack of understanding of the different types of Irrigation Boards. The result has been that instead of the water sector expanding to provide a sustainable water and sanitation supply to all users it has become increasingly polarised between the different players. It has become increasingly difficult to find sufficient funds to operate, maintain rehabilitate, replace and build new infrastructure.

In order to address these unintended consequences of the policy and legislative reform of the democratic period, the positioning of the NWSF must articulate the critical issues and provide a guide that will ensure that the benefits of the transformation project are realised within a reasonable period.

Whilst acknowledging the significant progress made in the post-apartheid era a historical context is provided to equally acknowledge the challenges and lessons learnt to ensure that the new approach is built on solid foundation. The sections that follow provide key aspects of the Water Security Framework which is also seen as the beginning of change building from the success of and learning from the past.

1.5. STRUCTURE OF THE FRAMEWORK

The NWSF is divided into focus areas and these are outlined in the sections that follow. It includes a chapter dedicated to background and context, which provides an overview and rationale for water security planning and the approach adopted to deal with the question of water security.

The contents have been configured to cover the six key thematic areas highlighted in the diagnostic report and delineated as critical for water security.

1. INTRODUCTION AND BACKGROUND

An introductory chapter on situation assessment, covering background, definition of water security and rationale for the water security framework as well as historical context of water sector as it relates to water security generally.

2. CONTEXT OF WATER SECURITY FRAMEWORK

The chapter provide a developmental context of water security and the South African perspective. It highlights the integrated planning for water resources and provision of water services with a critical focus of systems planning.

3. CHALLENGES AND KEY ISSUES

Chapter 3 highlights key challenges associated with water security in South Africa

4. SCOPE PRINCIPLES AND APPROACH

Chapter 4 provides a proposition for the water security from NPD implementation perspective as well as the principles and approach required in planning for water security.

5. WATER SECURITY FOCUS AREAS

Chapter 5 is the core of the framework which focuses on 10 focus areas. The introductory sections provide a contextual overview on natural system, socio-economic and the economics of water as well as administrative and institutional system generally. The 11 focus areas are designed to cover a full spectrum of topical areas which will allow a transdisciplinary approach to water security for the country.

These areas are deliberately organised into the main framework and supporting focus areas, as illustrated in Figure 5 below, to reflect the complexity of the interdependencies, as well as the transdisciplinary and nexus nature of the water challenges.

6. OVERSIGHT, MONITORING AND EVALUATION

This chapter covers oversight and performance monitoring of the implementation of the framework taking into account the fact that this should be done from outside the current Monitoring and Evaluation that is located within the government machinery.

7. CONCLUDING REMARKS AND RECOMMENDATIONS

Chapter seven provides concluding remarks and makes some key recommendations.

8. REFERENCES

Extensive reference materials that have been consulted to augment the analysis and stakeholder consultation process.

9. ANNEXURES

The document closes with annexures aimed at key policy issues on water and sanitation as well as process followed in the development of the framework.

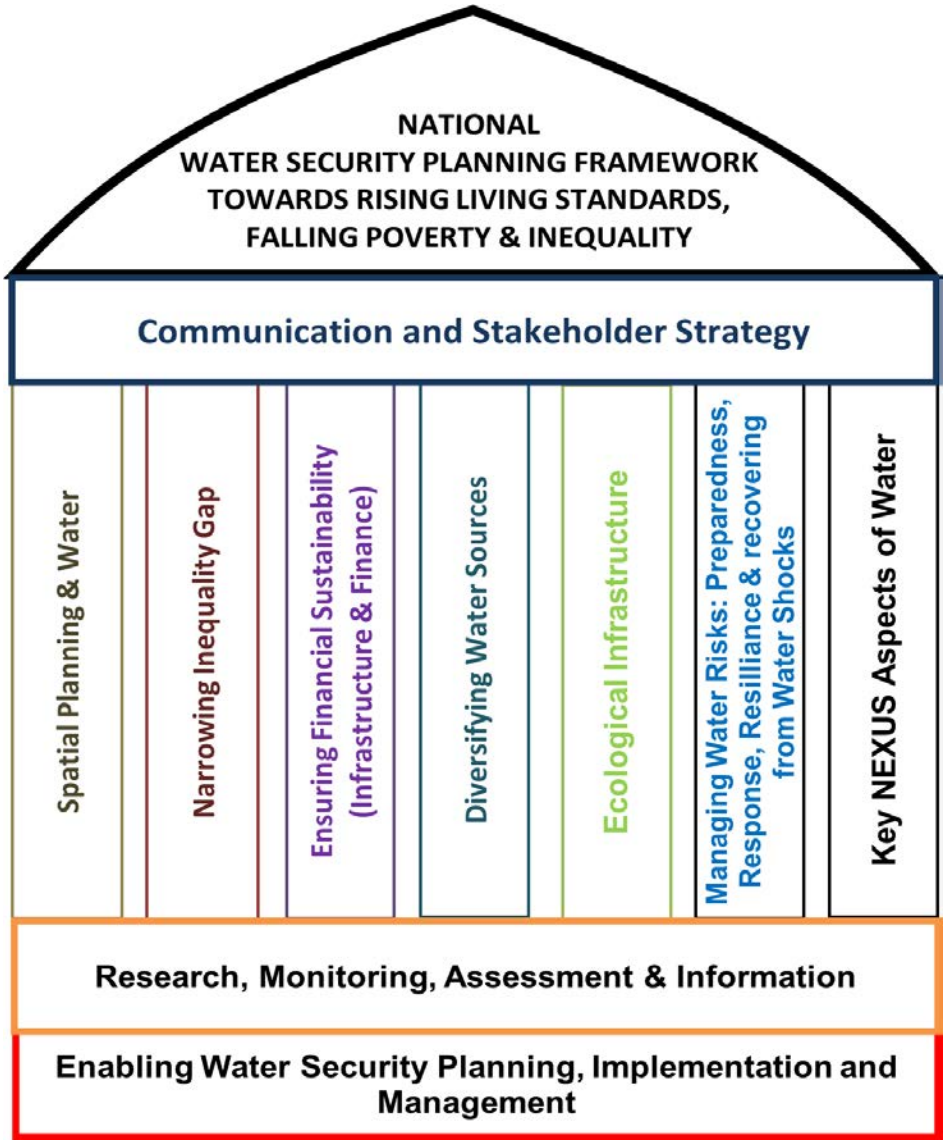


Figure 5. Water security framework with supporting thematic areas

2.
WATER SECURITY FRAMEWORK CONTEXT

We forget that the water cycle and the life cycle are one.

Jacques Yves Cousteau

2.1. WATER SECURITY IN THE CONTEXT OF NATIONAL DEVELOPMENT PLANNING

The development of the NWSF is based on South Africa's stated approach of a developmental state which is generally characterised by having strong state intervention[54], as well as extensive regulation and planning balanced by participatory democracy and progressive realisation of the transformation imperatives. Within this context, the attainment of the developmental state will not be complete if it does not include equity and redress of past imbalances created as a result of the apartheid system and the colonial legacy.

In this report water security has been defined in the context of South Africa's development agenda (Box 6) and made a case for a WSF that offers an encompassing perspective that provides several value adds/comparative advantages over past approaches. The NDP employs a human capabilities framework for development that assumes that a capable nation is the result of enhancing the capabilities of people through a capable State and inclusive economy[55]. The NDP can be a powerful tool for plotting the path ahead toward a reconfigured society and economy.

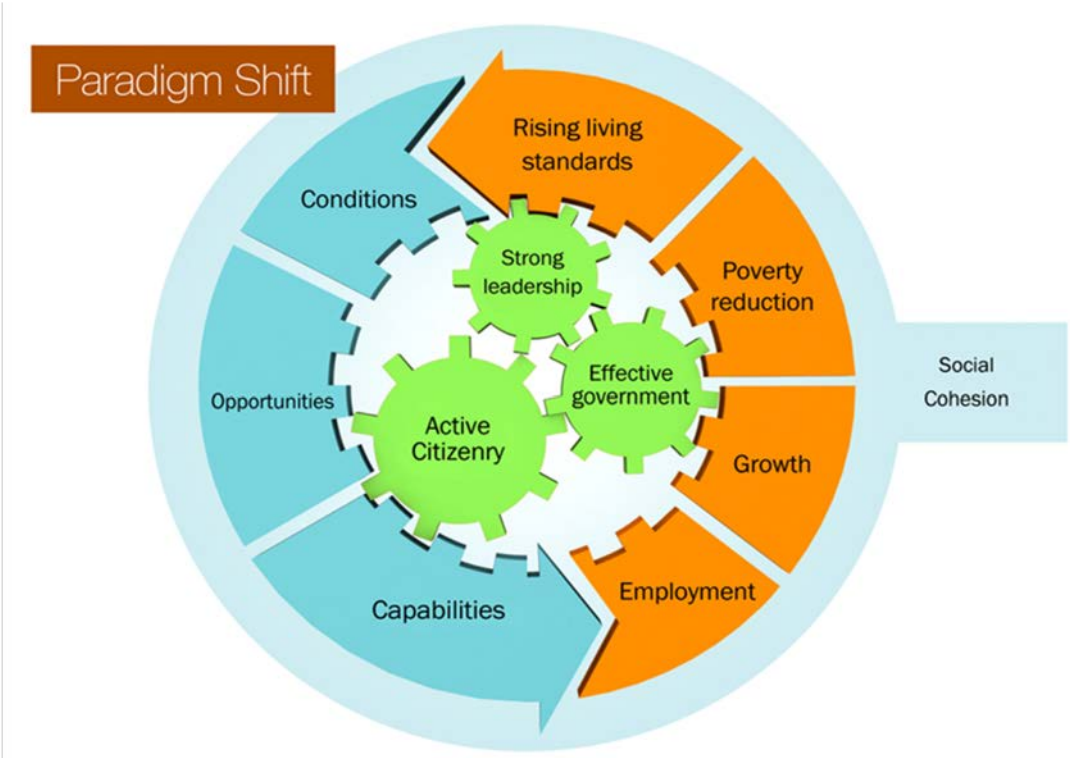
[54] Musamba, C. and Meyns, P., 2010. The Developmental State in Africa: Problems and Prospects in Institute for Development and Peace. *University of Duisburg-Essen*.

[55] National Development Plan, 2011

Box 6. Virtuous cycle of growth and development

"In pursuit of a '*virtuous cycle of growth and development*' as espoused in the National Development Plan – the Vision for 2030, water security has been identified among the key pillars. Its importance is appreciated within the context of a water sector legislative and institutional framework that is considered well developed and among the most progressive in the world. The framework is premised within a decentralisation agenda that is given effect through an intricate web of laws and institutions – at a national and local level. It also establishes a basis for integrated water resource management and a human rights dimension to sustainable water services. This is set out against a backdrop of a country that is largely semi-arid and with limited water resources, but which has an elaborate infrastructure network at both a water resource and water services level."

National Water Plan Diagnostic Report, 2015



Developmental cycle as presented in the NDP reflecting the close link between capabilities, opportunities and employment on social and living conditions.

NDP

Planning for water security at NDP level and context must include thinking in the medium- to long-term (at least 2030) horizon and align the current situation in respect of the outcomes and impact. From a developmental planning perspective, the two key overall targets as reflected in the NDP, on elimination of income poverty and reducing inequality – require enabling milestones and critical actions, most of which underscore

the centrality of water in planning for socio-economic development. Investment in water security is a long-term pay-off for human development and economic growth, with immediate visible short-term gains.

Three basic factors that determine water security can be identified[56] as follows:

- The *hydrologic environment* which, for the purpose of this document, could be referred to as the biogeophysical environment, i.e. mainly the natural legacy inherited by society;
- The *socio-economic environment* which, is economic structure and the associated behaviour of its actors which reflect natural and cultural legacies and policy choices. In the South African context this includes the legacy of inequalities resulting from decades of exploitation, discriminatory policies and the resultant inequality, and the need for redress at fundamental level. To this end the policy of developmental state is critical and requires assessment and analysis within the context of the water sector.
- The *future environment* inclusive of sustainability, global change, and climate change and adaptation. In the context of the NDP, this is critical as it is related to long-term planning based on the current scenario.

These factors play an important role in determining the institutions and the type of infrastructure needed to achieve water security. The six thematic areas identified in the diagnostic report[57] fall within these three broad factors, namely

- *The* water demand and supply situation
- Impact of extreme climatic events and climate change
- Infrastructure asset management and functionality
- Infrastructure planning and development
- Institutional and regulatory framework
- Human capital and *institutional capacity*

These are further elaborated under the chapter on challenges below.

2.2. PLANNING FOR WATER SECURITY – THE SOUTH AFRICAN EXPERIENCE

The experience of South Africa is characterised by limited and variable water resources has placed serious constraints on its development alternatives. As a result, South Africa has had a long history of innovation and investigation in water resource management

[56] Grey, D. and Sadoff, C.W., 2007. Sink or swim? Water security for growth and development. *Water policy*, *9*(6), pp.545-571.

[57] National Water Plan Diagnostic Report, 2015

(WRM), albeit skewed to the benefit of a minority of the population. The 20th century saw the growth of mining and industrialisation along with an extensive programme of infrastructural development in South Africa, including water infrastructure.

Over time, since the early 1990s, South Africa has transitioned from a focus on water resources development for supply expansion, to more balanced approach of water resource management. Government programmes were carefully guided to address this shift, including a new framework for water resource analysis which focused on issues such as regulations, institutions, information challenges and available technical expertise. Systems analysis modelling was used to address the various challenges including interdependencies as they relate to supply and demand. The socio-economic elements which generally have little to do with scarcity or abundance of water have not been fully addressed through these models for various reasons.

The evolution of water security has seen the refinement of earlier conceptual framing (Figure 6)[58]. The framing takes into account key issues of risks associated with water insecurity and link to socio-economic development. It is now generally accepted that scarcity or supply and demand are no longer the main drivers of water security, but rather a complex set of elements such as human and community security in terms of vulnerability, national security, water resources security, food security, energy security and climate security[59].

[58] Sadoff, C.W., Hall, J.W., Grey, D., Aerts, J.C.J.H., Ait-Kadi, M., Brown, C., Cox, A., Dadson, S., Garrick, D., Kelman, J., McCornick, P., Ringler, C., Rosegrant, M., Whittington, D. and Wiberg, D. (2015) Securing Water, Sustaining Growth: Report of the GWP/OECD Task Force on Water Security and Sustainable Growth, University of Oxford, UK, 180pp

[59] Halmatov et al. 2017. Water security for productive economies: Applying an assessment framework in southern Africa. Physics and Chemistry of the Earth 100. 258-269.

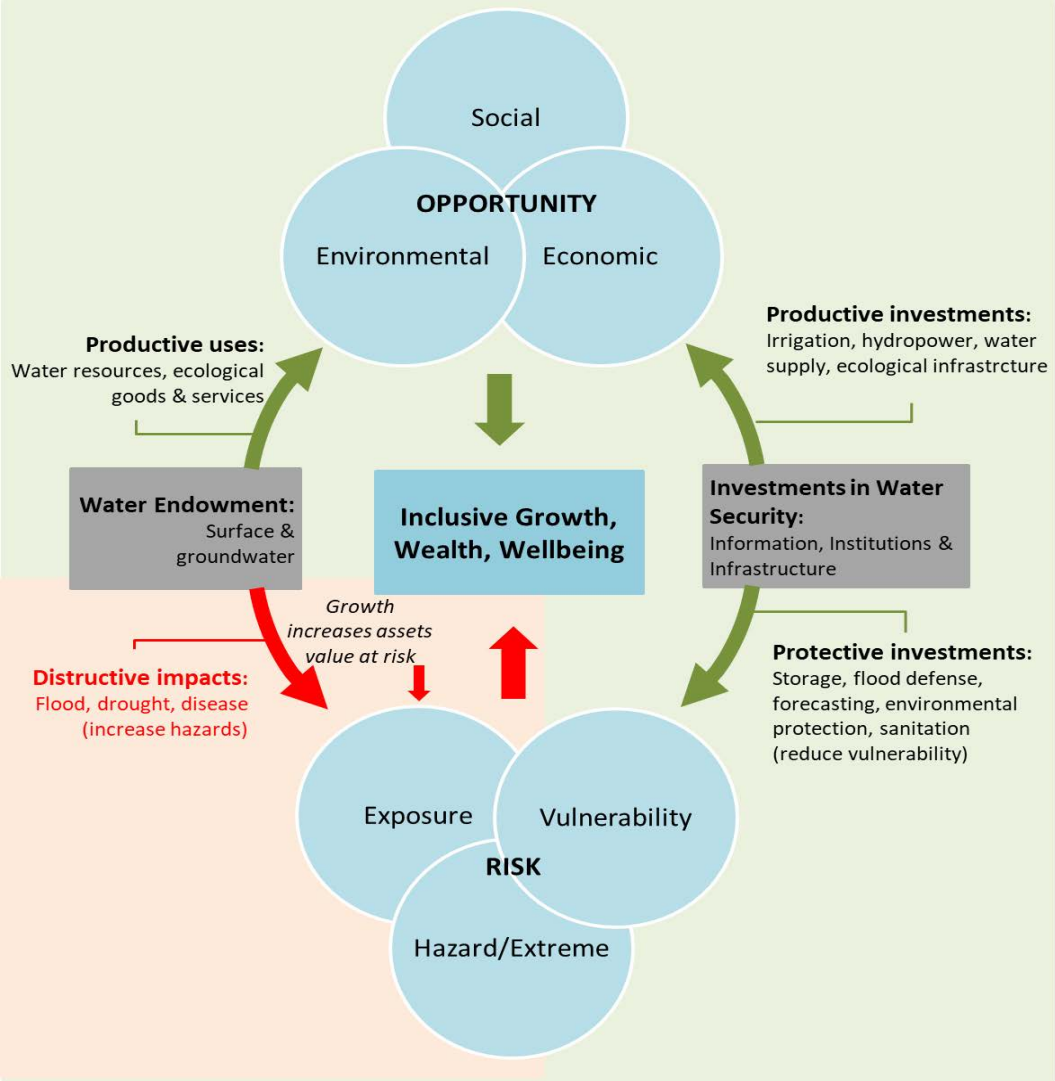


Figure 6. Conceptual framing of the dynamic of water security and sustainable growth[60].

The water policy review that was approved by Cabinet in 2013 and published by the Department of Water and Sanitation (DWS) in 2014[61] recommended that the Minister be accorded the mandate to develop a National Integrated Water Strategy (NIWS) that deals with the full water value chain covering water resource management, water and sanitation services as well as required infrastructure investment. The revised policy further emphasised a multiple water use service (MUS) approach in planning and infrastructure which begins to address issues of socio-economic development, and food security among others – at different scales. A careful assessment of these considerations leads to a conclusion that this is in reality what is now referred to or expected to be the Master Plan or roadmap!

[60] Modified from Sadoff et al. 2015. Securing Water, Sustaining Growth: Report of the GWP/OECD Task Force on Water Security and Sustainable Growth, University of Oxford, UK, 180pp

[61] DWS, 2014

Overall the Water Security Framework must reflect the quality and quantity of water available taking into account the demand required for transformation and national strategic goals, by reflecting on the processes and institutional mechanisms for implementation. While this is covered in the current policy and legislation framework, the problem of effective implementation remains a serious challenge. To date, the water planning in South Africa has been largely based on the response to policy and legislative transformation from the 1956 Act to the RDP policy, the Water Services Act, 103 of 1997 and the National Water Act, 36 of 1998. The current planning regime remains highly influenced by the past reactive approach, which does not necessarily fully utilise tools created for planning such as scenario planning or complex systems approach which look into uncertainty and volatility. The current methodologies may have reached their maximum capabilities given the complexities and changes brought about by the democratic dispensation and engagement in the global space.

2.3. INTEGRATED PLANNING FOR WATER RESOURCES AND PROVISION OF WATER SERVICES

Balancing the pressures of development alongside long-term prosperity for social, economic, environmental and health measures requires a coordinated development and management of water, land and related resources, to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

2.3.1. Water Value Chain and Water Cycle

It is critical that the value chain is appropriately contextualised in the NWSF to ensure that every aspect of service delivery is clear at different levels of governance and associated scale of execution. These contexts will be functional and institutional reflecting both hierarchical and horizontal scope and mandates.

Government, through DWS, takes full responsibility of the whole water cycle management (Figure 7) and the implementation taking place at different locations of the cycle. The cycle management includes

- Supply and demand management
- Environmental flows management
- Water use sector management
- Institutional arrangements – local through to national and across sectors
- Financial flows (including beneficiation or value chain capture)

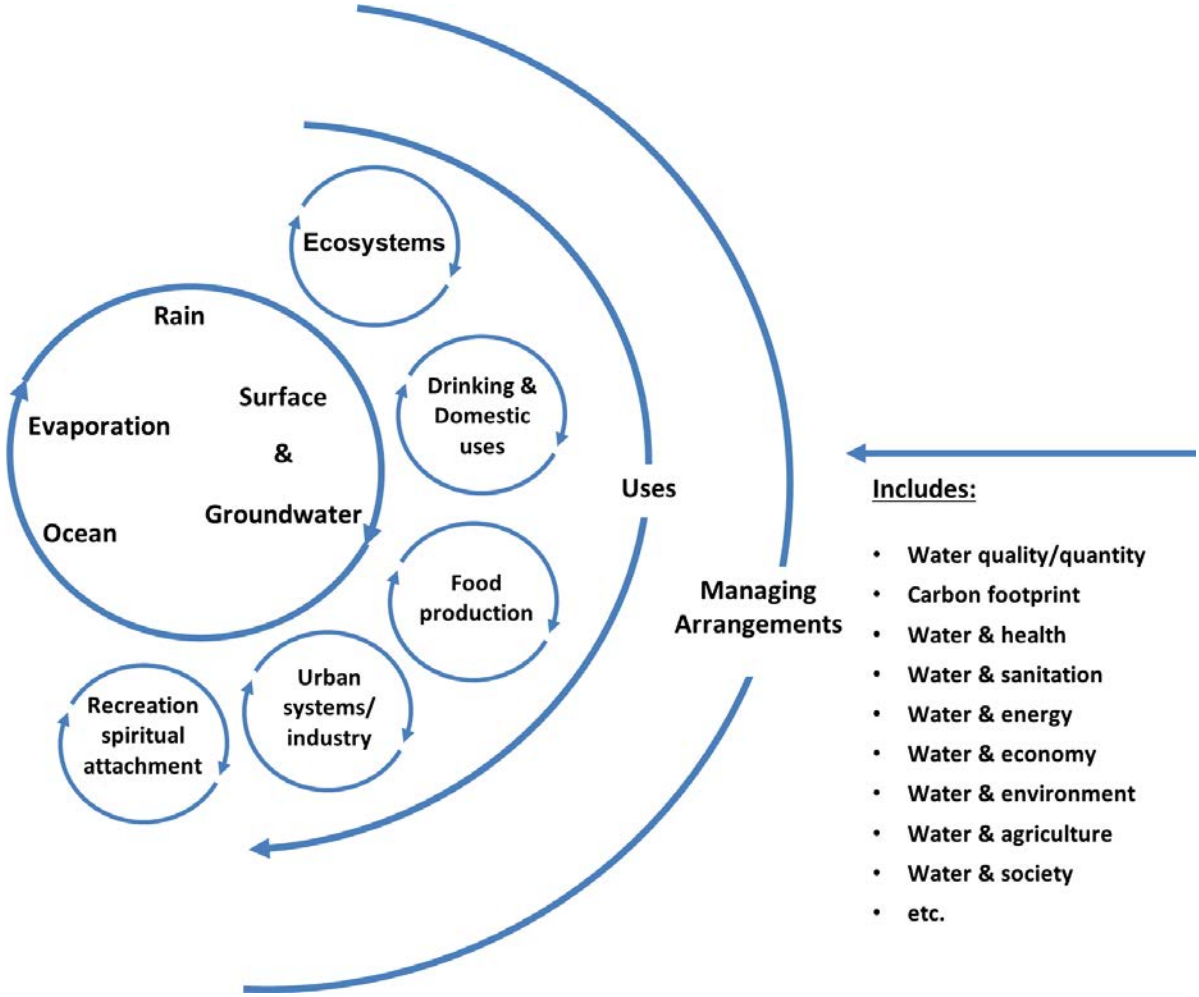


Figure 7. Simplified whole water cycle management at all levels

Figure 7 shows the links to key issues of water and industrilisation, circular economy, fourth indutrial revolution (4IR) and other new concepts linked to the just transition. Institutional setting and programmes designs must take into account inclusive of whole cycle water management.

2.3.2. Institutional and hierarchical context

Figure 8 reflects the water value chain from an institutional perspective and associated tools at different scales of operation. From policy and legislative perspective these tools have been designed to ensure effective functioning of the institutions at different scales.

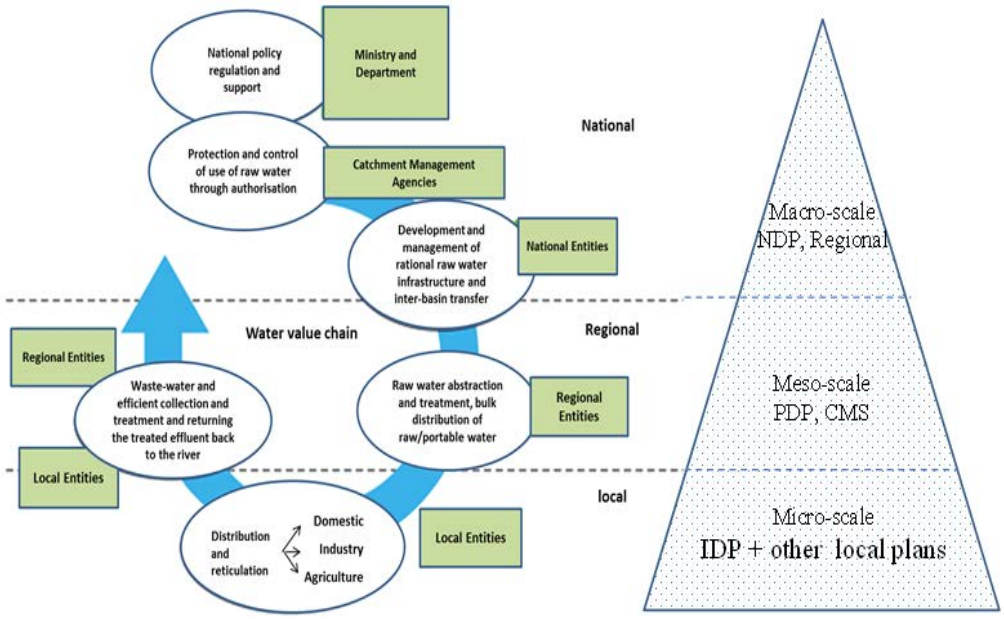


Figure 8. Water value chain in context of institutional positioning from local through to national.

2.3.3. Functional context

Figure 9[62] provides a schematic representation of the functional aspects of the water value chain that may provide insight into the challenges with implementation of policies and legislation in addition to the pressure to provide services to the entire population after 1994. The activities and functions are carried out by various role players in water. Other aspects of the functional value chain that are critical include an understanding of the funding requirements, institutional arrangements, tools for management, financial flows, information flows and the human capital requirements. Functional aspects of water are impacted by the institutional framework that covers a large spectrum of organisations operating at different level within the same space which include involving regulators relating land usage and activities impacting on the water resources.

[62] Modified from DWS, 2013 and Thompson, H. 2018)

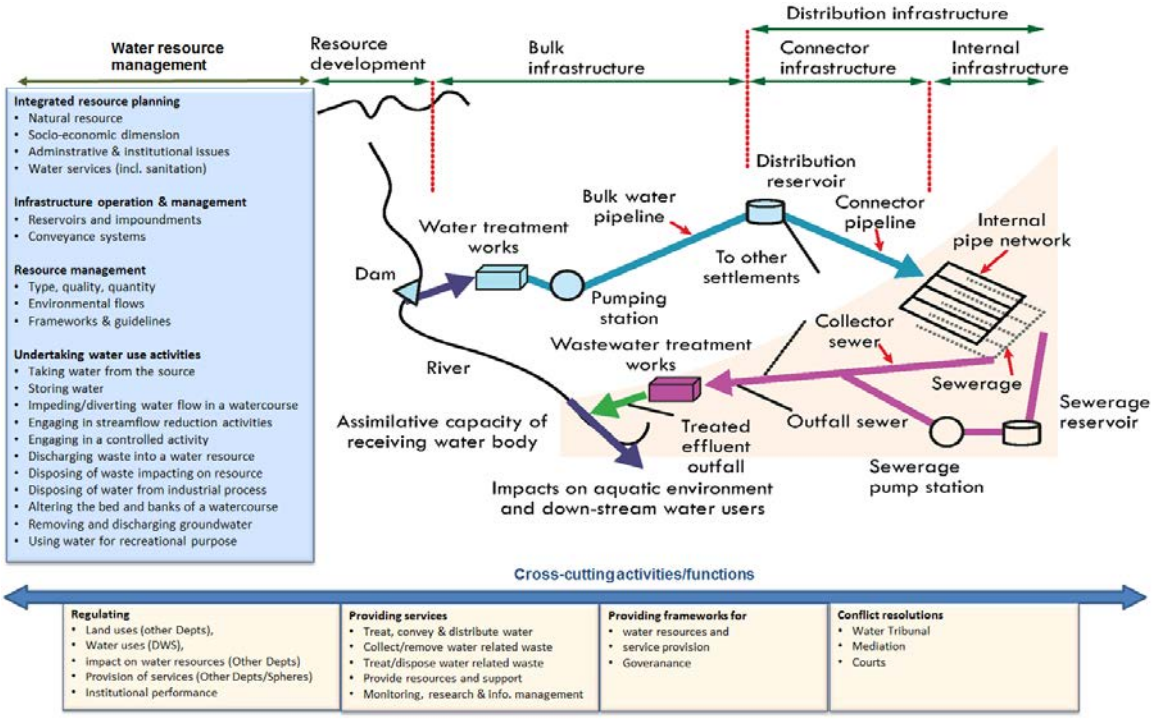


Figure 9. Water value chain from functional perspective

2.3.4. Planning hierarchy

2.3.4.1. Water Planning from Rural and Local Perspective

The DWS 2014 revised policy mentioned in 2.2 earlier in this document included ensuring that water supply should be based on yard taps and no longer based on RDP standard of 200m from the tap. The MUS approach to planning of water development and management means that key elements of the value chain at local level are covered to ensure that all aspects of water management are taken into account, thereby respnating with the concept of circular economy in which water projects and programmes are set to ensure *end-to-end value chain consideration* in a non-linear fashion.

Figure 10 below shows water management from local perspective for a typical urban environment. South Africa, like the rest of Sub-Sahara Africa is urbanising faster than any other continent, and most of the urbanisation is in emerging towns and villages[63]. Current estimates indicate that up to 65% of the population reside in urban areas. These areas often do not have mature or sufficient infrastructure and governance structures to cope with the growing demands. South Africa's revised water policy mentioned above provides an opportunity to relook at the institutional, functional and financing arrangements that are suitable for growing urban systems based on integrated urban

[63] Integrated urban water frameworks for emerging cities in sub-Saharan Africa. Vairavamoorthy, K, Tsegaye S and Ecart J. 2013.

water management referred to in the policy review as local water management. Such systems will include introduction of circular nonlinear systems that maximise opportunities for water reuse and recycling and generation of energy and nutrients from used water.

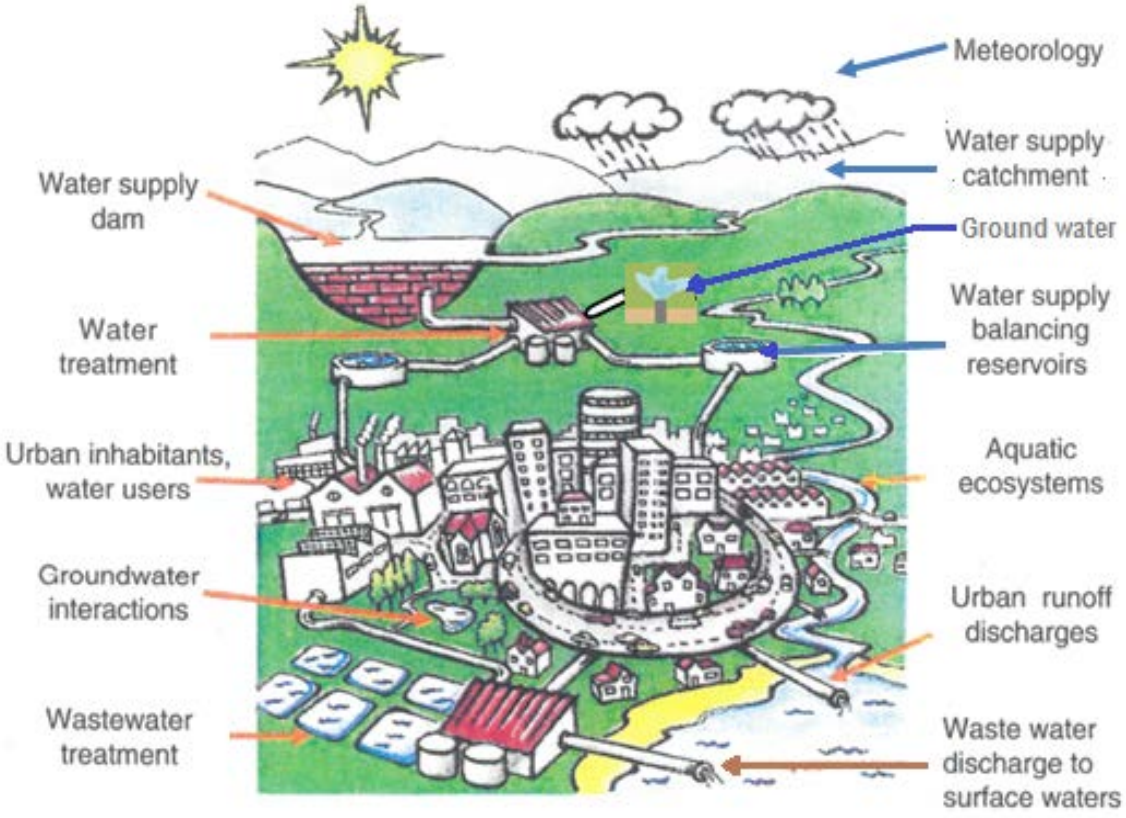


Figure 10. Urban water management from local perspective[64]

Eckart *et al*., 2013, proposed a water framework specific for African cities (Figure 11) that takes into account a number of water and sanitation practices characteristic of the African environment, where limitations of water supplies, infrastruture, leakages, demand management prgrammes are not based on developed cities.

The South African Local Government Agency (SALGA) has recognised a number of interventions as part of the quest to improve service delivery by enabling and executing water local economy and innovation taking into account the livelihood and deconstruction of historical models. This involves whole-cyle water management covering various aspects among others from governance, consumer behaviour, knowledge management to partnerships.

[64] Data requirements for integrated urban water management. Urban Water Series – UNESCO IHP. Fletcher, TD and Deletić A (eds). 2007.

In 2014 a report was published[65] recommending a framework and guidline for water senitive urban design (WSUD) for South Africa for adoption as a means of meeting the challenges facing the urban water management sector, and achiving the goals of the NDP and NWRS with respect to urban areas. This framework resonates with the 2014 revised policy and is aligned to internal DWS intervention which included establishing a programme dedicated to Water Services and Local Water management.

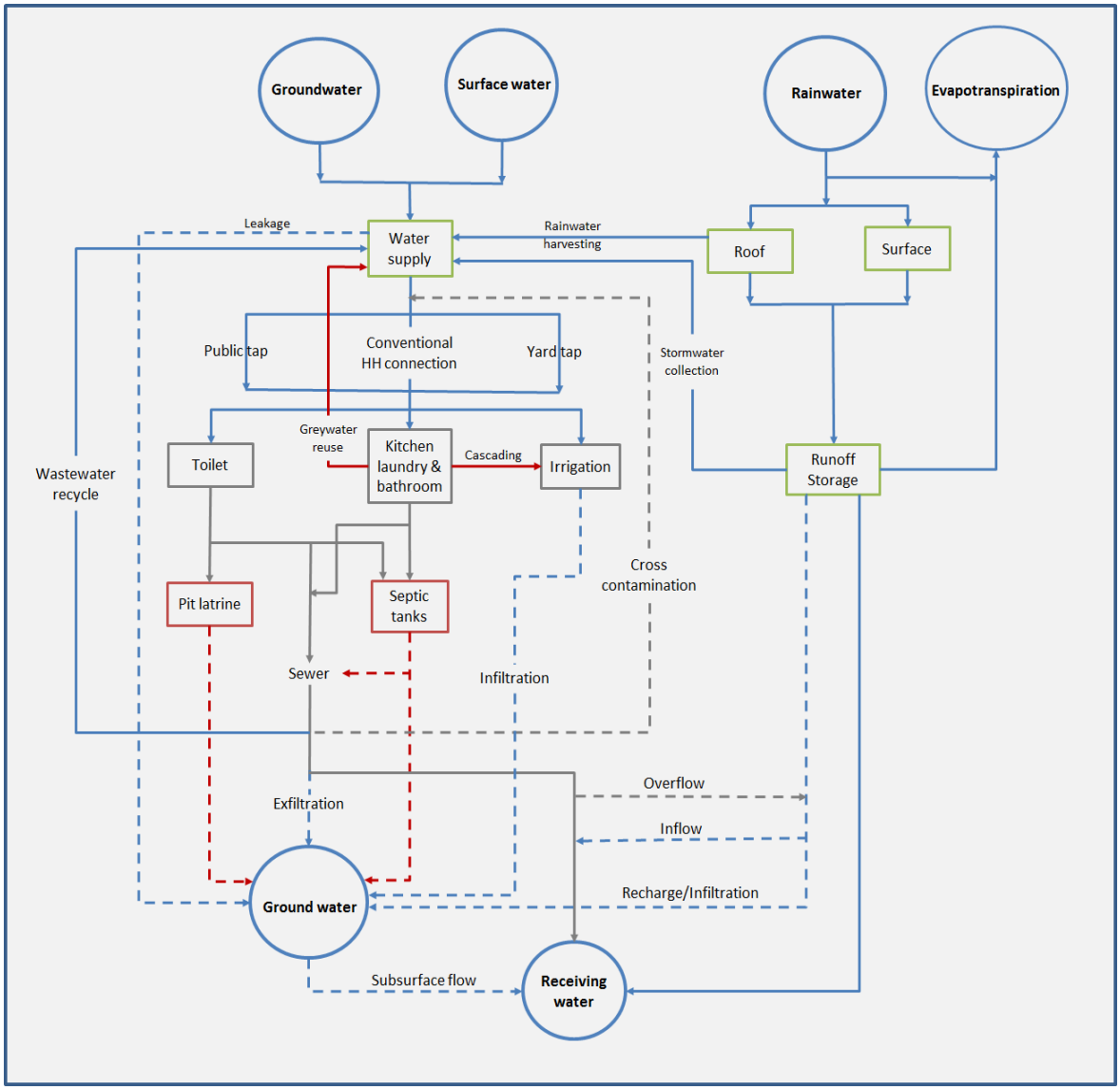


Figure 11. A tailored integrated urban water infrastructure for cities in sub-Sahara Africa[66]

[65] Armitage, N., Vice, M., Fisher-Jeffes, L., Winter, K., Spiegel, A. and Dunstan, J., 2013. The South African guidelines for sustainable drainage systems. *Report TT558/13. Pretoria: Water Research Commission*.

[66] Variavamoorthy et al. 2012

2.3.4.2. Water Planning from Regional/Catchment Perspective

Comprehensive assessments of water resources at the catchment level date back to the early 1950s when it was part of national hydrological assessments. These studies were limited by the amount of data, tools for assessment and the technological advancement which evolved over time. Over the past 10 years, a consistent problem of deteriorating monitoring networks and data collection required for assessment has been raised and is seen to be one of the key bottlenecks. Further, with the resource assessment has become more and more complex due to increase in land use, deterioration in water quality and the need to examine the interaction between surface and groundwater. All this is exacerbated by climate change and other pressures on natural resources, which call for a more integrated assessment using the tools available.

A full assessment needs to be done at quaternary level – initially using the DWS state of water report to establish baseline information. This should include exploring the idea of smaller more affordable dams closer to communities to counter or balance the situation where people live in source areas. The establishment of CMAs is critical to ensure that the CMSs required at this level of planning are in place. Globally, the trend in water resources management policies is to manage water at a catchment level, with the participation of all relevant stakeholders and aiming at the sustainable development of water resources. Currently, it was envisaged that South Africa will have nine CMAs across 19 Water Management Areas (WMAs). Thus far two CMAs are operational namely; the Breede-Gouritz CMA in the Western Cape and the Inkomati-Usuthu CMA in Mpumalanga. Two proto-CMA processes have been on the table for finalisation for quite a while, namely: the Vaal in the Gauteng and Free State Provinces and the Pongola-Mtamvuna in KwaZulu-Natal. The remaining five CMAs are yet to be established.

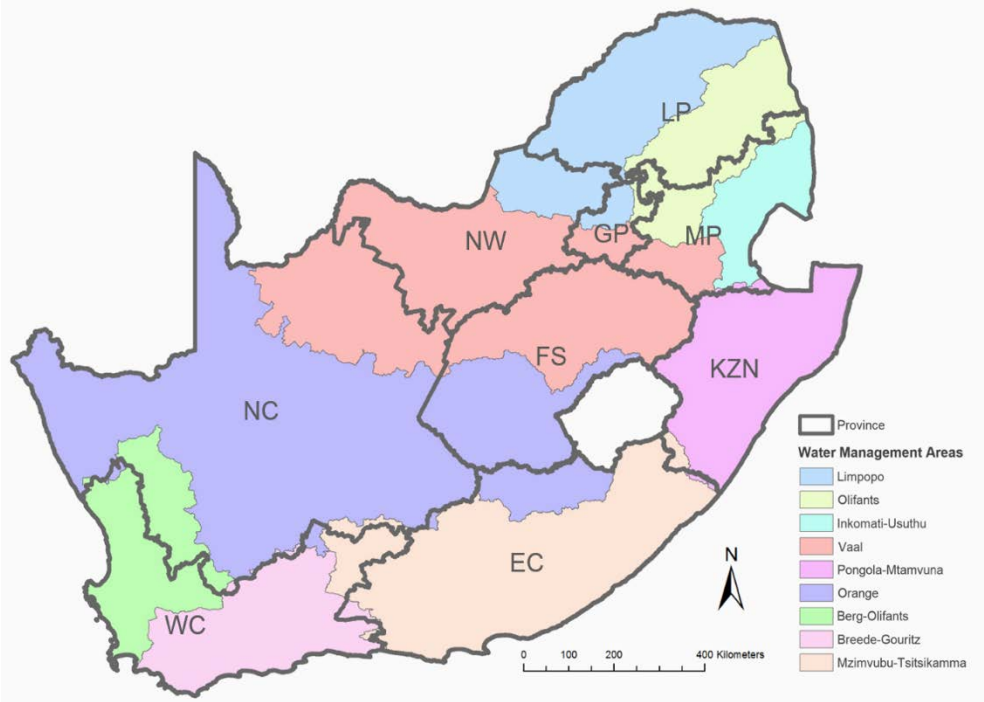


Figure 12. South African water management areas boundaries in relation to provinces[67]

2.3.4.3. Water Planning from a National Perspective

An analysis of the 1986 publication on Management of Water Resources of South Africa[68] that was building on the 1971 Water Commission Report shows that unless drastic steps are taken the sector will continue to be eroded and uncertainty increase. A number of challenges that were raised then remain in place today – or have been amplified despite plans and high-level commitments made.

Given the lessons over the past 20 years since the National Water Policy and subsequent individual work done by the Department and researchers from across the country as well as internationally, it should be possible to do a detailed assessment within 12 to 24 months. The process becomes feasible in these timeframes if what has been learnt is consolidated to ensure that the amendments address the shortcomings and not going a route that sounds like reinventing the wheel.

2.3.4.4. Water Planning from International and Global Perspective

South Africa's standing in the international and global space has demonstrated its capability to punch beyond its weight. Among others this international recognition includes involvement at the highest level globally – as part of the UN/World Bank High-Level Panel on Water. South Africa is also recognised as one of the leading nations in water resource infrastructure development to address the water supply requirements,

[67] NWRS2, DWA. 2013

[68] DWA, 1986

and the country is a leader in the development of legislation and new policies on access to water as a human right.

There are institutions and professionals that are celebrated in the water fraternity, such as the levy model of the Water Research Commission (WRC); the Department itself in respect of national monitoring; and the UNEP GEMS work done within SADC context.[69] A great number of universities that provide programmes and lectures on the sector are sought after by international students and many professionals have been recognised for the work they do.

However, this does not address the challenges of the water sector, which requires high-level skills in the knowledge space as the sector interacts with the best internationally and globally. There are examples of excellent work being done in this field, such as the Framework Programme for Research, Education and Training in the Water Sector (FETWater)[70], but more of the same is needed.

2.3.5. Systems Planning for Water Resources and Provision of Water Services

From a systems planning perspective[71], it is well accepted that generally the water resources and water supply system comprise the following:

1) The natural resource system (NRS) (How much and what are the sources):
   i. The natural sub-system - streams, rivers, wetlands, lakes and their embankments and bottoms and groundwater aquifer
   ii. The infrastructure sub-system - canals, reservoirs, dams, weirs, sluices, wells/boreholes, pumping plants and wastewater treatment plants (including operating rules for elements in this subsystem)
   iii. The water itself, including its physical, chemical and biological components in and above the soil
2) The socio-economic system (SES)

This can be viewed within the context of demand which would include:

   i. Water use and water-related human activities

[69] The United Nations Environment Programme (UNEP) Global Environment Monitoring System (GEMS) drives the global fresh water quality monitoring programme. More than a hundred countries contribute data from existing national monitoring networks to GEMS/Water, where the data is stored in a central database called the GLOWDAT. South Africa joined GEMS/Water in 2003.

[70] The FETWater programme was a result of a focused intervention to ensure South Africa's readiness to implement the then new policy and legislation on water through the UNESCO-WMO-DWAF mission on the assessment of the Education and Training Needs of the Water Resources Management Services. This programme has since taken a back foot.

[71] "Water resources systems planning and management: an introduction to methods, models and applications." Loucks D.P. and Van Beek E., UNESCO. 2005

ii. Financing for water development and management, including the financial flows in respect of livelihoods across the water value chain.

iii. The future environment – Risks and opportunities, including the implications for global climate change and associated transitions as they relate to water;

As earlier discussed, South Africa's growth areas and implications for water requirements must now be determined by two key drivers of change as articulated in the NDP regarding a reduced inequality gap and increased economic development.

- Growth over time must be measurable in real terms over say 10, 20, 30 40 years
- Historical assumptions must be questioned based on current and future medium- to long-term expectations and not focus on "protecting the status quo"
- Risks – natural and anthropogenic/climate change are to be assessed based on available empirical evidence
- Geopolitical movement is no longer only national but transboundary in nature thus vulnerability and interdependencies are more than just water
- Historical institutional issues need to be dismantled.

3) Administrative and institutional system (AIS) – Processes, institutional tools or mechanisms:

i. System of administration, legislation and regulation, including authorities responsible for managing and implementing laws and regulations

ii. Water governance in general, including national requirements and international obligations.

4) The water and sanitation services (conveyance systems up to tap or utilisation) can be seen mainly from a socio-economic perspective and include relevant infrastructure aspects. This must also be viewed in context of environmental flows, especially in terms of impact on ecosystems generally.

5) In addition, water information and knowledge (knowledge capital) is an integral part of the various elements, especially in view of the interdependency of water with other factors outside the water realm or so-called "water box". The South African legislation takes the issue of monitoring and information seriously as evident from the peremptory nature of the Chapter 14 of the National Water Act, 36, of 1998. The old adage of *"To measure is to know"* is critical in this instance.

As identified earlier in this document one of the key transformational issues is that of monitoring water use as result of change in focus to demand management and increased regulatory regime both from a compliance perspective and from the perspective of understanding the systems behaviour or response.

Figure 13 shows the three main interdependent aspects of the NRS which are of equal importance in any analysis. Inadequate attention to any of the three subsystems can undermine the value of the work done to improve any of the other.

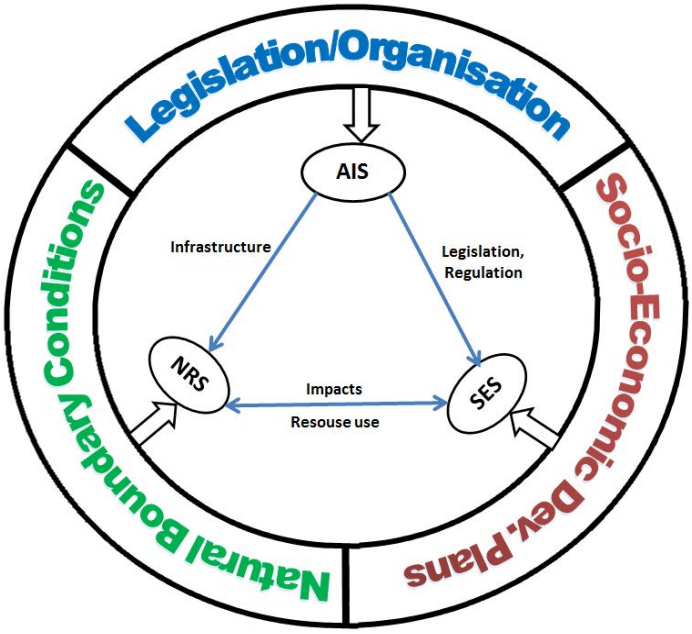


Figure 13 - Interaction between water resources sub-systems[72]

Systems planning for water resources and provision of water services and sanitation in South Africa have not been done in an integrative or holistic manner to sufficiently address interdependencies and new pressures of complexities and increased demands resulting from issues such as political constructs and global change, including climate change, land use changes etc. This has continued despite the 1996-98 policy and legislative changes that anticipated and planned for these changes and provided tools that could have been better utilised and improved upon. For instance an overview of current and future challenges water resources assessment in South Africa[73] suggests that the approach to do these assessments separately or in isolation has continued for decades, changing only in complexities rather than assumptions. Although the studies themselves are invaluable and provide an opportunity to have an excellent assessment of the natural resources subsystem and the other subsystems over the long-term, there does not seem to have been sufficient questioning of the assumptions and the level at which interdependencies across the water value chain is looking like today or from a future perspective.

[72] "Overview of water resource assessment in South Africa: Current state and future challenges". WV Pitman, Water S.A. 2011

[73] "Overview of water resource assessment in South Africa: Current state and future challenges". WV Pitman, Water S.A. 2011

3.
CHALLENGES AND KEY WATER SECURITY ISSUES

Victory comes from finding opportunities in problems.

Sun Tzu

3.1. GAPS RELATED TO PLANNING

Following on from the earlier reference to the relational definition of water security, some key gaps relating to planning for water security can be discernible, such as:

a) Inadequate understanding of the biogeophysical environment largely due to lack of sufficient regular assessment, including as a result of using old or out-dated information or spatial planning models that are not necessarily responsive to new and complex demands.

b) Water governance and leadership issues

These refer mainly to adequacy of legal regime, institutional arrangements, infrastructure and capacity required for implementation and management -

i. Lack of follow through on policy and legislation – reflected in many decisions being aborted, slowed down or reviewed unnecessarily;

ii. Functional instability and lack of continuity resulting from change in leadership of the Department and some water entities over the past few years since 1994;

iii. Failure to implement the basic institutional framework espoused in the post-Apartheid water policy and legislation;

iv. Inadequate emphasis on the new water management model and consistent stretching or even extrapolating old strategies without analysis based on empirical evidence;

v. Incapacity resulting from incompetence and ineptitude – many decisions appear to have been either delayed or aborted due to this, including officials lacking confidence or being afraid to make decisions.

vi. Incomplete restructuring and re-organisation processes that is exacerbated by start-stop processes since 1999.

c) Inadequate enforcement of data and information ownership and curatorship resulting in moving away from the notion of the knowledge commons – large

consultancy companies appear to have a hold on critical data and information required for national planning needs.

d) Consistent under-expenditure and qualified audits by the sector leader – a serious concern that requires closer examination and decisive intervention. One of the most critical factors contributing to risks to water security is corruption and misappropriation of funds and lack of accountability.

e) Inadequate financing and investment exacerbated by too much wastage in the system resulting mainly from how the function is done.

3.2. OVERALL GENERIC CHALLENGES

The DPME's 2015 diagnostic report identified and delineated six key thematic areas that are seen as critical for water security as reflected in Table 1 below.

Table 1. Key issues identified in the National Water Diagnostic Report, 2015

ISSUE/AREA	COMMENTS/OBSERVATIONS
The water demand and supply situation	• Inefficient water use • Unconstrained water use increases in many municipalities • Unauthorised water use is prevalent especially in mining & agriculture
Impact of extreme climatic events and **climate change**	• Precise magnitude and spatial extent are uncertain; • A recent flagship research programme on climate change - using a scenario-based approach to explore adaptation options • Under a 'wetter' scenario, water allocation between sectors will be less restrictive, but under a 'drier' scenario significant trade-offs are inevitable • Under all scenarios, higher frequencies of flood and drought events are anticipated
Infrastructure asset management and functionality	• history of under-investment in asset maintenance and renewal and deficient management systems and record keeping • Concern about the actual state of existing water resource schemes • Failure to adhere to the established operating rules poses a critical water security risk • Prevalence of water supply interruptions and recurring social protests • High number of water systems are in the high to critical risk category • Pockets of waste water effluent infrastructure in a critical state require urgent refurbishment

ISSUE/AREA	COMMENTS/OBSERVATIONS
Infrastructure planning and development	• While there is an elaborate inventory of planned projects to ensure water security, based on past records there are concerns about the sufficiency of funding, robustness of institutions, and decisiveness in implementing the envisaged infrastructure • Commitments made during the conception of such infrastructure tend to be irreversible once implemented, and given that resultant assets might have limited functionality outside the original 'intent, the robustness of governance during the planning stage is critical (socially robust information). • Many municipalities fail to comply adequately with the prescripts. • Planning maturity in most municipalities has remained poor • Challenges to coherent planning, amid increasing urbanisation and migration • Indications that factors like political interference, lengthy litigation processes, time constraints, limited skills, and inadequate alignment across the spheres of government, all contribute to deficient planning
Institutional and regulatory framework	• Collaboration appears to be elusive • Across all spheres of government, divergent interpretations of the framework seem to have fuelled territorial contests to the detriment of service delivery • Two decades into the democratic era, while access to a safe water supply is a constitutional right and critical in meeting socio-economic objectives, there is still inequitable access and allocation • Many institutions in the sector and their overlapping roles have often severely compromised effective regulation • Prevalence of limited compliance with the prescripts of the regulatory framework
Human capital and institutional capacity.	• In each of the foregoing themes, deficient human capital and institutional capacity across the water value chain have surfaced among the key features that could inhibit water security • Skills shortage in the country has been at the centre of many discussions, and well documented • Although the skills deficit in the country is considered as critical, the problem is part of a global phenomenon affecting both developed and developing countries • Concerns about the capacity of key national government departments and municipalities - in ensuring the effective implementation of developmental water management and services

The diagnostic report recognised significant strides that have been made in confronting the daunting legacy of apartheid, and in particular in addressing serious backlogs in water services. It raised a wide range of issues that cut across the various themes and that are seen as exhibiting *wicked* attributes where the term 'wicked' in this context is used to suggest problems that comprise complex interdependencies – where there is often little consensus on the precise problem to be addressed or the approach to its resolution. It is stated that moving forward, the continued ability to ensure water security for the country will only be certain if a number of critical choices are prioritised and implemented to urgently confront the challenges and limitations facing the water sector. The report proposed a suite of opportunities and recommendations for sector-wide and migration into water security strategies that covers the following:

- Scaling-up non-traditional water augmentation;
- Enhancing demand-side management and conservation;
- Innovatively pursuing universal service coverage;
- Proactively planning for strategic water infrastructure;
- Increasing attention to water resource protection;
- Strengthening human and institutional capacity; and
- Establishing quality assurance protocols for the front-end phase.

3.3. EMERGING CHALLENGES AND KEY CONSIDERATIONS

Consultation processes during the development of the NWSF have confirmed many of the findings from the diagnostic report and subsequent assessments. The following broad issues were among the those raised during the consultation process:

Table 2. Some challenges raised during consultation processes

ISSUE/AREA	COMMENTS/OBSERVATIONS
Integrated Planning	• Ensure alignment and build in scenario approaches and other tools • The framework should recommend de-linking long-term planning for water from political cycles. • Financing and investment should form part of long term planning • Need for foresight in water planning. • Spatial planning to incorporate environmental protection (protection of source areas) • Include water sensitive design in planning
Water and Agriculture	• Agricultural water requirement is critical and of national strategic importance. The decision-making round what is grown where and what measures are to be put in place to ensure that water is not wasted must be examined and addressed.

ISSUE/AREA	COMMENTS/OBSERVATIONS
Governance and Institutional	• Institutional design may have had direct impact on effective decision making and implementation • Regulation/enforcement, monitoring and evaluation, enforcement of ground water use and capacity to manage water licensing conditions needs to be strengthened. • Investigate failure of CMAs implementation. Berg and Breede River systems are heavily involved in supplying the Western Cape Water Supply System and may be merged.
Infrastructure asset management and functionality	• Maintenance and expansion analysis to accommodate growing demand • The is a need to involve the private sector, including small business and traditional authorities/leaders across the value chain.
Communication and Stakeholder engagement	• Advancing active citizenry, including awareness and education
Research, monitoring, assessment and information	• Promote alternative technologies to ensure water security, including IR 40.0, artificial Intelligence (AI), Machine Learning (ML), etc. • Elevate research and development to support exploring ways of conserving water, re-use and other alternatives. • Update data and information. • Judging from declining values of research there may be a need to investigate the adequacy of the levy system or find alternative sources.
Water financing and investment	• There is a need to cover the true cost of water, including environmentally provided 'goods and services'. If not done there may be externalisation of costs to downstream users and/or environment with long-term negative consequences.
Human capital and institutional capacity.	• Re-professionalise engineering, scientific and technical fields. • Deal with revolving door • Ongoing failure to address skills shortage and asymmetry is the single biggest strategic risk facing water management in South Africa
Water use and unaccounted for water	• Reduction of unaccounted for water to be made a key priority and set ambitious target such as a net per capita water use of 100 litres per day with a plan of action to achieve both.

Box 7. Emerging water issues from consultation process.

What the people say on the ground

- Possible allocation of water to communities (communal water rights) with land and associated support.
- Recommend decisions for immediate action which will not require any resources such as putting some institutions in place immediately, alignment of plans, enabling local communities to participate in local activities – less usage of consultants
- Bring in strong accountability and consequences – as part of foundational principles –" Speak truth to power"
- Security for who? Implications for balanced approach to trade-offs across the board, icluding:
    - Communities expect secured supply and access for livelihood and participation in the economy, e.g. spending too much time accessing water and not do other economic activities
    - Business expects security of supply for their economic activities (Farming, energy, mining, etc.)
    - Environmental conservationists focus on environmental flows and protection

3.4. FRAMING KEY WATER SECURITY DIMENSIONS

Water security challenges may differ from environment to environment (regions, countries, localities and so on) and contexts may have different dimensions. The core argument advanced in this framework is that water security is essentially "*beyond abundance and scarcity*" which over the years has been about development of storage capacity, the approach which has since been challenged by ecosystems based approach to water resource management and reflected in South Africa's post-1994 water policy and legislation. In South African context, like many countries with similar challenges the dimensions shown in the diagram below may be used to cluster these challenges generally (Figure 14).

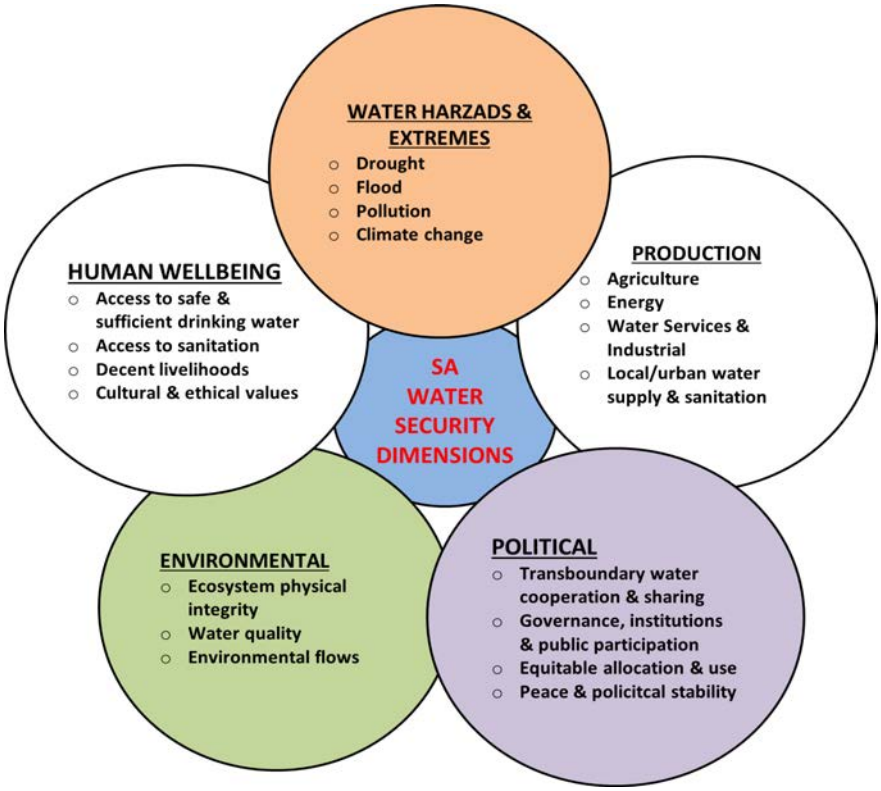


Figure 14. Water security dimensions that may be relevant for South African situation to be taken into account in Monitoring and evaluation

4.
SCOPE, PRINCIPLES AND APPROACH

The key to good decision making is not knowledge. It is understanding. We are swimming in the former. We are desperately lacking in the latter.

Malcolm Gladwell

4.1. SCOPE

At national level, the overall vision of the NDP is that of rising living standards and falling poverty and inequality by 2030 (Figure 15). This vision resonates with the 2050 World Water Development Report's (WWDR) vision on water security[74] which states that:

> ***"By 2050, humanity has achieved a water secure world**, where every person has access to adequate quantities of water of an acceptable quality and from sustainable sources, to meet their basic needs and sustain their wellbeing and development. The human population is protected from waterborne pollution and diseases and water-related disasters. Accessing water is no longer a gendered burden, and equitable access to water resources and services for both women and men has fostered greater social inclusion. Ecosystems are protected in a climate of peace and stability. Local and national economies are more robust, as the risks and uncertainties related to the availability of water resources have been taken into account in the long-term planning for poverty reduction and economic development. Norms and attitudes have changed as a result of educational interventions, institutional changes, improved scientific and technical knowledge, sharing of lessons learned and best practices, and proactive policy and legislative developments."*

Key aspects of the NDP vision are reduced inequality by 2030; eradication of poverty; and significantly reduced unemployment through inclusive economic growth.

[74] WWAP (United Nations World Water Assessment Programme). 2015. ***The United Nations. World Water Development Report 2015: Water for a Sustainable World.*** Paris, UNESCO.

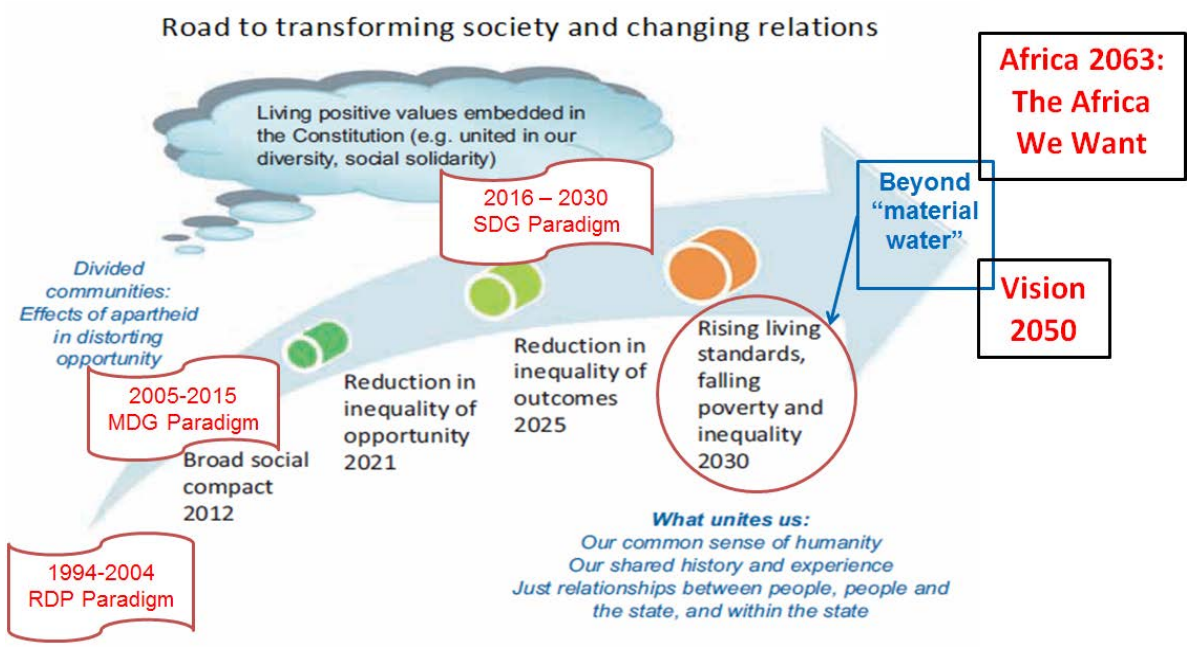


Figure 15. National Development Plan vision 2030 and global water paradigms

Agenda 2063 ("the Africa we want") prioritises inclusive social and economic development, continental and regional integration, democratic governance and peace and security amongst other issues aimed at repositioning Africa to becoming a dominant player in the global arena[75]. It represents a re-dedication of the Pan African Vision of "*An integrated, prosperous and peaceful Africa, driven by its own citizens, representing a dynamic force in the international* arena".

The UN's 2016 WWDR estimates that three out of four jobs in the global workforce are heavily or moderately dependent on water, and has highlighted three issues related to water and economy, water and inequality as well as water and poverty[76]:

- **Water, economy and jobs**

  Critical functional categories recognised on value chain, such as

  - Water resource management and ecosystems restoration and remediation;
  - Building, operating and maintaining water infrastructure; and
  - Provision of water related services including water supply, sanitation services wastewater management.

[75] https://au.int/en/agenda2063/overview

[76] See also Ward, M and Mudombi, S. 2018. Protecting and unlocking jobs through water stewardship: a case study linked to the Umbogintwini industrial complex, Ethekwini.

- **Water and inequality**
  - Access to safe water and sanitation services is a human right.
  - Required balancing act is that increasing access reduces inequality but increase demand
- **Water and poverty eradication**
  - Water is key to poverty eradication and health.
  - Balancing act is that supply can be increased but at steeply increasing costs and interdependency.

Box 8. Water Future - vision 2050

The future of water – A vision for 2050

Over the past several decades, ever-growing demands for – and misuse of – water resources have increased the risks of pollution and severe water stress in many parts of the world. The frequency and intensity of local water crises have been increasing, with serious implications for public health, environmental sustainability, food and energy security, and economic development.

Although the central and irreplaceable roles that water occupies in all dimensions of sustainable development have become progressively recognized, the management of water resources and the provision of water-related services remains far too low on the scales of public perception and of governmental priorities. As a result, water often becomes a limiting factor, rather than an enabler, to social welfare, economic development and healthy ecosystems.

The fact is there is enough water available to meet the world's growing needs, but not without dramatically changing the way water is used, managed and shared. The global water crisis is one of governance, much more than of resource availability, and this is where the bulk of the action is required in order to achieve a water secure world.

WWDR 2015

The recent report by the World Bank Group[77] in collaboration with Stats SA and the DPME assessed the poverty and inequality looking at drivers, constraints and opportunities. The diagnosis shows that:

- Poverty levels are high for an upper middle-income country;
- High inequality slows down poverty reduction;
- Skills and labour market factors have grown in importance in explaining poverty and inequality and that

[77] Sulla, V. and Zikhali, P., 2018. *Overcoming poverty and inequality in South Africa: An assessment of drivers, constraints and opportunities* (No. 124521, pp. 1-148). The World Bank.

- There are root causes of poverty and inequality in South Africa and potential solutions.

The report puts water insecurity (environmental fragility) among key challenges and underscores the need to focus on a water security framework to form part of the solution to achieving the NDP goals. The GWP/OECD report mentioned earlier in this document provides a starting point to analysis and framing water security for South Africa in that it places water at the centre of socio-economic growth and development.

The NWRS2 highlights the vision 2030 for the water sector in relation to NDP as a driver. As stated, the NDP articulates the national development goal of eradicating poverty and sharply reducing inequality by 2030. To achieve this, government has defined a New Growth Path, which is one of inclusive growth and development, with a focus on diversification and wide participation by South African citizens within a vibrant and growing economy. Water plays a central role in all sectors, including agriculture, energy, mining, industry, tourism, urban growth and rural development, the allocation. Development and protection of water is an essential prerequisite for inclusive economic growth, poverty eradication and the significant reduction of inequality in South Africa.

The NWRS2 analyses the role of water in the economy and identifies the specific challenges, development opportunities and actions that inform an agreed framework for priority areas of focus for the country. It seeks to address concerns about socio-economic growth and South Africa's potential, which may be restricted if water security, resource quality and associated water management issues are not resolved efficiently and effectively. The NWRS2 aims to ensure that water serves as an enabler for inclusive economic and social development and not a bottleneck. This begs the question of how we are doing as a country after all is said and done. The diagnostic report suggests that a lot still needs to be done and a radical change is needed, hence the decision to develop a national master plan that addresses the transformative role that water sector should play at a level beyond the different plans.

The NWSF must provoke thinking so that the country looks at the medium to long-term horizon (2030 and beyond) and ensure that current actions are always aligned with outcomes and impacts. It cannot simply elevate the outputs and programmes as listed in the Departmental plans as the trustee of water resources and overseer of water services and sanitation in the country.

A radical paradigm shift is needed if the implementation of the NDP goals and aspirations is to be realised. It is critical that at the highest level the Water Security Framework's achievement must be tested against two key aspects of the country's development, namely, per capita growth and reduction in inequality. It must be able to connect all aspects of water contribution to social and economic development which has proved to be difficult if not impossible for the line Department, especially in recent times and given that it is not necessarily mandated to control or manage the total value chain.

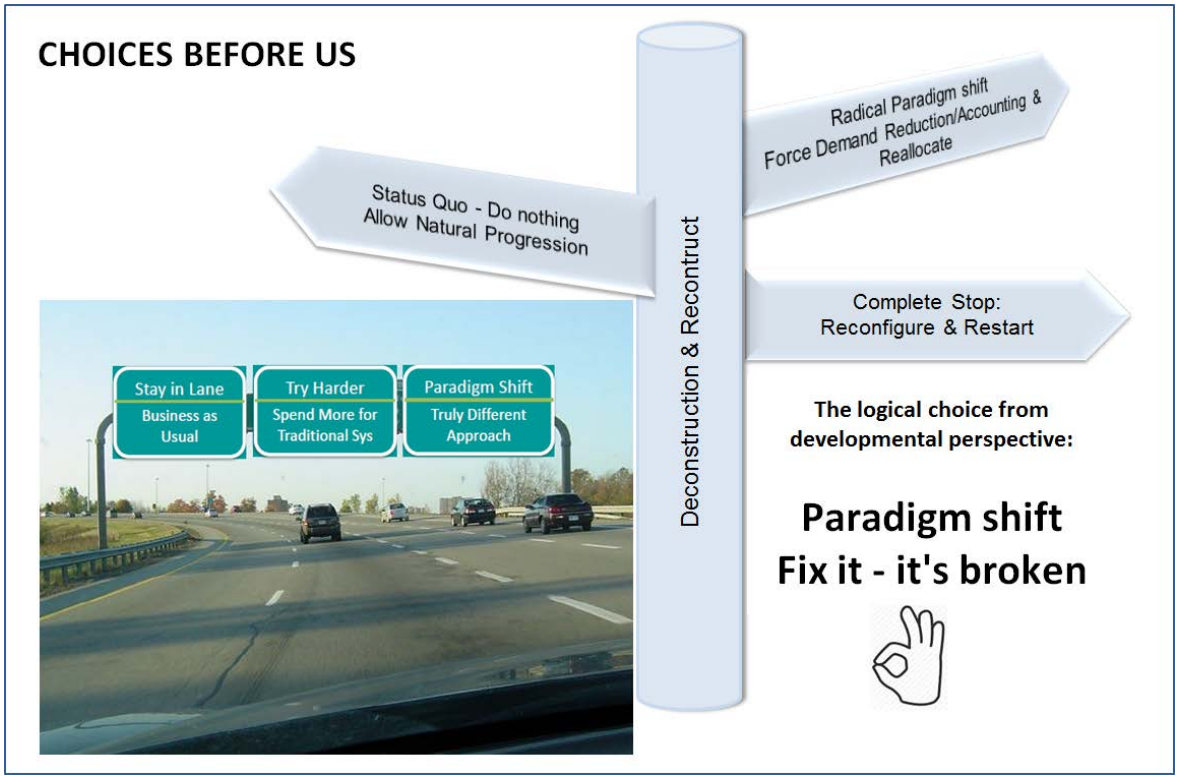


Figure 16. Three scenarios to a 30-year water security future[78]

In defining the end state for this sector a radical view is essential to address the spatial equity and examine why there are gaps between the intent of policy and legislation on one hand and the implementation on the other. Systems and processes must be compatible with the goals. Specifically, the following, among others, need to be revisited:

- Poor quality, quantity and relevance of data. A concern that was also raised in the 2013 WWF report on South African water sources;
- Poor regulation and enforcement thereof;
- Lack of reform and transformation of the water institutions as envisaged during policy and legislative development;
- Lack of integration and common goals;
- Lack of accountability and unclear roles and responsibilities; and
- Arguably sufficient legislation, but poor implementation and lack of decision making or follow through.

[78] Photo from presentation by Kala Vairavamoorthy at the African Water Week, 2014 Dakar, Senegal.

It is necessary for the framework to be integrated and use the mass balance approach[79] when it comes to water in that it must ensure aspirational need for every drop and movement thereof to be accounted for. The framework will seek to integrate:

- All the competing water requirements from all sectors, look into input water from neighbouring stated (surface and ground water through shared basins and aquifers) and precipitation (meteorological information necessary), sea water (desalinated for potable or industrial use)
- Look at output in the form of evaporation, exit to neighbouring states, and consumptive use of water (irrigation without runoff); and
- Span beyond South Africa and do risk assessment for security of supply in neighbouring countries like Lesotho, from which bulk of our water comes from.

It is also evident that the silo paradigm and approach in the water sector has persisted into the democratic dispensation, which results in a tendency or risk of focusing on the lowest common denominator and not focusing on interdependencies. Spatial planning has not managed to break the former homeland boundaries, which deprives many communities the required economies of scale when it comes to water for livelihoods and economic development. The allocations for irrigation use must be reformed and structured to be informed by the quantified livelihoods benefit per volume allocated.

Indications are that per capita consumption per day may be in the region of 150 litres (based on mean annual rainfall availability per quaternary catchment generally)[80]. There are areas where higher allocations can be made to enable local economic activities. This is in contrast with the incremental, proposed RDP/MDG standards ranging from 25 litres to 60 litres per capita (net), progressively to universal access. The argument was that it should be enough to allow for livelihoods locally, compared to the RDP initial plan. From a planning perspective we should be doing this where possible, such as the eastern parts of the country which are source areas, yet communities in those areas have been somewhat deprived at the expense of so-called development zones. Inordinate amounts of money are spent to transport water and yet locals do not have enough allocated. In short, planning needs to be done from the real needs perspective across the board.

The reported actual use is much higher than 150 litres (averaging 188 litres countrywide and 270 litres for Gauteng, for example). The number of 150 litres must be seen as target, which needs to be verified through scenario planning and depending on what is

[79] The law of conservation of matter states that matter (e.g. water) is conserved – that is, neither created nor destroyed. A mass balance is an accounting of a material for a specific system boundary. In other words, you are keeping track of all sources of the material that enter the system, all sinks of the material that leave the system, and all storage of the material within the system. This method is called the mass balance technique. Source: http://environ.andrew.cmu.edu/m3/s4/matbalance.shtml

[80] Msiwa MC, 2016. Personal communication

possible, hence the condition of 'where possible'. These numbers are proposed as a starting point for discussion. The actual figures can be tested through a consultation process in the same way we did when we came to the earlier 25 litres per capita. Irrespective of the actual figures that are agreed upon once the research has been done, the fact remains that radical changes, such as raising the minimum up to 150 litres (depending on local conditions) per person per day, need to be considered in areas where this is possible. This would include but not be limited to, employment created by revenue from produce, food security and achieved efficient water use efficiency index, and contribution to GDP. Further, reducing water loses from about a third of potable water supply to say 10% across the country, a target per capita use in the order of 50 to 100 litres (net) per person per day achievable – as has been demonstrated in Cape Town since 2017. In this context the nexus approach should be clearly articulated and implemented.

In considering the radical changes, the mutual interconnections between land, water, energy and food (the WEF nexus) must as a matter of cause be taken into account. It can no longer be seen as an isolated issue as a result of lack of understanding and complexities of the relations between the component parts[81]. For instance, if the demand for water for energy and the associated impact on water quality is reduced significantly by 2030, the water allocated for energy will become available for other uses. The interdependencies with agricultural requirements for both water and energy need to be strategically determined in order to maximise the benefit to society.

The Water Security Framework should take cognisance of the fact that unlike other resources, **WATER CANNOT BE SUBSTITUTED** with anything. It is finite and must be preserved and protected for future generations.

We should also note that the scarcity of fresh water or water fit for use is driving the world towards innovative technologies which look into more efficient ways or treating water and also reducing pollution of our water resources. Desalination of sea water into potable or industrial grade water is common practice around the world where surface water is depleted. These technologies demand huge investment costs together with high level skills sets which South Africa should have. The fourth industrial revolution (4IR) brings with it an opportunity to address various aspects of water management and provision.

In recent years, a *fatigue* resulting from start-stop regarding issues of water governance can be discernible. The advent of Local Government legislation made the governance of water services even more competitive. Understanding and alignment of legislation is a critical process that must be undertaken. It should be noted that legislation is one of the critical tools at our disposal for the governance and management of water in South Africa. It should be clear on the allocation of responsibilities and mandates across the

[81] Mpandeli *et al*. 2016

water value chain, and across the various role players. Of outmost importance is the enforcement of regulation, where accountability is demanded.

The OECD[82] in addressing the question of why water security matters, after assessing the common challenges of water security globally and in the context of OECD countries recommended that a risk-based approach to water security is essential. Achieving water security means maintaining acceptable risk levels for four water risks, namely:

- Physical shortage (including drought): Lack of sufficient water to meet demand in short, medium and long-term for beneficial uses by all water users;
- Inadequate quality: Lack of water of suitable quality for a particular purpose or use;
- Excess: Overflow of the normal confines of water system or the destructive accumulation of water over areas that are not normally submerged; and
- Risk of undermining the resilience of freshwater systems: Exceeding the coping capacity of the surface and groundwater bodies and their interactions (the "system"); possibly crossing tipping points, and causing irreversible damage to the system's hydraulic and biological functions.

In the context of South Africa and her relatively new transformational policies the above risks are exacerbated by the lack of skills and capacity in general across the board. Assessment of the risks needs to be done conjunctively as they impact on each other given the nature as a hydrologically interconnected resource. Effective management of the risks is central to achieving the objectives of the Water Security Framework.

Key aspects of the framework include the fact that it must, as a matter of course:

- Remain a high-level national guide that is long-term in nature but that determines immediate decisions and actions based on empirical evidence and best available information and knowledge.
- Be sufficiently instructive to ensure that all mandated institutions and organisations draw from it with the line Department sufficiently capacitated to play its sector leadership role properly;
- Provide an analysis of why the sector seems to be in a stagnant state with decisions either not being made or if made they are not executed or followed through;
- Reflect urgent and immediate decisions to be made to ensure sector functionality such as institutional framing and establishment as well as high level roles and responsibilities and financing, a basket of tools such as foresight methodologies etc.;
- Recognize and take into account that water programmes are by nature long-term and that every effort must be made to decouple water security planning cycles from the geopolitical, financial and other cycles which are largely short term in nature.

[82] OECD (2013), Water Security for Better Lives, OECD Studies on Water, OECD Publishing. http://dx.doi.org/10.1787/9789264202405-en

Further, bad planning whether due to wrong assumptions or lack of requisite capacity can result in irreversible or devastating impact in the long-term. For instance, on average a mega project conceptualised in 2020 can produce first results in to 2035 to 2040 (three to four political/administrative/governance cycles multiplied by three spheres of government and several economic cycles which may include recessions and so on); and

- Cursory assessment of the water situation in the country reflects that the challenges faced are a result of cumulative effect over a long period which needed proper long-term, scenario-based planning and implementation (see also Figure 1).

Further,

- National spatial planning needs to be responsive to the redistributive needs of the country and not the *usual* economic zoning which by default leads to maintaining the *status quo*. Water should form an integral part of the spatial planning. It is an irreplaceable and a national asset in Government's trusteeship;
- Water security needs to be seen as key driver, especially in respect of sustainability and the nexus approach (water-food-energy-health etc.);
- Sector direction as dictated and lead at the highest level with clear roles and responsibilities across the value chain is critical;
- Strengthening leadership, water governance and stewardship should be non-negotiable.
- Serious consideration is to be given to separating the technical functions through a structured process, starting immediately with those that will not need political or legislative changes;
- Tools and instruments exist to be used for co-implementation, state-owned enterprises, private institutions, and other spheres of government;
- As a country we must be looking at *end-to-end value chain* coverage that takes into account a holistic development agenda through beneficiation.

The scope of the framework is to position the need for key interventions at short, medium and long-term with the objective of developing an integrated approach to planning for water security, creating an enabling mechanism for implementation and clarifying roles and responsibilities. For instance, linking water issues with other aspects of the NDP such as spatial planning among others, and ensuring that the various role players at national level focus on the priorities of the NDP goals and objectives.

In doing so it is important to note the critical constitutional framing of trusteeship of all water resources which underscores the principle of "total value chain ownership" and the need to ensure water justice in all its manifestations taking into account historical injustice.

The framework segregates the various elements of implementation both in terms of areas of focus and the respective roles and responsibilities across the board. Most importantly it provides a platform for monitoring implementation in a focused manner at the highest level in line with short- (up to 5 years), medium- (5 to 10 years) and long-term (beyond 10years) impact. To this end, two key areas will drive the monitoring, namely:

- Economic growth measured by GDP growth contributed through water and allied activities;
- Reducing the inequality gap measured in terms of human development index (HDI) focusing on livelihoods locally through to national (bottom up) and reflective of past imbalances.

The above must be viewed in terms of the three apex priorities of reducing inequality, eradicating poverty and improved employment in line with the NDP's vision and enabling milestones of universal access to clean running water in the homes as well as the commitments made through the SDGs.

4.2. PRINCIPLES AND APPROACH

4.2.1. Source to sea across the water value chain/water cycle

In articulating the water and sanitation value chain, water supply and use are considered from source to sea in holistic or integrated manner (Figure 17) with indication of needs for conveyance systems that link to infrastructure requirement, financial flows and impact at the lowest/local scale.

The framework is based on a holistic approach that considers the entire water cycle from source to sea, and back; and should put human influence on the water and *nutrient* cycle (environmental flows) at the centre[83]. In the South African context this must as a matter of course include putting livelihoods and improvement of the country's majority at the forefront of efforts. The moment this approach is taken; the transboundary aspect of water security gets logically incorporated. A case in point is the ORASECOM's approach where both land and oceanic circulation are taken into account from Angola's Cabinda Province through to the Eastern Cape (Port Elizabeth) in South Africa[84]. Further, discussion and planning on projects such as the opportunities presented by the Zambezi and Congo Rivers, as well as desalination bring about a different narrative which is in a way narrow.

This framework reflects key elements of an "*end-to-end water value chain*" consideration that will allow full beneficiation upstream and downstream of any project.

[83] Conradin, K., (2012). World Natural Heritage Sites–Triggers for Sustainable Development Processes?

[84] ORASECOM (2013). From Source to Sea: Interactions between the Orange-Senqu River Basin and the Benguela Current Large Marine Ecosystem.

A case in point would be the drive for Operation Phakisa[85] that aims at unlocking the oceans' economy in that water resource and provision of water and sanitation services development must be looked at as an integral part of the marine integrated plan. Further, local water management must as a matter of course be considered within the context of socio-economic development and not just from a social perspective.

[85] https://www.operationphakisa.gov.za/Pages/Home.aspx

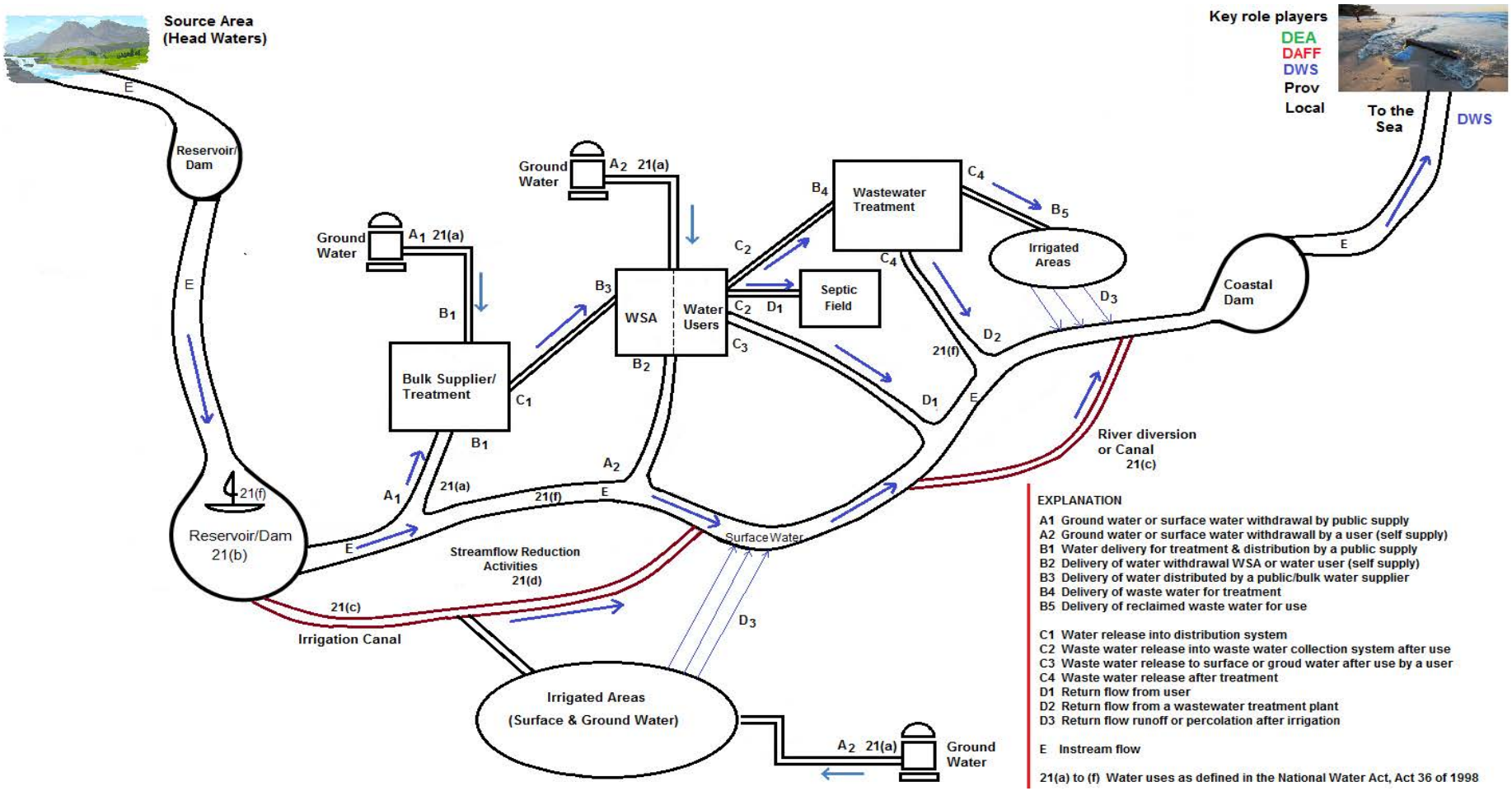


Figure 17. Value chain from water use perspective reflecting section 21 of the National Water Act, 36 of 1998 [86] as it currently exists.

[86] *Modified from USGS, (2002): http://water.usgs.gov/pubs/chapter11/index.html*

4.2.2. Long-term view based on scenario planning and associated risks

Water management generally takes a long-term view due to the nature of the resource. For instance, a typical large water resource development scheme generally takes 15 to 20 years from conception to first day of benefit realisation like water coming out of the tap. Further, the impact of such project will take several decades. Viewed in the context of the South African water situation of scarcity and uneven distribution, as well as impact of high climatic events, climate variability and change are critical that interventions and management need to be holistic and take into account the various supply and demand scenarios.

It is critical that planning for water security must by design go beyond the 2030 horizon reflected in the NDP. The various planning horizons should be accommodated for, depending on the objectives as well as the size of planned intervention.

4.2.3. Policy and Legislation as starting point

In line with the 1996 principles of the National Water Policy and the revised positions of the 2013/14 policy and legislation need to ensure focus and creation of enabling conditions. Reviewing of policies and legislation must be informed by the need to enable planning for water security and judicious management. The basic assumption in this regard is that until changes to policy and legislation are motivated for and carried out, water security planning, management and implementation must be based on the current policy and legislative regimes. That is why water security planning and implementation should be an integral part of IWRM. Changes to legislation or policy must be run as parallel processes to avoid unnecessary delay in implementation.

The institutional framework must be finalised within the shortest possible time, so that the policy and legislative regime is properly tested through implementation and not defeated or questioned before implemented at least at a 60 to 70% level of implementation.

4.2.4. Nexus approach to planning, implementation and management

In simplest terms nexus refers to a connection or series of connections within a particular system. Within the water context, it is recognised that water is central and in many respects a limiting factor in terms of energy, food, health, economy, etc. In the context of the NWSF, focus is placed on the W-E-F nexus which refers to the interconnections that exist between the water, energy and food sectors. Since 2011, the W-E-F nexus approach has been promoted as an integrated and sustainable approach to managing key sectors related to water resources, energy and food security. These three are critical to sustainable development, with synergies and trade-offs, that if not managed well can derail sustainable development efforts. This realisation led to global leaders meeting in 2011 at the World Economic Forum in Davos, Switzerland, agreeing to drive the W-E-F nexus in a sustainable or integrated manner. Although the Millennium Development Goals (MDGs) missed an opportunity to clearly factor the WEF nexus especially in its targets, the approach is now adopted under the SDGs framework. After the SDGs agenda was established by the United Nations (UN) in 2015, the WEF nexus activities were factored as part of the SDGs, especially goals 2 (Zero hunger), 6 (Clean Water and sanitation) and 7 (Affordable and clean energy) (Figure 18). Based on the

decisions taken by the UN on the SDGs, various countries including South Africa are at various stages of driving the W-E-F nexus both at technical and policy levels.

The NEXUS approach to dealing with the SDGs provides a platform for a holistic and systems view that goes beyond access to water and sanitation services. In this way we are able to deal with the limits imposed by reality on the ground in terms of natural carrying capacity, human capability and financial constraints to ensure a balanced and sustainable availability of the resources. It is clear that the financial requirements, estimated at approximately one trillion rand over 10 years, to address the challenges of water in South Africa cannot be seen in isolation and in all probability will come to nothing if all other issues are addressed in a systematic and integrated manner.

Figure 18. 17 SDGs as agreed upon by 193 countries in UN General Assembly in 2015[87].

The Nexus approach resonates with the IWRM principles and the water security as an ultimate goal to be achieved in perpetuity.

4.2.5. Decision support from credible information and research results

Policy, planning and implementation decisions must be based on credible information and appropriate knowledge currently available.

Intellectual capital associated with full value chain (whole water cycle) in recognition of the importance of knowledge economy is essential. South Africa's capability to leverage this aspect in line with its positioning, especially in respect of infrastructure and socio-economic development is critical. It cannot be acceptable to allow a situation where, whilst the legislation takes monitoring and information seriously, the national monitoring network

[87] Source: UN 2015

infrastructure is allowed to deteriorate. The value of investing into national research, monitoring and information cannot be overemphasized.

Tools for analysis using the latest technological advancement are critical for decisions support at every level.

4.2.6. Mass balance approach to assessment and implementation

A mass balance approach to assessment and implementation is necessary to ensure that the spatial and temporal distribution of water effectively address the imbalances of the past on one hand and the social and economic needs in the long-term. Mass balance will ensure accounting for what happens through the water value chain. Continuous improvement through identification of risks and bottlenecks and provision of appropriate interventions and guidance needs to be taken into account.

Such assessment brings to the fore the notion of accounting for water which looks into water inflow, change in storage, depletion or process as well as outflow taking into account the quantitative and qualitative values. Water productivity has been studied over the years, especially in respect of agriculture normally represented in kg/m^3 or even monetarily in R/m^3 and so on.

Strategic planning needs to move away from the 'consumption' notion to utilisation which is nuanced to a more accurate framing of efficient use and availability for re-use – in theory indefinitely. Strategic planning needs to take into account that key consideration is not so much about water quantity but quality. Given adequate control of water quality, there is adequate water quantity for all for ever through recycling.

4.2.7. Accountability and clear roles and responsibility

A key concern highlighted by sector role players across the board has been the issue of accountability and clarity of roles and responsibility. It has been observed that a greater part of the challenges in the water sector space generally is lack of accountability and consequence management. Generally, accountability refers to being able to accept responsibility for one's actions, whether it be good, bad or indifferent. Further, accountability is critically linked to ethical behaviour and leadership and translates into the ability of individuals and institutions' ability to provide services as expected from various jurisdictional mandates. This is much more so for a highly technical and professional area of water management and service provision

Appropriate checks and balance need to be developed in addition to the normal sectoral oversight, monitoring and evaluation. This is much more so given that mistakes and errors in development may have devastating impact on the country and society on the whole.

4.2.8. Total value chain ownership concept in context of the trusteeship doctrine

In South Africa the right of access to water is enshrined in the Constitution, and the National Water Act empowers the National Government to be the trustee[88] of all the nation's water

[88] The NWA, Act 36, of 1998 s3 states that:

resources through the Minister who has a duty to regulate all water use for the benefit of all South Africans in a way which takes into account the public nature of water resources and the need to make sure that there is fair access to these resources, including redressing the past imbalances as they relate to beneficial use in the public interest. The framing of water security must take the above into account.

(1) as the public trustee of the nation's water resources the National Government, acting through the Minister, must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons and in accordance with its constitutional mandate.

(2) Without limiting subsection (1), the Minister is ultimately responsible to ensure that water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

(3) The National Government, acting through the Minister, has the power to regulate the use, flow and control of all water in the Republic.

5.
FRAMEWORK FOCUS AREAS

In preparing for battle I have always found that plans are useless,
but planning is indispensable.

Dwight D. Eisenhower

5.1. CONTEXTUAL OVERVIEW

The DPME's 2015 Diagnostic Report outlines a roadmap towards what was then called a water plan based on the sector-wide consultation process which was used to guide the NWSF (Figure 19).

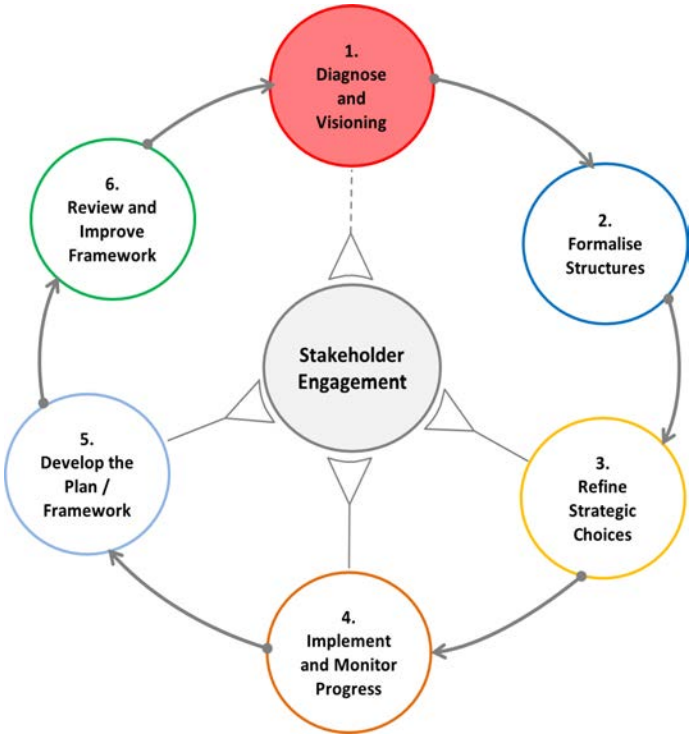


Figure 19. Water Plan Roadmap adapted from the National Water Plan Diagnostic Report, 2015

As earlier stated, the water security framework is the highest national planning platform and tool from which all other plans must draw. By design, it is set to clearly and unambiguously address the developmental state as articulated in government policies and the NDP. Its focus is the socio-economic development and is strategically broader to form the "*hook and hanger*" from which all other plans draws their implementation plans. The performance indicators are

largely those that directly impact on the country's economic position and national transformation imperatives. The WfGD was attempting to address some of these needs – albeit in part. Further, the framework resonates with international obligations as well as intersectoral interdependencies which would not otherwise be fully covered from the line Department perspective.

The institutional settings cover the different levels of plans on the water value chain, from the NDP to the local intergrated water management (IWM), in a regionalised manner in line with the policy and the legislative model (Figure 20).

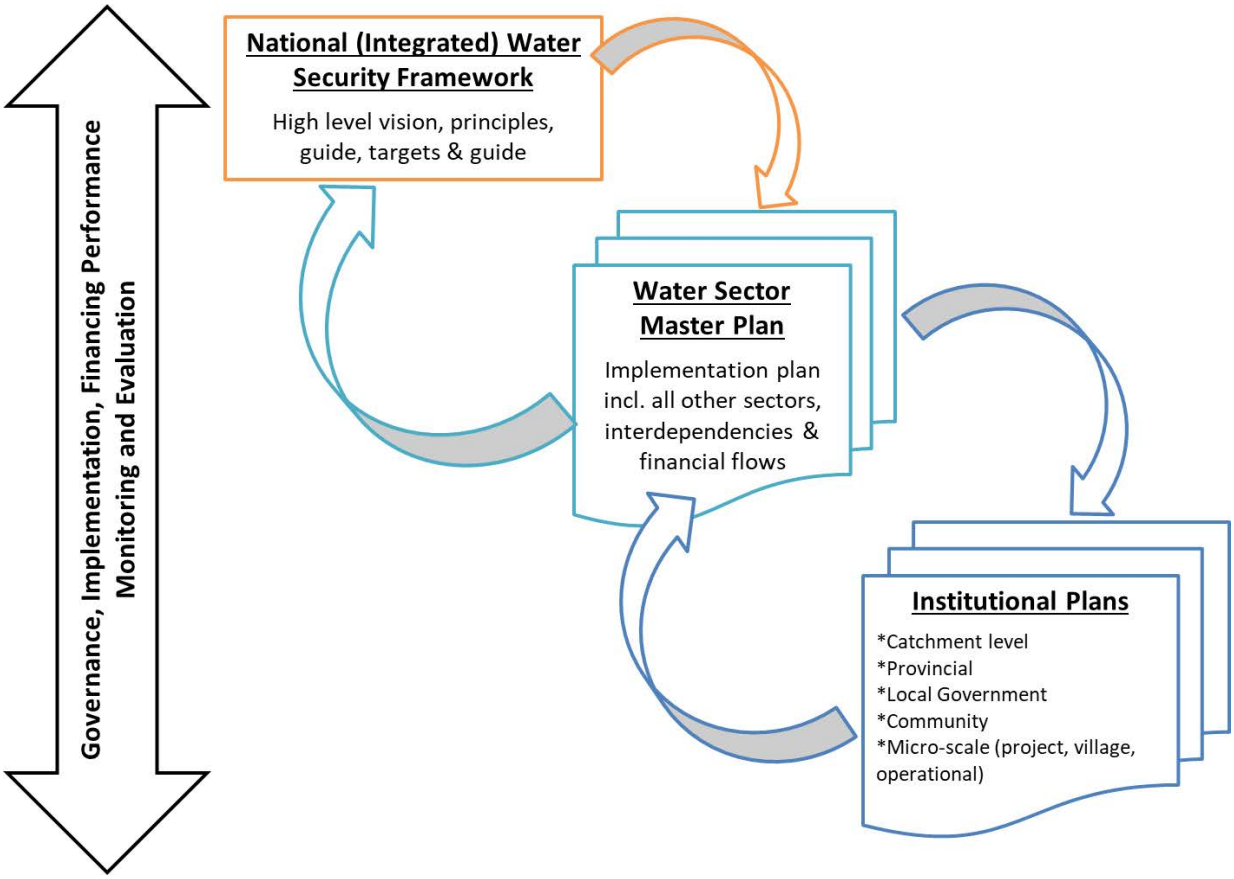


Figure 20. Hierarchical schematic illustration of NWSF in relation to other plans.

The NWSF takes into account the institutional jurisdictional boundaries and helps to ensure that each institution is clear about what is expected of it. It unpacks and articulate the water situation at the highest level with examples of successes and failures over the past and setting the scene on what is to be done in the medium- to long-term.

The infrastructural works are planned in time to accommodate increases in the water demand. The NWRS2 addresses the infrastructure challenges and demands for the entire water value chain. The document states that an estimated R670 billion is needed over the next ten years. In addition, an investment of R30 billion is required for sustainable water

management programmes, bringing the total sector investment to R700 billion, being R70 billion per year. This is a considerable investment which is expected to be funded from on-budget and off-budget sources through the private sector. Assuming that these numbers accurately reflect the real costs, the reality is that the funding is not available and even if it was, the inefficiencies in the system suggests that unless something drastic is done differently, the allocated funding will not necessarily yield the desired results.

The positioning of Africa globally is that the continent is a resource-based economy continent, with a low rainfall: runoff ratio and high evaporation rate. Only 20% of the runoff is available for development, while 80% evaporates (Figure 21). Innovative solutions must be found to mitigate the high evaporative demand, including soil and land management to retain water at landscape level as well as improved groundwater recharge.

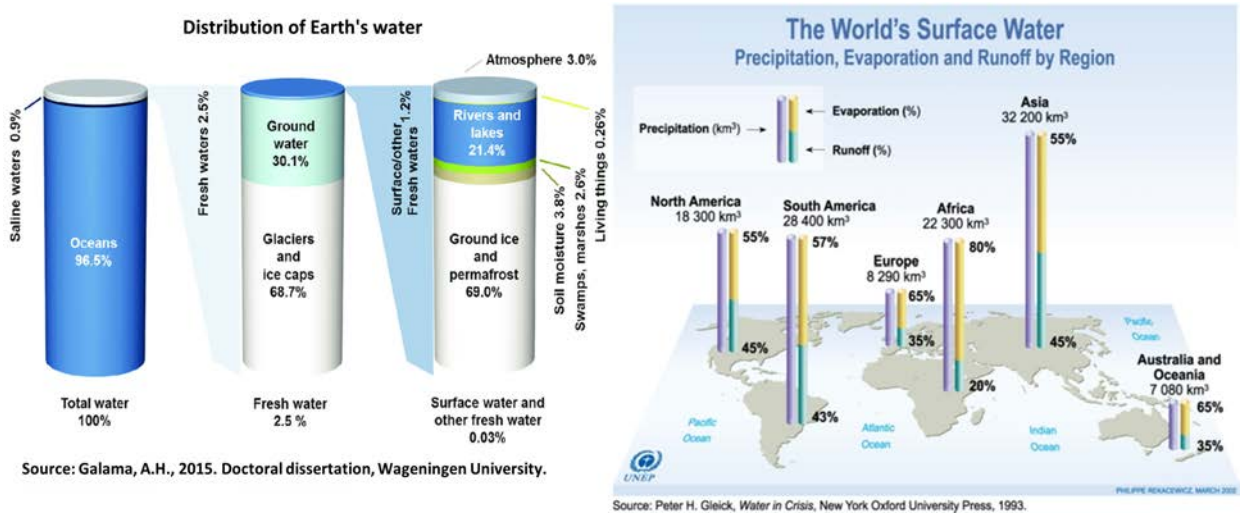


Figure 21. Distribution of the earth's water and the world's surface water precipitation, evaporation and runoff by region.

Africa's water towers (Figure 22)[89] have been identified as elevated areas (generally 200–800 m above the surrounding area) where precipitation is higher than 750mm and runoff above 250mm. They contribute to water resources for population beyond their delineated boundaries and are key planning factor for water security.

In the South African context this would be primarily the Drakensberg mountain range and the Lesotho highlands which contribute more than 60% of the total precipitation. In assessing long distance water transfer schemes this could be the areas to look into in terms of benefit to cost analyses.

[89] UNEP. (2010). "Africa Water Atlas". Division of Early Warning and Assessment (DEWA). United Nations Environment Programme (UNEP). Nairobi, Kenya.

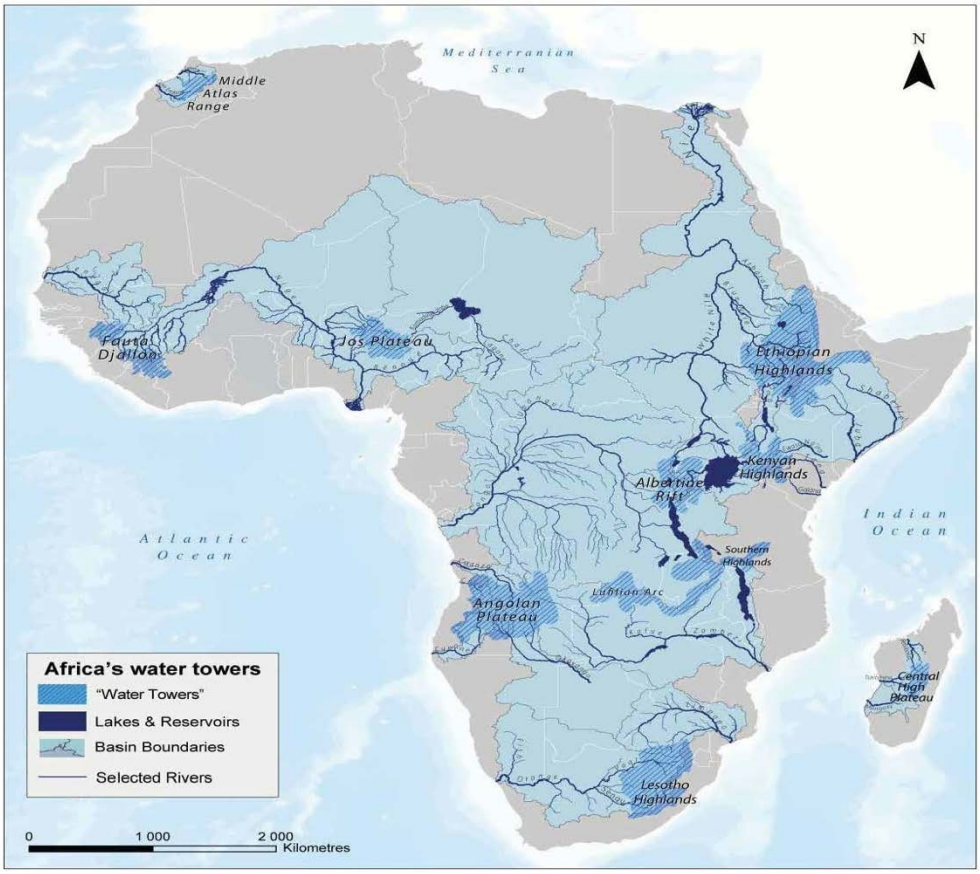


Figure 22. Africa's "Water Towers" with selected rivers

South Africa has 22 water source areas spread across five provinces (KwaZulu-Natal, Mpumalanga, Western Cape, Eastern Cape and Limpopo). The total size of our water source areas is 12.32 million hectares. A number of these areas extend and are shared with Lesotho and Swaziland; approximately 1.91 million hectares in Lesotho and 0.93 million hectares in Swaziland. The total volume of water supplied by these areas per year is approximately 2 457 million cubic metres. The greatest volume of recharge is generated by the Southern Drakensberg, followed by the Eastern Cape Drakensberg and the Boland Mountains.[90]

Of the 263 major international transboundary river basins, Africa has 63 (comprising about 24%) covering about 64% of the continent's land area and containing about 93% of the total surface water resources (Figure 23). Some 77% of Africa's population is said to be located in these areas. Within the context of SADC political boundaries and major river basins (Figure 23 and Figure 24) comprise:

- 15 River basins shared by at least two countries;
- 70% rural population relies on groundwater supplies – compare this to poverty levels and livelihoods in general;

[90] https://water.cer.org.za/

- Of 280 million people, 40% is said to have no access to adequate safe drinking water and 60% has access to adequate sanitation services;
- Of 50 million irrigable hectares, only 7% (3.4 million ha) is currently irrigated; and
- 14% of total annual renewable water resources utilised compared to 70-90% in industrialised countries.

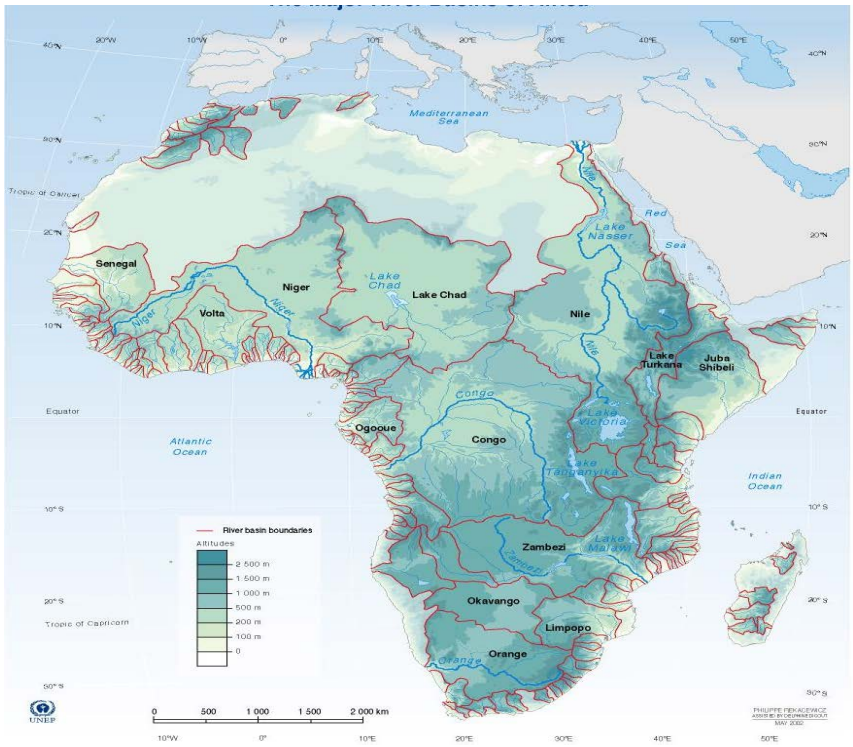


Figure 23. Major river basins of Africa[91]

In the South African context more than 60% of river systems are shared with neighbouring countries and the international allocation is written into policy and law as one of the priorities (Figure 24). Regionally transboundary water management is done through the Revised Protocol on Shared Watercourses in SADC which provides the context for the Regional Water Policy (RWP) which states over-arching goals designed to be put into practice by the Regional Water Strategy (RWS), namely:

- Regional cooperation in water resources management;
- Water for development and poverty eradication;
- Water for environmental sustainability;
- Security for water-related disasters;
- Water resources information management;

[91] UNEP, (2001)

- Water resources development and management;
- Regional water resources institutional framework;
- Stakeholder Participation and Capacity Development; and
- Accessing funding and resources.

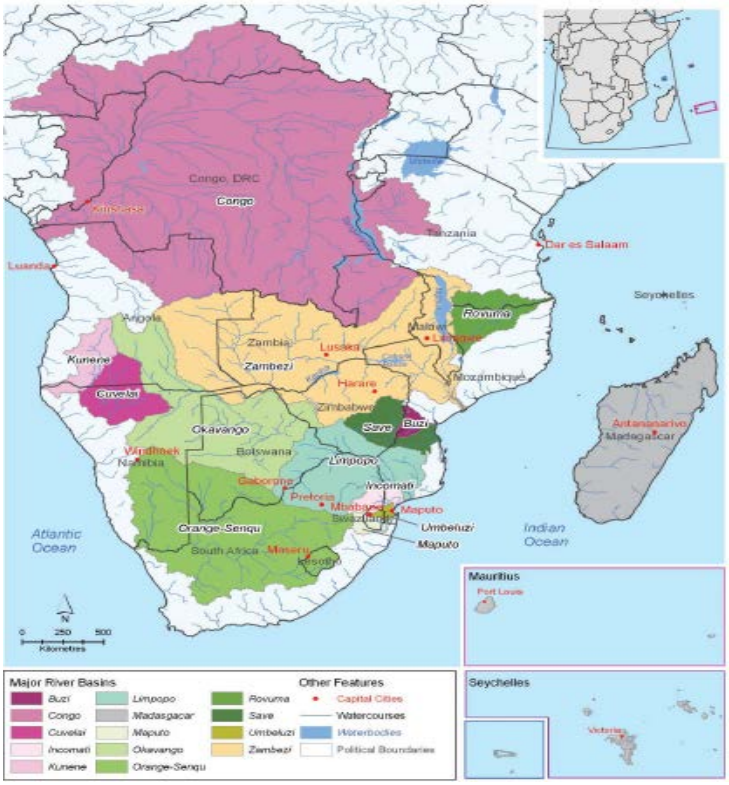


Figure 24. SADC Political boundaries and major river basins

Institutions to manage international obligations created and recognised under the South African Law include:

- Limpopo Water Course Commission (LIMCOM);
- Inkomati Tripartite Permanent Technical Committee and the associated Komati Basin Water Authority (KOBWA);
- Orange-Senqu River Commission (ORASECOM); and
- Lesotho Highlands Water Commission (LHWC).

These are also complemented by the bilateral agreements with neighbouring countries on water matters. In this context, it is important to note that where South Africa is not a riparian state, it makes it complex to negotiate water transfer even when geopolitically this could make sense.

Water availability in Southern Africa is characterised by uneven spatial distribution and seasonal variation with the driest parts being the southern-most parts of SADC. Key elements of water availability in South Africa include the following:

- 43% of rain falls on 13% of land[92];
- Unreliable and fluctuating stream flow for use;
- Total natural runoff averages 50 billion m^3 p.a.[93];
- Major urban and industrial development areas are not located in areas with water resources – necessitating large scale transfers;
- Of the 50 billion m^3, only 14 billion m^3 (28%) is available for use through dams, basin transfers and other resource developments throughout the country. This must be viewed in the context of high levels of sedimentation and evaporation which impact water available for use.[94]

Figure 25. Shared basins providing water sources and reflecting transboundary inter-basin transfer

South Africa's water sources in relation to SADC are shown in Figure 26, which also illustrate that the increases are mainly in the eastern side of the country. The framework focus must ensure that even at this level, solutions for water security are not seen in isolation from the rest of the region.

[92] Aquastat: http://www.fao.org/nr/water/aquastat/countries_regions/ZAF/

[93] National Water Conservation and Demand Management Strategy, DWAF, May 2000

[94] National Water Conservation and Demand Management Strategy, DWAF, May 2000

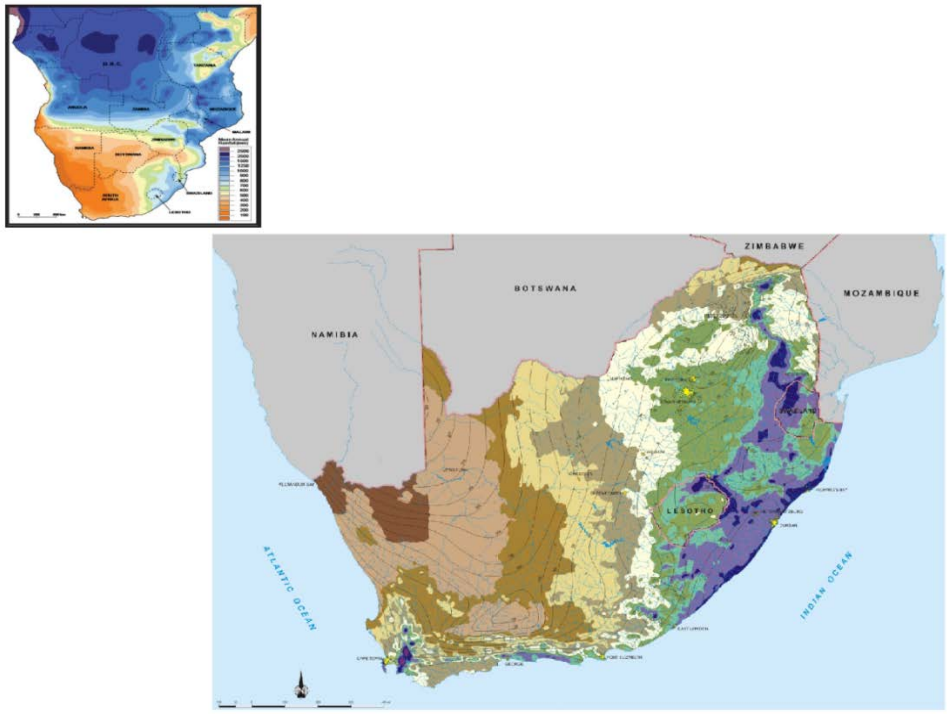


Figure 26. South Africa's water sources in relation to SADC

The story of freshwater systems cannot be complete without specifically including groundwater. An equivalent map has been produced on shared transboundary aquifers on the continent. Although these resources are very important as part of fresh water sources for drought security, and can be available for productive use, they are largely under explored both nationally and at transboundary level.

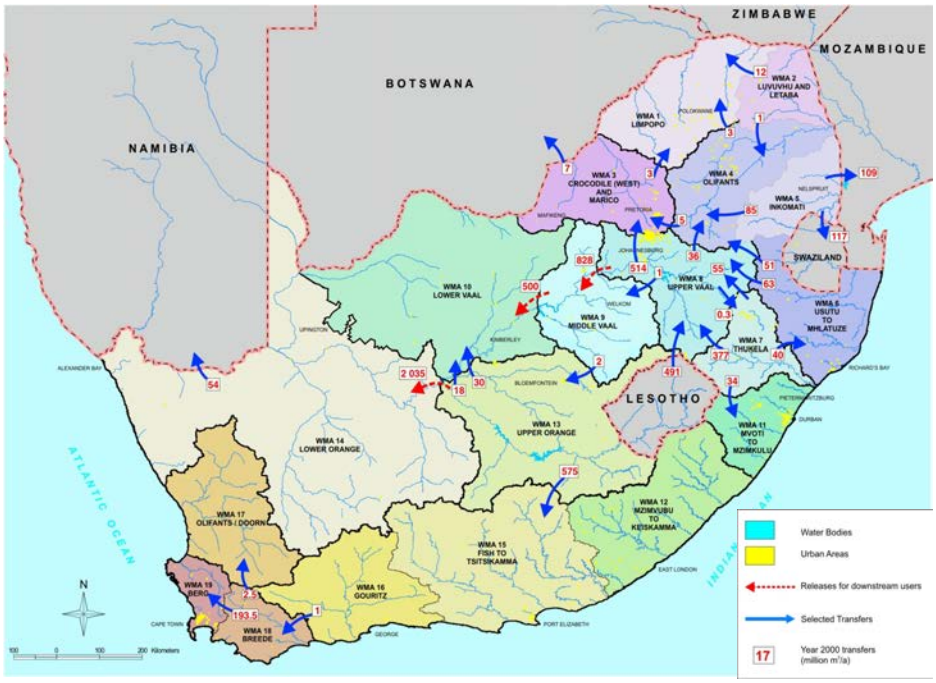


Figure 27. South Africa's interbasin/catchment transfer, DWAF 2000.

The International Water Management Institute (IWMI) has developed a map[95] (Figure 28) and inventory that shows the presently known transboundary aquifers in Africa which includes 80 aquifers and aquifer systems superimposed on 63 international river basins. Transboundary aquifers cover 42% of the continental area and 30% of the population.

[95] https://wle.cgiar.org/content/transboundary-aquifer-map-africa

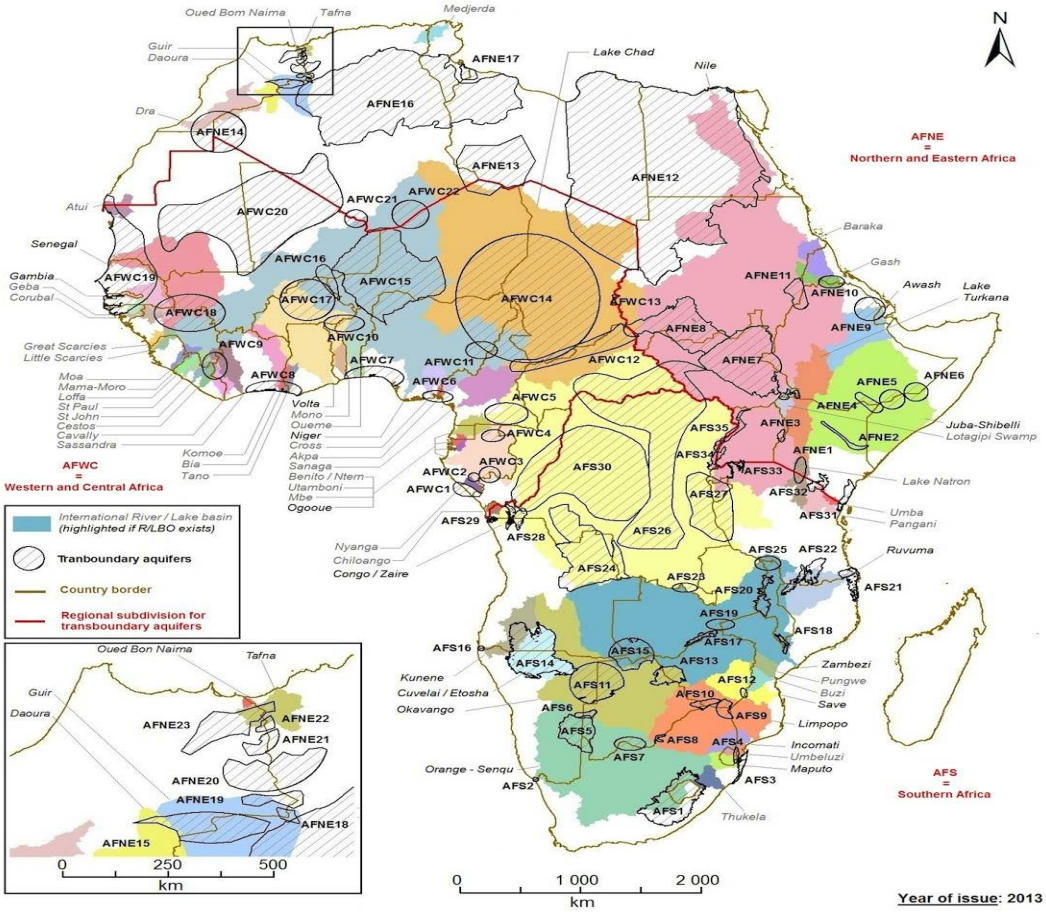


Figure 28. Major shared aquifer and transboundary waters in Africa

In South African context, groundwater (Figure 29) is limited due to the geology of the country and large porous aquifers occur only in a few areas and availability is estimated at 10% of the total water availability of 910 m^3/capita/annum[96]. From water availability perspective it is estimated that National Utilisable Groundwater Exploitation Potential measured in $m^3/km^2/a$ is:

- 12 billion surface water (+11 billion allocated);
- 10 billion ground water (7.5 billion under drought conditions (only 2-3 billion used); and
- 2 billion usable return flows.

Groundwater is often the primary source in the rural and more arid areas, as well as for many towns. It is estimated that more than 100 towns (more than 60% of small towns) in South Africa depend on groundwater and about 7.5% of the water supply to Pretoria is from groundwater. It also supplies water to large irrigated areas, livestock and many mines and industries. Groundwater use can be increased substantively, at least in a local supply context.

[96] Kevin Pietersen, K and Hans Beekman, H. 2015. Groundwater Management in the Southern African Development Community.

It is expected that groundwater requirements for human use will further increase, especially in the western part of the country which lacks perennial rivers.

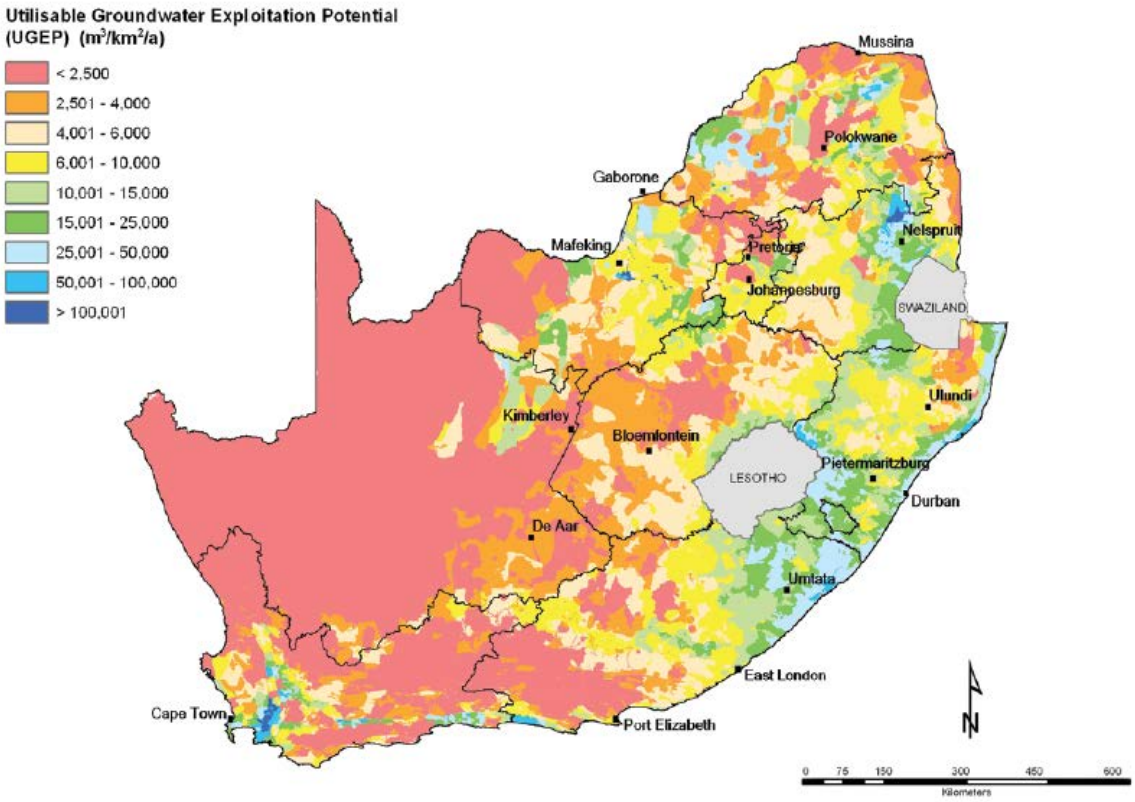


Figure 29. Utilisable groundwater exploitation potential[97]

Distribution of dams in Africa[98] (Figure 30) reflects that South Africa has a high number of dams compared to many parts of the continent and reconfirms the argument that spaces for large water resource development projects are limited. The need for direct or indirect transboundary water transfer such as through re-balancing demand through virtual water flows will remain a critical intervention from a national and regional water security perspective.

[97] DWAF, 2013

[98] UNEP, Africa Water Atlas, 2010

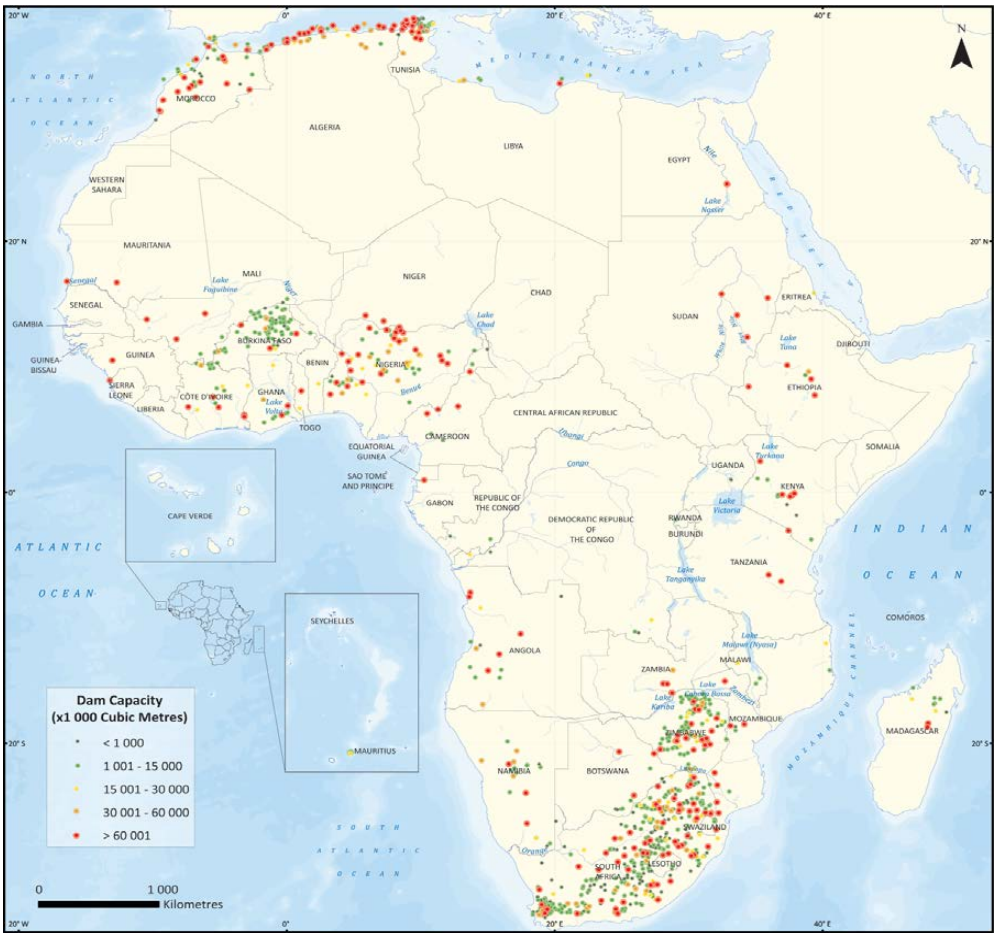


Figure 30. Dam/Reservoir distribution in Africa

5.2. FOCUS AREA 1: NARROWING THE INEQUALITY GAP – WATER AS AN ENABLER

5.2.1. Introduction

This focus area addresses the issue of measurable improved livelihoods, human well-being and socio-economic impact of the total value chain from conception to impact in the short-, medium- and long-term.

A paradigm shift in thinking and approach is required so that future planning takes place within the new Water Security Framework that emphasises scenario-based planning with continued measurement of impact both real and potential. For instance, a holistic approach is required to plan and monitor the contribution/benefits/relevance of schemes to communities throughout the water value chain taking into account long-term implications. Project or operational planning must not be confounded with scenario/strategic long-term planning. From water accounting perspective as envisaged within Stats SA's environmental accounts, it will be critical for all scales from lowest level (individuals, households and communities through to national scale intervention) to be assessed to see how water impact or contribute to the economy in the real sense, not indirectly.

The World Bank report cited earlier in this document shows that the inequality gap in South Africa is high, persistent and has increased since 1994 and states that South Africa is one of the most unequal countries in the world. The report further shows that the wealth inequality is high and has been increasing, suggesting that the commitments made through the NDP will not be achieved by 2030 unless some drastic actions are taken. From the water security perspective GWP/OECD examined the effects of water security on wealth and wellbeing and indicated that the goal of improving the material wealth of societies must be negotiated within the boundaries imposed by the availability of the water resource and balanced with the cultural and spiritual values of water. Sustainable economic growth, wealth and human well-being are at the heart of the water security framing presented (ref. Figure 6). Drags on growth is associated with compromised water security in that where water is reliable, economic opportunities are enhanced, whilst where it is unreliable or inadequate quality or where water related hazards are present there will be drags on growth. In the context of South Africa the issues of inequality are intricately linked to colonial and apartheid spatial planning[99] and until this is addressed as an integral part of the interventions the problems will persist. Spatial planning and water is covered as a separate focus area in the framework. The challenge of inequality is exacerbated by the politics of exclusion, corruption, poor governance and weakened human resource capacity in the sector generally.

An assessment of in-country economic water security, highlighting priorities, is recommended taking into account that although some assessments done show South Africa being among the top in terms of this, it is among the highest in terms of inequality. Sufficient metrics based on modified human development indicators and indices and other measures have been developed over the years which can be used at national level to assess the water security/insecurity dimension of sustainable development such as the UNDP initiative[100]. These assessments will need to go beyond simply measuring access as has mainly been the case to assessing the key aspects related to fundamental root causes of income inequality linked to water economy.

Research has been done[101] and maps, indicators and inequality measures presented which provide monitoring and communication tools that could be used for the SDGs and for geographical targeting for more effective decision-making; and made policy recommendations which included: (1) using more ambitious official indicators for water access; (2) reporting suburb level water use data by sector to identify high and low end users; (3) exploring innovative cost-effective solutions to provide on-site piped water access to informal settlements and remote communities; (4) increasing the official minimum per capita water supply to 100 l/c/d to meet WHO guidelines; (5) introducing a maximum per capita

[99] Source: https://mg.co.za/article/2019-12-01-00-analysis-of-inequality-in-south-africa-remains-shallow. (Accesed 11 -1 2020 @ 23h50

[100] See http://hdr.undp.org/sites/default/files/2018_summary_human_development_statistical_update_en.pdf

[101] Cole MJ; Bailey R.M.; Cullis JD and New MG. Spatial inequality in water access and water use in South Africa. Water Policy (2018) 20 (1): 37–52.

water supply in line with supply and demand projections; and (6) use additional indicators of inequality in the SDGs based on disaggregated data. It is further noted that as South Africa's population grows and its climate changes, water scarcity and inequality are worsening at national and local level. It is critically important that water resource policy, planning and management is informed by accurate, up-to-date data and analysis at the appropriate spatial scale, that will allow a properly targeted intervention in line with the NDP goals.

Recent work on water and inequality has been done covering issues of inequality and dispossession and water governance; spatial inequality; urban-rural inequality; historical imbalance among others[102] [103] [104]. Analysis of the extent to which the post-94 reform has succeeded in reducing inequality beyond access to water is essential and to focus on the contribution of water to inclusive economic growth and development in context of water security for all.

5.2.2. Conceptual Framing - The socio-economic environment

From water security perspective, in socio-economic terms, water has long been seen as both a social and an economic good. The lack of proper water management and provision of services can lead to debilitating impact on human wellbeing, potential revenue losses and inability to generate and sustain livelihoods. One of the key considerations in the socio-economic issues of water is cost recovery in terms of balancing access and commodification of water. Water security framing must ensure that the balance is appropriately kept and managed.

South Africa's water challenges are in general Africa's challenges. South Africa's estimated water use per sector reflects a high level of allocation to irrigation like many sub-Saharan countries. It has been reported [105] that Sub-Saharan Africa suffers from chronically overburdened water systems due to increased stress from fast-growing urban areas and that weak governance, corruption, mismanagement of resources, poor long-term investment and lack of environmental research; and urban infrastructure exacerbate the problem. In some situations, violence has occurred domestically and across borders. Critical to address these challenges is incorporating water security improvements into economic development to improve wellbeing and livelihood and advance socio-economic stability.

The disparities compared to other continental regions as a result of insufficient water resource and sanitation development compared to other regions is also evident within the sub-continent with countries such as South Africa having a lion's share of large dams

[102] Ravnborg, H.M., 2016. Water governance reform in the context of inequality: securing rights or legitimizing dispossession?. *Water international*, *41*(6), pp.928-943.

[103] Cole MJ; Bailey R.M.; Cullis JD and New MG. Spatial inequality in water access and water use in South Africa. Water Policy (2018) 20 (1): 37–52.

[104] Funke, N., Nortje, K., Findlater, K., Burns, M., Turton, A., Weaver, A. and Hattingh, H., 2007. Redressing inequality: South Africa's new water policy. *Environment: Science and Policy for Sustainable Development*, *49*(3), pp.10-23.

[105] United States Council on Foreign Relations (CFR), 2006.

comprising approximately 60% (Figure 30). In addition, the colonial boundaries drawn in the past resulted in residents being separated from resources, especially water, resulting in the emergence of the concept of nation-state; and national boundaries drawn creating transboundary waters as a by-product. The implication for all this is that water management cannot be separated from migration resulting from socio-economic driven migration. The presence or abundance or scarcity of water even though significant, is not the major issue but the presence or absence of water and economic development. This may include utilisation or deployment of resources. In the case of South Africa such challenges were glaring during the Apartheid period and the dawn of democracy with movement of people across the country and continent generally resulted in pressure on the resources and the associated infrastructure. Reference has been consistently made to the "Apartheid Spatial Planning" problem which manifests in the form of geographic location of former Bantustans and poverty and the continued migration of people to city regions of the country. This challenge cannot be ignored or taken as *feit accompli*, and remains one of the most critical aspects of transformation.

The WWF, in their 2017 publication on *Scenarios for the Future of Water in South Africa*, reports that water demand in South Africa has been witnessing a steep increase, with three major sectors driving the demand. The agriculture sector is the highest at around 62% irrigation water, followed by the municipal and industrial sectors at 27% and 11% respectively. This demand is expected to further grow at around 1% annually to reach ~18 bn m^3 in 2030 from 15 bn m^3 in 2016.

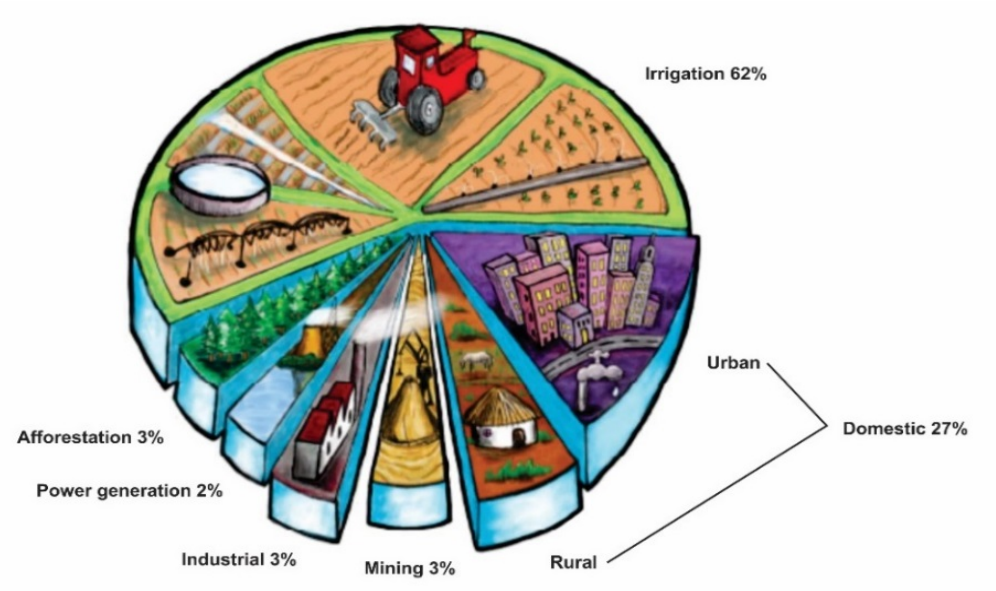


Figure 31. South Africa's estimated water use per sector (DWS)

Overall, the demand management has become a key part of water management in that demand is estimated to far outstrip the supply (reported to be estimated at 17% by 2030[106]). However, this is still not fully accounted for in respect of efficiencies and true return on investment. In considering the use per sector, the following need to be taken into account:

- A proportion of about 35% of waste water can be recycled;
- Measurements on use are largely based on allocation and modelled data; thus monitoring water use needs to significantly improve;
- Up to 62% of the data is unmeasured or not monitored;
- The need to cleanup data and creating better responsive tools to facilitate planning and monitoring;
- "New water" (desalination, cross-border transfers, etc.) is needed but we must also ensure efficient use of current available water – ground and surface.

Figure 32 shows South Africa's water balance at macro-level reflecting that almost all water is allocated as reported in many publications. Drastic steps are required to address the challenge. Such steps must include accurate assessment of real use, full cost recovery and reconsideration of boundaries of demand centres vs. source areas.

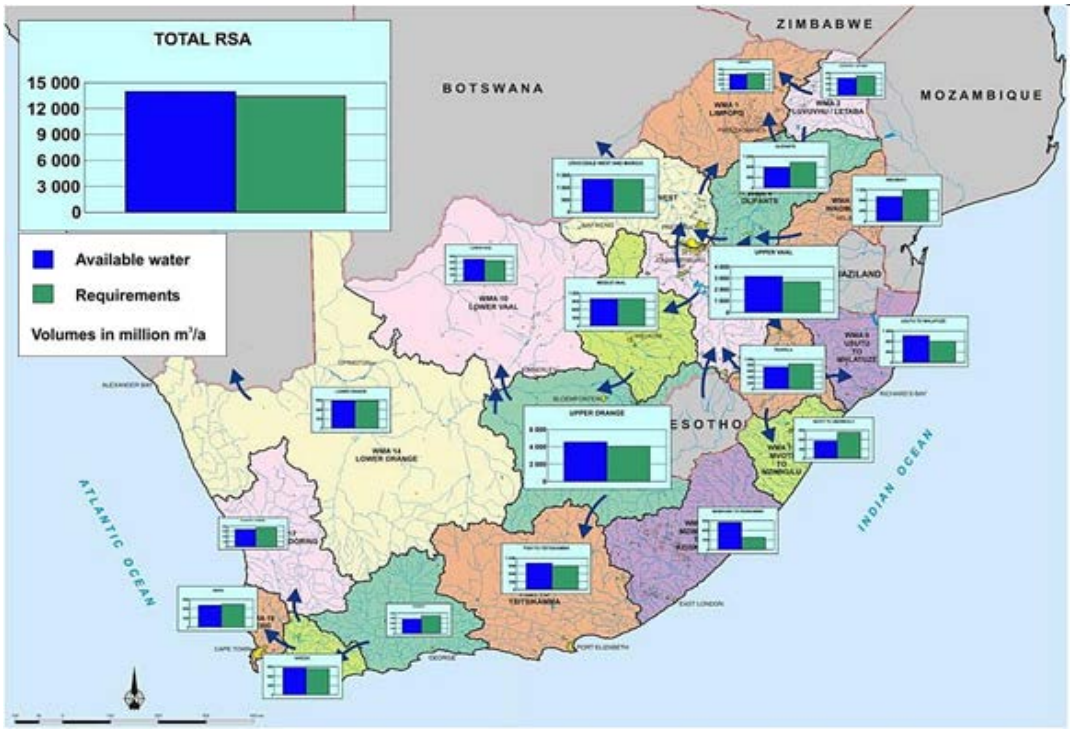


Figure 32. South Africa's water balances at macro level[107]

[106] WWF, 2017 Scenarios for the Future of Water in South Africa

[107] DWS, 2004

The planning regime still maintains a *status quo* of "*economic zoning*" as demand centres that are largely a construct of the past economic and social engineering. With South Africa's population currently estimated at 65% in urban centres and still growing the planning for water security will continue to be a serious challenge unless drastic changes are made to address the past. Figure 33 shows ideal national spatial development pattern as reflected in the NSDF showing demand centres. It is critical that in planning for the national spatial development priorities water security forms an integral part of the national planning.

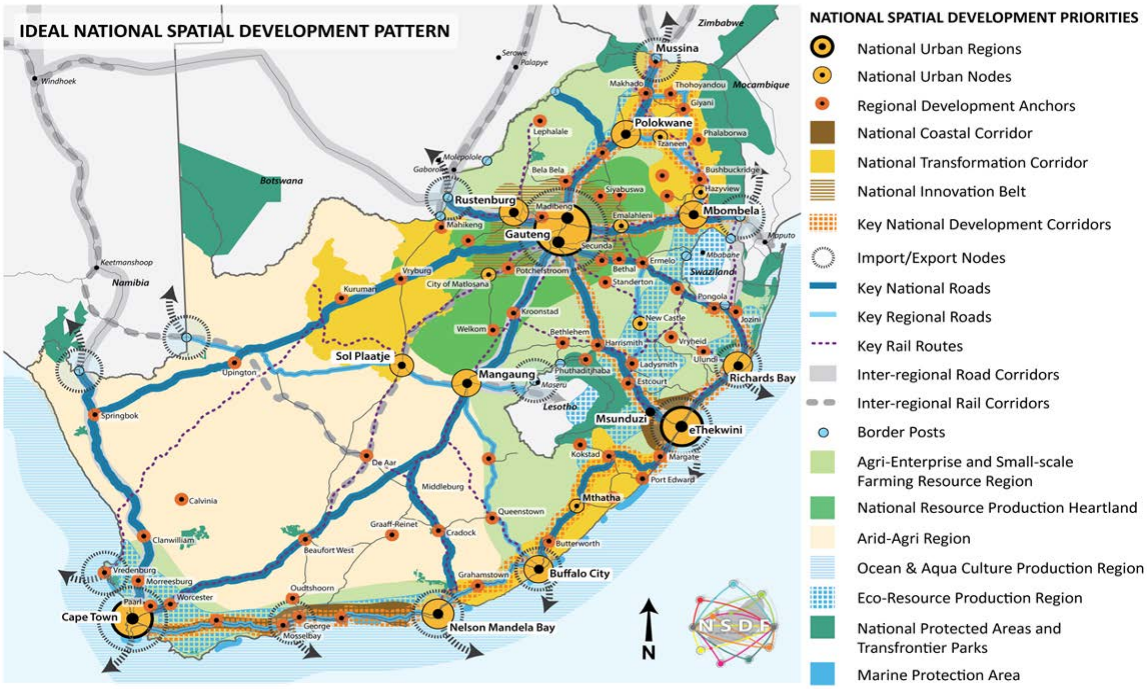


Figure 33 Ideal national spatial development pattern as reflected in the NSDF showing demand centres

Current demand and water use dynamics within the context of sub-Sahara Africa and implications for South Africa are such that

- Water is embedded in goods and services;
- South Africa has more diversified economies characterised by a relatively higher level of development and political stability;
- Water rich goods and services are generally exported from drier south to wetter north.

Given the situation depicted in Figure **34** is it not important then to review our planning models, boundary conditions and assumptions to be robust enough to address the current realities and future scenarios?

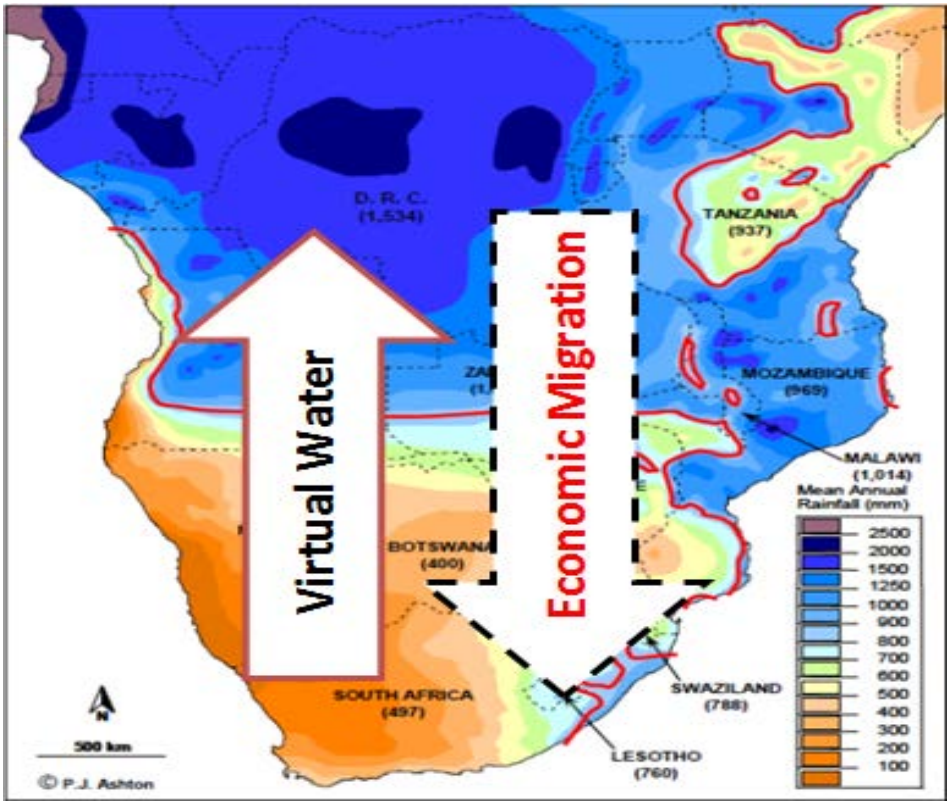


Figure 34. Water demand and use dynamics in Southern African context

In its country report for South Africa, the Aquastat database of the Food and Agriculture Organisation (FAO) states that:

"development and use of water resources differ widely between the northern arid parts of the country, where both surface and groundwater resources are nearly fully developed and utilized, while in the well-watered south-eastern regions of the country are significantly undeveloped and little-used resources exist."

The question is how do we use our data to predict future rainfall patterns? How robust are the methodologies given the opportunities brought about by supercomputing for instance? SA is behind the curve on this kind of investment especially in the context of water sector.

Figure 35 shows the location and extent of the Vaal-Orange/Senqu river basin which covers a significant proportion of central part of South Africa in addition to Lesotho, Botswana and Namibia who's combined water demand from the basin could be less than 10%. The countries rely to varying degrees on the river basin as a source of water for industry (mining and manufacturing), agriculture, energy, tourism, conservation and residential needs.

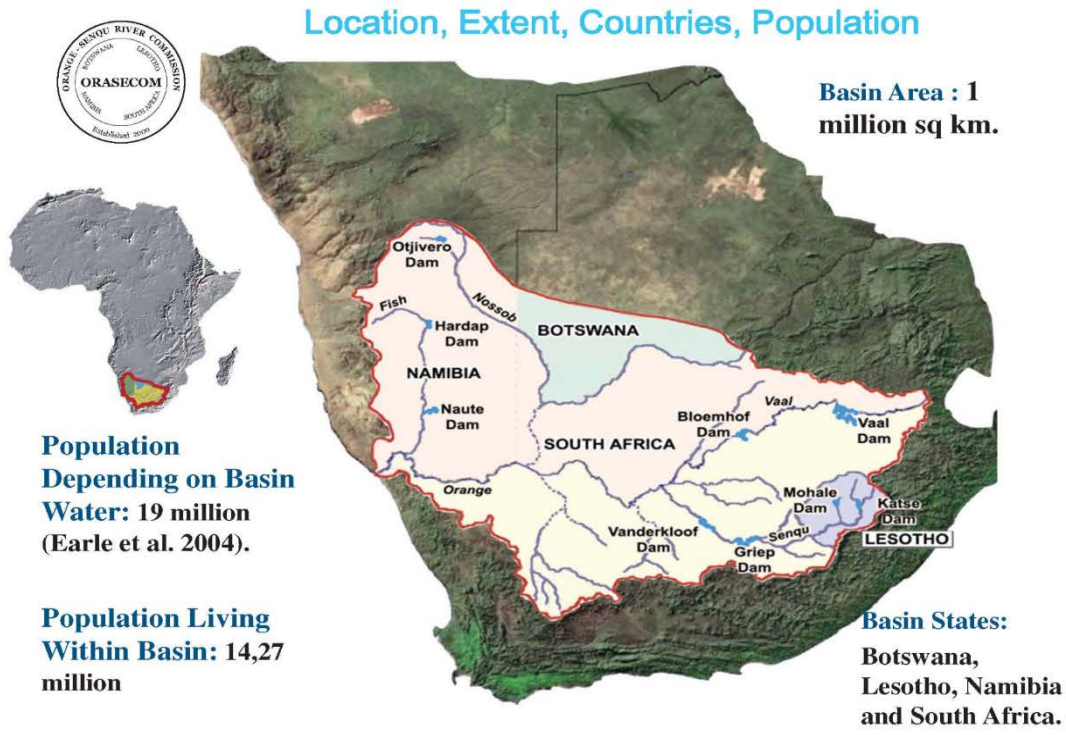


Figure 35. Vaal-Orange/Senqu basin to be seen in context of economic footprint of the Vaal-Orange River System and the potential risk of water insecurity

5.2.3. Recommendations

Key recommendations in respect of inequality are:

- Holistic approach to plan and monitor the contribution or relevance or benefit of water to community using modified human development index and other supporting measurements at all scales beyond drinking water requirements. Current policy and legislation allows for this;
- In country assessment of inequality to be related to socio-economic driven migration from a regional perspective; and
- Prioritisation and elevation of MUS policy to stimulate local economy and improve livelihoods.

5.3. FOCUS AREA 2: WATER INFRUSTRUCTURE AND FINANCE

5.3.1. Introduction and Background

This focus area addresses the issue of financial sustainability from a point of view of financial flows and sustainability with some emphasis on investment on infrastructure and the associated interdependency with socio-economic development in the water sector.

Accessing water can be expensive and complex, irrespective of the mode of mobilisation of funding resources or time allocated to developing and executing solutions. Water projects tend to be indivisible and capital-intensive, and South Africa like many countries has major backlogs in developing water infrastructure. There is a need for innovative and smart national and international financing approaches as well as appropriate incentives to achieve development goals. Financial resources need also be allocated to public sector financing e.g. for the management of the resource, not only the water services. Therefore, full value chain of infrastructure requirements, financing, including its impact on institutional alignment, financial flows etc. need to be clearly articulated as part of planning for water security. This includes the NEXUS and interdependency nature of the water projects to other sectors and subsectors. Currently the financing for infrastructure is largely project-driven and not sufficiently focussed on the "spill over effect" of other sectors. This has largely been addressed through the Government's outcomes and SIPs. However, the overall long-term implications remain largely unclear, and in many cases impacting negatively on the economic development.

Ensuring that projects are funded effectively from conception to execution through to outcome and impact needs to be clearly articulated to ensure effective implementation. Most importantly the financial flows and sustainability are critical as the projects on water tend to be interconnected with almost every other sector, especially in context of South Africa where water availability challenge is a reality due to the centrality of water.

5.3.2. State of Play and Conceptual Framing

As stated in the NWRS2[108], water infrastructure in South Africa is mainly funded by a combination of loans on the basis of user charges (water tariffs) and government grants (primarily through the municipal infrastructure grants). Presently there is little private equity and investment in the water infrastructure generally.

Figure 36 shows financial flows and water institutional value chain and infrastructure in South Africa.

[108] NWRS2, 2012. Natural Water Research Strategy 2: Managing Water for an Equitable and Sustainable Future. DWA. South Africa

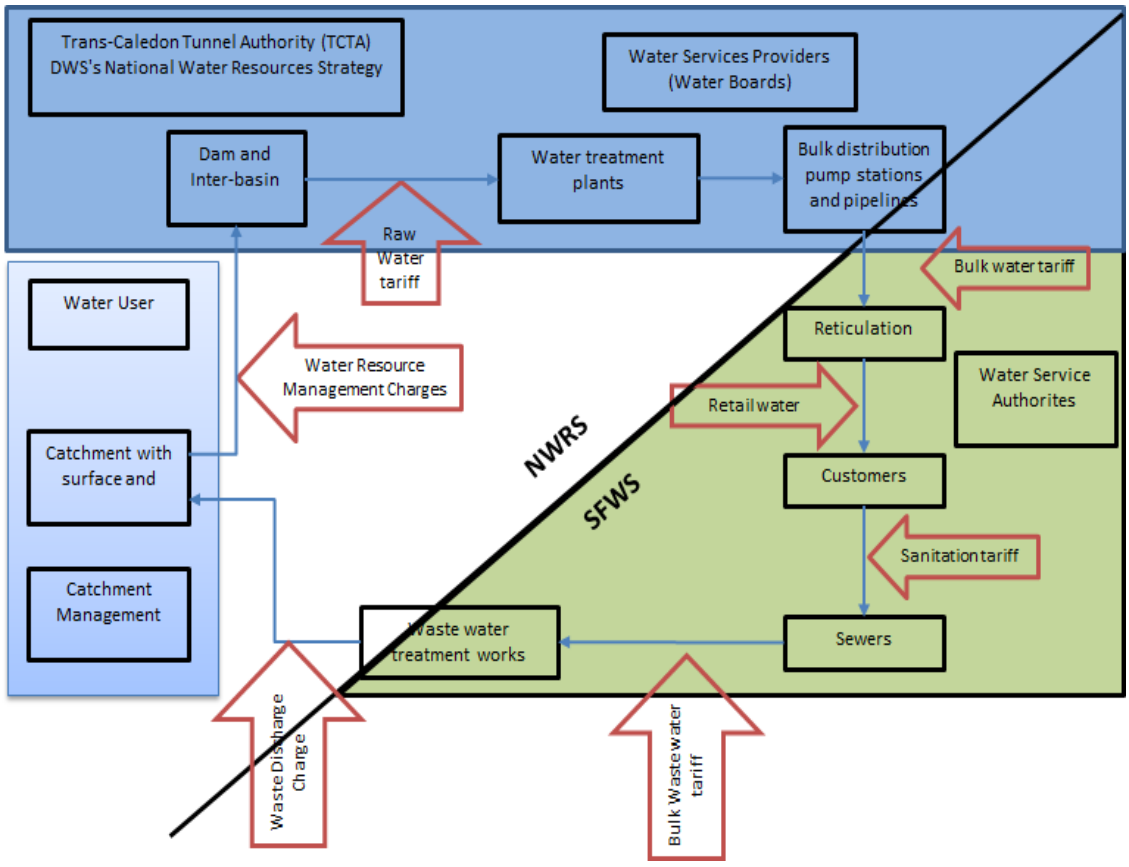


Figure 36. Financing for water resources and water services components[109].

From a funding perspective, National Treasury allocates funds in different ways, as explained above. The categories of funding are as follows:

- National Treasury in form of grants
- National Department
- Catchment management charges
- Raw water tariff
- Bulk water tariffs
- Water Services tariff
- Sanitation tariff
- Waste discharge.

It is now common cause that many municipalities do not ring-fence their revenue and costs for water and sanitation services leading to inadequate and inconsistent provisioning for the

[109] Source: Ruiters and Matji, 2015. Water institutions and governance models for the funding, financing and management of water infrastructure in South Africa. Water SA Vol. 41 No. 5

full lifecycle cost of infrastructure. As a result, maintenance is neglected and there is mostly under-provisioning of depreciation capital. Further, maintenance challenges are experienced as a result of lack of standardisation and use of appropriate technology. To this end, it is argued that independent regulation of pricing and tariff setting is required as the current model is not effective[110].

Municipalities distribute water and charge for water, but still get support from the fiscus through National Treasury. The stepped-up tariffing done by the Municipalities does not cascade up to benefit bulk water providers (water boards/utilities) whose tariffs are based on a flat rate. This is critical in that in the end the customers or end user suffers. Further, risk of the gains brought about by water conservation and demand management resulting in building revenue that does not end up funding water infrastructure.

From the NDP perspective, bottom up plans based on the full cycle and value chain and supported by appropriate funding are needed. Innovative ways of funding need to be found. Financial flows and decisions must be monitored and regulated appropriately with emphasis on accountability.

The above also have implications for proper configuration of water (resources and services) management institutions across the value chain. Such configuration must include regional bulk water provision based on "big picture" planning.

Experience in Cape Town to some extent demonstrates the need for a bulk supplier. Further, privatisation of reticulation is not always preferable because a situation should not be created where protection of the source is undermined. The interdependencies linked to water are too high to be left to independent inadequately regulated environment. At the same time, government has to be efficient enough to make this all work.

The impact of water infrastructure and associated financial flows on the economy can best be understood by considering the complex ways in which critical infrastructures are interconnected and mutually dependent both physically and through a host of information and communications technologies. Figure 37 shows depicts a broad range of interrelated factors and system conditions representing six dimensions which include technical, economic, business, social/political, legal/regulatory, public policy, health and safety, and security concerns that affect infrastructure operations. The degree to which the infrastructures are coupled or linked strongly influences their operational characteristics, and will determine impact or domino effect resulting from failure of a particular dimension or type of infrastructure. It is primarily for this reason why in the case of water we chose to look specifically into infrastructure and financial flows as a complex system constituting or constituted by small part(s) of the intricate web that forms the whole beyond a simple sum of its parts rather than discreetly looking at water infrastructure in isolation.

[110] Source: Ruiters, C and Matji, MP. 2017. Funding and financing for wastewater and sanitation infrastructure in South Africa: Pricing, tariffs and operational efficiency.

Like energy, aggregating components of the water value chain in an *ad hoc* fashion will not ensure reliable water supply. Rather a careful creation of an intricate set of services will yield a system that reliably and continuously supplies water- hence water security not being a linear supply and demand process.

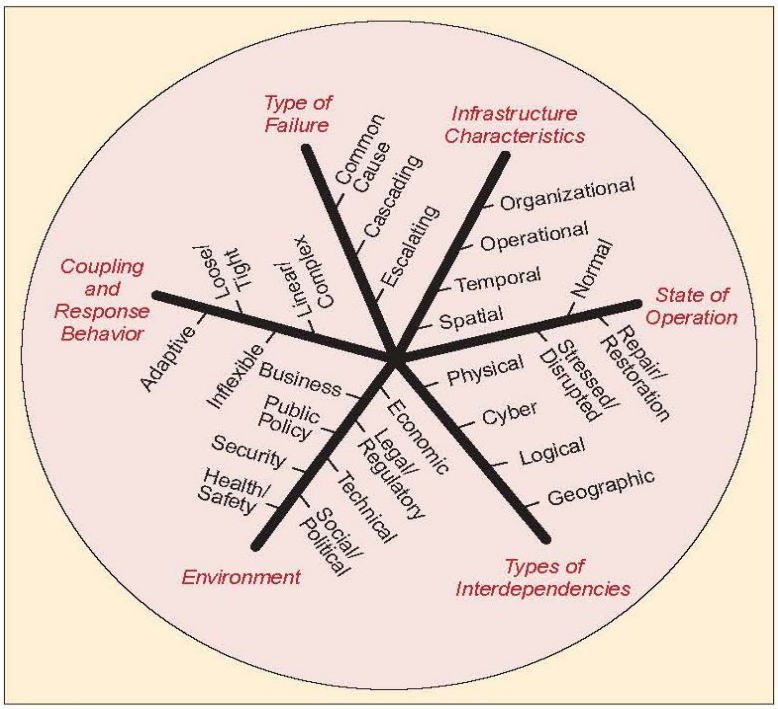


Figure 37. Dimensions for describing infrastructure interdependencies[111].

Like other types of infrastructures, water related infrastructure has specific characteristics such as spatial and temporal scale, operational factors and organisational considerations. Critical to note is that what happens to one infrastructure or portion thereof, can directly and indirectly affect other infrastructures, impact large geographic regions, and create a domino effect throughout the national and some cases regional or global economy. It is therefore critical to note that a simple action or non-action such as delaying implementation of creation of a national agency to manage water resource infrastructure will have significant impact on the economic development and growth of the country. From a scale perspective, scaling a project on water resource development at quaternary compared to quinary[112] catchment level will determine how much funding is required and the time it requires to finish a project from conception to outcome/impact.

[111] Source: Rinaldi, SM, Peerenboom JP and Kelly, TK. 2001. Critical Infrastructure Interdependencies. IEEE Control Systems Magazine.

[112] Fifth in order or rank

5.3.3. Provision of Water and Sanitation Services

Principle 25 of the Fundamental Principles and Objectives for a New Water Law in South Africa[113] states that

> "*The right of all citizens to have access to basic water services (the provision of potable water supply and the removal and disposal of human excreta and waste water) necessary to afford them a healthy environment on an equitable and economically and environmentally sustainable basis shall be supported.*"

Further, Principle 27 states that

> "*While the provision of water services is an activity distinct from the development and management of water resources, water services shall be provided in a manner consistent with the goals of water resource management*."

Critical to note is that there cannot be planning for water resources without full consideration of water services and sanitation. Second, the national department through the Minister focuses on policy and regulatory functions as well as the larger proportion of the water resources part of the value chain whilst the services are the preserve of local government.

From the NDP perspective, it therefore becomes critical to ensure that the total system functions seamlessly even when the activities are better carried out separately. It is for this reason that the concept of "hook and hanger" becomes critical in respect of securing water for the country.

As reflected in the 20-year review, South Africa has gone a long way to addressing the provision of water and sanitation, especially given the historical backlogs inherited from the past. However, with the current pressure from higher demand and changing socio-political environment as well as global climate change coupled with lack of implementation capacity a lot needs to be done to reach a level of comfort in respect of water security. Some of these challenges have recently ben articulated in the 25-year review where water security was sharply raised as a critical challenge confronting South Africa and presenting a profound challenge to social wellbeing and economic growth (pp 187).

5.3.4. Recommendations

The following need to be considered among others:

- Build or re-build capability to do proper systems analysis to ensure effective water infrastructure development and management with strong emphasis on financial flows;
- Create an enabling environment by ensuring proper water governance from institutional arrangements through to clear role and responsibilities with identifiable accountability and authority at all levels;

[113] DWAF, Water Law Principle 1996

- The cost of securing, managing and restoring ecological infrastructure must be explicit given that it is already factored into the official pricing strategy for water use charges as envisaged in section 56 of the National Water Act, 1998 (Act 32 of 1998)"
- Strengthen legal and regulatory regime in the water space starting with separation of regulation from implementation. The NDP proposes assessing independent regulatory environment. However, this needs to be looked at in totality and not in isolation, particularly in view of an "unfinished" institutional model or lack of implementing the current one.
- Promote innovative funding models that are based on the true cost of water development and management, including recognition of the contribution of ecological infrastructure to the balance sheet. Such models should be able to attract private funding for various components of the value chain without compromising the total system.

5.4. FOCUS AREA 3: DIVERSIFYING WATER SOURCES (NON-TRADITIONAL WATER SOURCES)

5.4.1. Introduction and Background

In general, surface water from impoundments or dams as well as direct abstraction from the river systems account for all water available for use, 74% of all water available in South African context, taking into account that a proportion of this is transboundary or from shared rivers in nature). There is still opportunity for surface development, but this theme looks at what can be regarded as "*non-conventional water sources*" (Figure 38 and

Table 3), which although currently seen as comprising a smaller proportion (up to 25%), are critically important for socio-economic development. Indications are that there is substantive opportunity for growth towards contributing to water security. The proportion of virtual water largely depends on movement of goods and services in the water are directly or indirectly embedded.

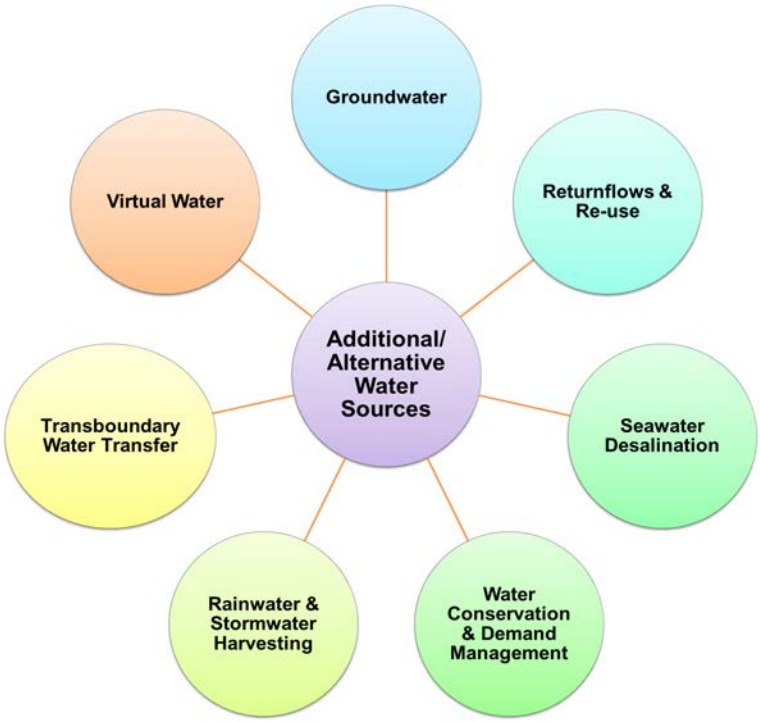


Figure 38. Additional alternative water sources

In considering these sources cognisance of South Africa's stated goal in the recent past of a "water mix" approach is recognised.

The primary purpose of the theme is not to repeat the current national strategies on these source types but to look into integrating them from a point of view of strategic socio-economic development in the context of water.

5.4.2. Strategic implication for 'water mix'

Table 3. Forms of "unconventional" water sources from a national perspective

Source	Description	Strategic implications
Groundwater	Stored in aquifers with potential yield estimated at 7500 million m^3 per annum (2000 million m^3 per annum in use and 5500 million m^3 per annum estimated to be available). Generally, widely distributed and available in isolated individual use, small towns, villages farming community, tourism fraternity etc.	Utilisation in small towns and individual user requirements, emergency use during drought (Also note its use in few larger cities, such as Pretoria and increasingly Cape Town) Possibility for artificial recharge as storage for later or future use.

Source	Description	Strategic implications
	South Africa shares 9 transboundary aquifers: Karoo sedimentary aquifer, Coastal Sedimentary basin V, Coastal Sedimentary basin VI / Coastal Plain Sedimentary Basin Aquifer, Rhyolite-Breccia aquifer, South Stampriet Artesian Aquifer System, Khakhea/Bray Dolomite, Zeerust / Lobatse / Ramotswa Dolomite Basin Aquifer, Limpopo basin and Tuli Karoo Sub-Basin.	Conjunctive use with surface water has been recommended for many years in South African context Proper planning and commitment to implementation and measurement of performance in relation to the development model and the three apex issues articulated in the NDP.
Desalination	Involves removal of salts from seawater and/or brackish groundwater to potable levels. May include brackish inland water or mine waste water for more local usage.	Technological advances are enabling this method of making water available possible, especially in respect of reduced energy requirements.
Rainwater and storm water Harvesting	An old human activity involving the collection and storage of rainwater for immediate use of making water available during off-season.	Key strategic issue is to see rainwater harvesting beyond social and cultural activity to seeing it as contributing to economic development which can be used as part of conjunctive use. For instance, a province like Gauteng which sits at the top of the watershed with its average rainfall just above 600mm p.a. can be a good candidate for encouraging rainwater harvesting by individual households and private sector as a way of conjunctive use. Where possible, in rural areas rainwater harvesting could be an additional source of water where big infrastructure is geographically or financially not viable. Water sensitive settlements and water sensitive cities The line Department has established a water services and local water management programme in line with the policy position on Multiple Use Services (MUS) which should able to mainstream these activities in the implementation programmes if properly implemented will go a long way to addressing the challenges as seen in the National Water Security Framework. Further, research as been done on development of water sensitive design tool which is aligned to the MUS.
Water Conservation and Demand	This refers to minimisation of loss or waste, care and protection of water	With up to 35% of water in the country not accounted for (losses), this becomes critically important in order to ensure that

Source	Description	Strategic implications
Management (WC/WDM)	resources and the efficient and effective use of water. From a planning perspective, it reduces the need for additional sources of water which forms part of the reconciliation of the water balance.	causes whether management or ageing infrastructure must be addressed at all levels. Efficiency measures in any form need to be properly planned, funded and executed. With more than 60% of water in the country used for irrigation, even the smallest saving in the agricultural sector become significant. Such savings can then be utilised for further economic development in the agriculture space[114]
Return flows and re-use	Return flows include approximately 10% irrigation water which seeps back into streams and rivers and up to 50% or more from urban setting. Re-use refers to beneficial use of previously used water from a range of sources like irrigation return flow, mine dewatering, industrial effluents and sewage discharges with or without further treatment.	This type of water use, though to strictly speaking "new water" it has been taken seriously enough to be included in the planning as a separate strategy due to its significance.
Transboundary water transfers	More than 60% of South Africa's surface water is shared with neighbouring countries and contribute more than 45% of the total river flow. Four major river systems are shared, viz., Orange/Senqu - shared with Lesotho and Namibia Limpopo River System - shared with Botswana and Zimbabwe; Incomati System – shared with Swaziland and Mozambique; Usutu/Pongola-Maputo system – shared with Mozambique and Swaziland. These areas support more than 60% of the GDP and similar proportion of population.	Given the nature of the social and economic interconnectedness within the SADC region, further work needs to be done to address the need for water security from a regional perspective, including going beyond riparian states consideration (see reference to Zambezi River Development and the Inga project as reflected in **Error! Reference source not found.** and **Error! Reference source not found.**). These aspects of water provision is even more critical now that the trade agreements at AU level have now been advanced.
Virtual water	Water embodied in food or other commodities, goods and services that are traded from one place to another. Generally referred to as "hidden flow of water" or water footprint.	Water deficit could be reduced by importing high water consuming goods and services and exporting those that do not require too much water. This is an

[114] DWS, 2010. Integrated Water Resources Planning for South Africa – A situation Analysis. Report No. P RSA 000/00/12910

Source	Description	Strategic implications
		example of the impact of economics on water security or availability.

South Africa has 216 major dams (>3 million m^3) with the total capacity of 31 022 million m^3 and shares four transboundary river basins and nine transboundary aquifers (see Figure 28 page 76).

The international inter-catchment transfers and inter-country systems (including LHWP) form part of a sophisticated national water resource management system that is meant to ensure water security. The positioning of South Africa in respect of international water transfer is critical as a risk that needs to be assessed against the other options for sources given that the country's water endowments are significantly low and pressure due to demand is very high. The concept of virtual water needs to be fully explored at the highest level. Virtual water can be described as the volume of water required to produce a commodity or service. Virtual water will generally flow from water-rich to water-poor regions. Also known as embedded or embodied water, it refers to the hidden flow of water if food or other commodities are traded from one place to another. In South Africa, this will require shifting the economy to a more water-wise regime given the physical water scarcity in the country. The risks associated with transboundary cooperation are real, although opportunity within SADC is greater than many parts of the world given the high regional peace index[115].

Lastly, it is also critical to look at the "virtual" water as an additional category as this plays a critical role in respect of water security given the socio-economic dimensions such as movement of people, goods and services.

5.4.3. Recommendations

Key recommendations in this theme include the following:

- To ensure South Africa's water security, the water accounting programme must be elevated and properly resourced;
- There must be a balance between small scale water projects and large multiyear projects such as transboundary transfers which require resources and time; and
- Funding for small scale projects must be prioritised to ensure local economic development beyond access to potable water.

[115] State of peace as a measure of relative positions of nations and regions peacefulness (Institute of Economics and Peace)

5.5. FOCUS AREA 4: WATER RESEARCH, MONITORING, ASSESSMENT AND INFORMATION

5.5.1. Introduction and Background

The rationale behind this focus area on water research, monitoring, assessment and information can best be understood by examining the policy intent as articulated in the White Paper on National Water Policy[116] which when correcting the weaknesses in the previous legislation stated that:

> "*Ongoing monitoring and assessment of the patterns of resource use, and the response of the resource to use, are critical to our ability to manage and protect those resources on the basis of sound scientific and technical information and understanding. Adequate information is essential for effective resource management and protection*."

The policy was clear in terms of role and functions and what was expected from institutional arrangements to scoping of the functions and funding arrangements thereof.

Read together, the three pieces of legislation, namely, National Water Act, 36 of 1998, Water Services Act, 108 of 1997 and the Water Research Act, 34 of 1971 provide a framing that looks at the total value chain as identified in the principles and other focus areas. To this end, it is by design that the Water Research Act was excluded from being repealed; which was to maintain the levy model and the coordination of water research and knowledge. Most of the challenges identified during the policy development and subsequent enactment of the legislation are largely a result of weak implementation capability for various reasons as articulated in this document and earlier diagnostic report. Scholarly literature is also replete with assessments concluding this weakness.

5.5.2. Conceptual Framing

The policy and legislation on water information and related activities are largely premised on the need to coordinate and lead the sectoral mandate through the national Government with the Minister given the authority to delegate functions and activities to other government agencies or private enterprises provided capacity existed.

The role of information and knowledge in decision making and empowerment was realised and the implications for technological advancement appreciated. This reflects the framing of socio-scientific context or hydro-social relations and systems understanding to allow for a transformation from data focus to knowledge and wisdom (for decision making). Figure 39 also shows the idea of a 'bottleneck' with the generally accepted model of progression from observation to wisdom.

[116] DWAF, 1997 Section 8.8. White Paper on National Water Policy

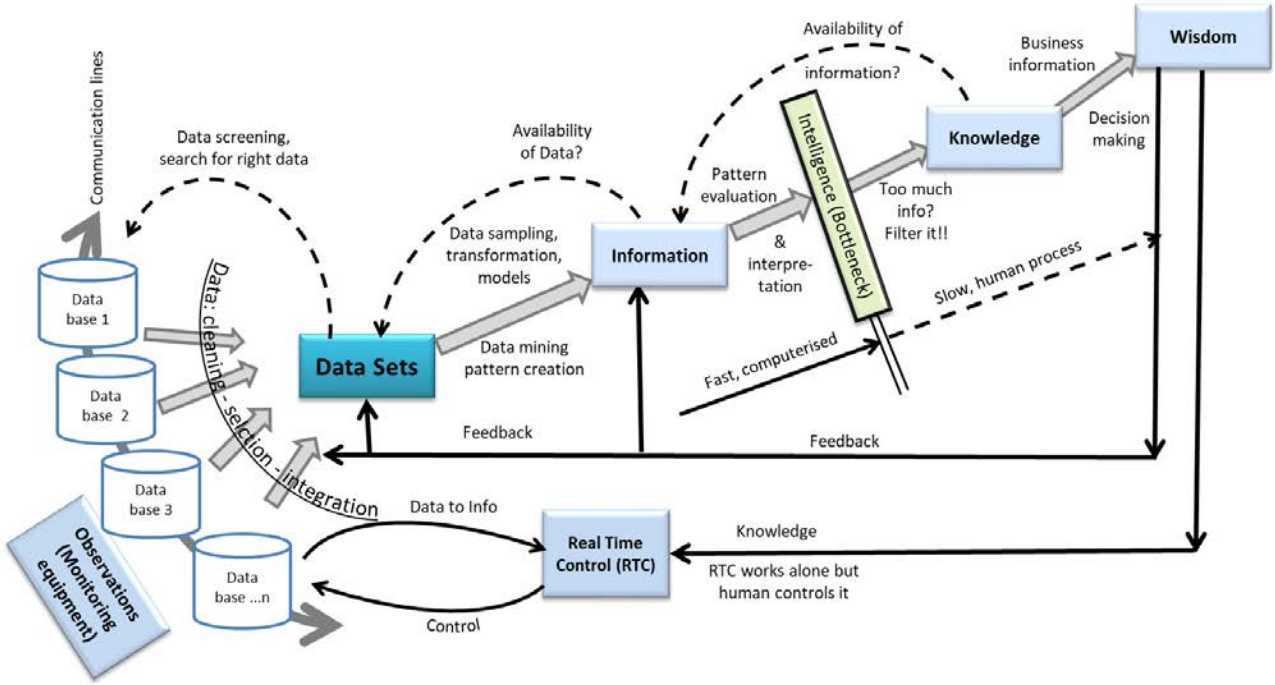
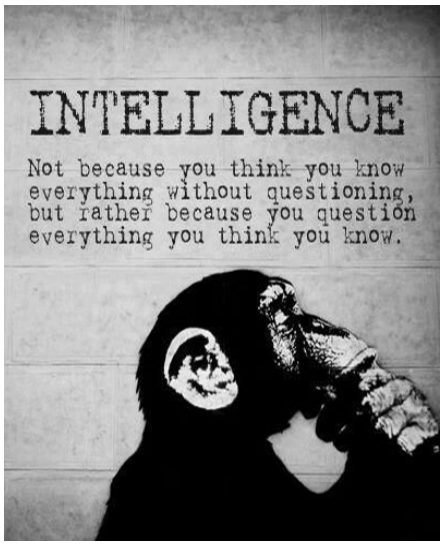


Figure 39. Conversion of collected data to knowledge as an interactive process (modified from Prodanović, 2008)



Steps from observation, data capture and cleaning through pattern evaluation are nowadays done using computers. Big data analytics tools can process large quantities of data and vast amounts of information created. However, the path from information to knowledge still has one important 'bottleneck', human beings, who have to be able to accept all those patterns and information in order to compile it into knowledge. Often the capacity of computers to produce patterns and information exceeds the capacity of human beings to interpret them[117]. It is the aspect of 'bottleneck' that we are referring to as 'intelligence' which for the purpose of framing we regard as a product or service (as conceptualised by the author of this report). Borrowing from Dent (2008 and personal communication), key issues in the human system domain linked to the water research, monitoring, assessment and information would include:

- credible, trusted, shared understanding of information;
- Sensible options and innovative options;
- Shared understanding of consequences of decisions;
- Acceptable and wise decisions; and

[117] Prodanović, D. 2008. Use of data to create information and knowledge. In: Data requirements for integrated urban water management, Fletcher, T.D., and Deletić, A. UNESCO Water Series – UNESCO IHP.

- Equitable, peaceful, lasting, timely resolution.

Framing of this focus area is also premised on the need for information to be accessible, and that information systems are designed to enable sharing and free flow of information and knowledge. Effective systems are key to effective working together in water management. Industries such as information technology and telecommunications, aerospace and related travel industry, and the financial services and banking industry with ATMs, credit cards and on-line payment systems are a case in point. These systems allow a plethora of independent yet interdependent organisations to operate together seamlessly[118]. The water policy and legislation was crafted to enable the decentralisation of water resources management, giving more power to stakeholders, providing opportunity for distributed capacity and skills across the board as well as multi-stakeholder based integrated water management at local level through institutions such as CMAs and WUAs, Catchment Management Forums (CMFs) and other legislated processes.

Lastly, we know that water information and knowledge are valuable and need to be assessed and utilized in line with policy and legislative prescripts, however, from the water security framework perspective, the central issue to be elevated is flow dynamics that takes into account the complex historical, geographical and water setting of South Africa. Issues of access, affordability, complexity, interpretation and balancing knowledge power relations in the dynamic, democratic interplay amongst various role players, with respect to water related information are at the core. This presents a critical argument that places water security beyond the proverbial 'material water'.

5.5.3. The water information and research situation in South Africa

The water policy developed since the dawn of democracy, and subsequent legislation envisaged the need for information and made provision for this. However, as evident from the decisions taken or not taken, implementation has not happened to the extent envisaged. For instance, the water management as a system with tools such as NWRS and CMSs, Water Services Development Plans (WSDPs) as well as integrated Development Plans (IDPs) is premised on the ability to assess the water resource base and the needs or demands every five years based on the information that is collected and assessed regularly. However, the ability to do this has significantly declined over time and most of the assessment is no longer systematic but *ad hoc*, disparate and largely under the control of consultants.

Currently there are a number of issues that contribute to the state of play in the water research, monitoring and information that are discernible from a national perspective such as:

- Disconnect between chapter 14 of the National Water Act and the rest of the sector;

[118] Dent, M.2011. The role of information systems management in the management of water. In: Transforming water management in South Africa: Designing and implementing a New Policy Framework. Schreiner, B and Hassan R. (eds.)

- Outcomes of the review of national monitoring network and deterioration of hydrological data monitoring;
- Funding position and capacity implication going into the future;
- Jostling for positioning in the space, despite specific and clear mandates articulated in policy and legislation. For instance, the tension between DWS, CSIR, SAWS, WRC, ARC and others resulting largely from dysfunctional environment and fighting for survival. The WRC's drive to get a mandate expanded on one hand and the CSIR's desire to establish a water research centre without having done full analysis of the state of play as well as cost benefit analysis from a national perspective demonstrate this challenge. The state of affairs creates unnecessary competition as institutions spend an inordinate amount of resources trying to survive or duplicate mandates.
- Multiple private institutions, SoEs, research organisations, service providers, professionals and universities operating outside the state institutions that end up either 'fending for themselves' as a result of lack of sectoral leadership or carry out activities that should be covered through funding from the fiscus or cost recovery mechanisms embedded in the pricing strategy.

The state of play reflects a serious weakness in the institutional setting which requires urgent attention as the research, monitoring and information is crucial for planning and decision support. Reports have shown that over time the country's national and regional hydrological monitoring infrastructure has been deteriorating to a point that basic data and information is not being collected leading to decisions based on half measures.

5.5.4. Policy and legislative provision for Water Research, Monitoring and Information Management

The foundational aspects of the modern South African Water Policy developed during the post-Apartheid period was in 1996 and had envisage a strong emphasis on the sectoral capability to monitor water and provide information to support the sector. This was articulated in the National Water Act 36 of 1998 (Chapter 14) and the Water Services Act 108 of 1997. In addition, the Water Research Act 34 of 1971 (as amended) was left intact as a result of the recognition of the unique and special nature of the model that was developed as part of the outcome of the 1971 Commission on Water Matters. Modifications of these aspects in these pieces of legislation have been minimal and only focussed on enhancement and keeping up with the times.

Monitoring, recording, assessing and disseminating information- on water resources has been embedded in the legislation as important for enhancing water resource management and achieving the objectives of the NWA as well as the Water Services Act. The policy and legislative provision is based on the principle that the quality of surface and ground water is

inextricably interrelated and that decisions can only be made if informed by reliable, relevant and up-to-date information which reflect the integrated nature of the water resources[119].

This includes the role of knowledge generating institution/ organisations in producing national research that addresses nexus challenges in the medium to long-term. The institutional space in water research requirements needs to be looked into in terms of enhancement of all the institutions within the National System of Innovation and the National Research and Development Strategy. This includes the recent developments towards policy framework that includes the Fourth industrial revolution (IR 4.0).

Knowing what we know, with improved data and information, at national level it should be possible to achieve the vision of reduced inequality and poverty eradicated to globally acceptable levels from the perspective of both implementation and monitoring by 2030. Research and development must be aimed at technological and systems improvement to help with improved water security and management in general.

Positioning water and sanitation research, monitoring, assessment and information to enable water security planning in South Africa include the role of knowledge generating institution/ organisations in producing national research that addresses nexus challenges in the medium to long-term. The institutional setting for water knowledge and information requirements must be investigated further and looked at in terms of enhancement of all the institutions within the National System of Innovation and the national research and development Strategy.

Discussions and inputs from CSIR, WRC and consultations on water research suggested that there is need for urgency to stabilise the environment given the failure and limitation of current set up such collapse of laboratories and capability to collect basic water information or take advantage of new technological advances.

5.5.5. Pathway to water security through water intelligence facility

Assessments and consultation processes have shown the need to organise the water research, monitoring, assessment and information in a coordinated fashion. The recommendation is to create a facility, which will also entail looking at options of getting an entity such as the CSIR to focus on water research monitoring and information and the national department retaining the jurisdictional mandate. CSIR could have the responsibility for "*curatorship*" of "*water intelligence data*". The WRC model of commissioning research is unique and has proved to be beneficial, especially if operated properly to serve the real need of the sector and the country and not run as a completely independent entity with inclination to going commercial or overreliance on donor funding or compete with mandated government institutions. The levy model therefore needs to be maintained but repositioned as a programme to be part of the new ecosystem arrangements.

[119] Thompson, H. 2006. Water Law: A practical Approach to Resources Management and the provision of services

Should a completely separate entity be created, clear linkages with existing institutions must be established from an institutional ecosystem perspective. To this end, an urgent need to create a sector-wide "*water intelligence*[120]" capability through reorganisation of current configuration is critical. Such a facility must devote its time and resources to research, monitoring, analysing the information and support the national planning and decision making across the board. This will limit the silo and piece meal approach that seems to have prevailed over the years and advance implementation of the national policy in context of the NDP's three apex priorities. It will also address the loss of capacity to do regular assessments which has become systemic and endemic. The framework themes make provision for this kind of intervention.

In developing the 'water intelligence' facility in the form of a National Water Monitoring, Research and Information Centre (NWMRIC), it is critical to note that the information required for regulatory functions including compliance monitoring and enforcement with associated tools such as waste discharge charge system, water authorisation and management system are enhanced to effective use. It is also recommended that the information on regulatory requirements can be located within the regulatory space in a similar way that USEPA is separate from the USGS in the case of USA for example. This will also ensure separation of responsibilities and ensuring independence.

Positioning monitoring, information and research to enable water security planning in South Africa will reduce barriers to implementation that need to be tackled at the highest possible level within government such as:

- Cost (both capital and operations and maintenance);
- Buy-in from decision makers and will to implement that may be a result of lack of understanding the impact in medium to long-term;
- Financial flows in relation to institutional roles and responsibilities as well as quantum of funds dealt with in this space that tends to look little but has higher impact if not provided;
- Human resources – most of the key professionals are retiring in the next few years or have retired (many less than 5 to 10 years);

Procurement arrangements – e.g. if purchasing of fairly small quantities of supply like sample bottles take too long the impact on data gaps become real, etc.

The formation of a facility to specifically focus on research, monitoring and Information on water to be funded through fiscus up to 75% and consolidated from current government activities is now essential – this option was investigated at cursory level and conceptually tested when the idea of a shared service was broached in the early to mid-2000s but not proceeded when the priority was placed on the establishment of the National Water Resource Infrastructure Agency (NWRIA).

[120] This includes traditional hydrological services covering all water quality, quantity and related information

The national facility as an entity must take a hybrid posture allowing for physical locations and virtual network forming an ecosystem which include all role players, and consisting of a number of research institutes; tackling different aspects of water resources and provision of services related fields such as: Irrigation and drainage, hydraulics, hydraulic structures and machinery, surface and groundwater hydrology, sediment transport, water quality and pollution control, coastal protection and reservoir/lake/riparian environment, climate change and geo-measurements analysis, water/hydro socio-economics, etc., structured in a manner that there is no duplication in other government institutions such as among others the ARC, CSIR, CGS, WRC, SAWS, SAEON, SANBI, water utilities, as well as the current configuration in the line Department (currently represented by the planning and information functionality). The proposed approach takes into account that in addition the regulatory aspects of the research,

Initial assessment is that this will be possible and can be concluded with a less than 12 months if commitment to implement is made in earnest, initially without a key shift in policy and within the current legislative regime. The model espoused above resonates with the earlier approach to the South African Earth Observation Strategy (SAEOS) which generally allowed for independence in terms of institutions working within their mandates and interests yet allowing common sharing of data and information.

5.5.6. Recommendations

Key recommendation in the focus area is to consolidate and align research monitoring and information into one "national water intelligence centre" with characteristics of both physical and virtual institutions mainly funded from the fiscus (90%), water research levy (6%) and others such as internal and advisory services revenue (4%). Included as the role of the centre would be the key issue of centralised and coordinated data curatorship that will ensure accessibility and reliability in much the same way as a typical centre for statistics or national meteorological services. This is what was generally envisage when Chapter 14 of the National Water Act, Act 36 of 1998 was conceptualised and promulgated.

This recommendation is also meant to address the disparate water related intellectual capital currently undermining the country's capability to provide national support. Public institutions such as CSIR, WRC, SAWS, ARC, SANBI, Water Boards, CMAs, DWS' planning and information function, universities among others have specific jurisdictional mandates, and are expected from a policy perspective to work together. However, these largely either spend time trying to survive (self-preservation and survival) or competing for limited resource thereby compromising the national water security imperatives.

Assessment during the development of the NWSF revealed that positioning and jostling has already been the order of the day to the detriment of even making progress currently.

Most importantly taking into account the business value chain of water generally, the funding of such an entity/institution and associated activities is estimated to be around 6% overall (using the current annual operational budget allocation of R16 billion from the fiscus). It is therefore clear that even under financial constraints there is sufficient capacity which just

needs to be redirected properly. No need for emphasis on donor funding if internal national institutions and industry can be properly aligned.

5.6. FOCUS AREA 5: KEY NEXUS ASPECTS OF WATER SECURITY

5.6.1. Introduction and Background

In this focus area, special focus is applied to water-energy-food (W-E-F) nexus as well as climate change in relation to access, cost or investment, economic and environmental foot print among others. The intention is to look at the W-E-F nexus and how its complex interactions affect national water security, including access to safe water; national food security, including food availability; and national energy security, energy pathways and geopolitical issues. These issues are covered across the other focus areas.

The W-E-F nexus (Figure 40) could form an integral part of the IWRM approach, although more emphasis on the interrelationships needs to be given. IWRM includes a multi-sectoral approach, hence the "I" for integrated. The W-E-F nexus is a systems-based perspective that recognizes water, energy, and food systems as both interconnected and interdependent; and considers how water, energy, and food systems operate and interact. The nexus approach aims to maximize synergies (mutually beneficial outcomes) and minimize trade-offs (which may potentially include non-optimal outcomes), improve resource-use efficiency, and internalize social and environmental impacts, particularly across a range of contexts and scales[121].

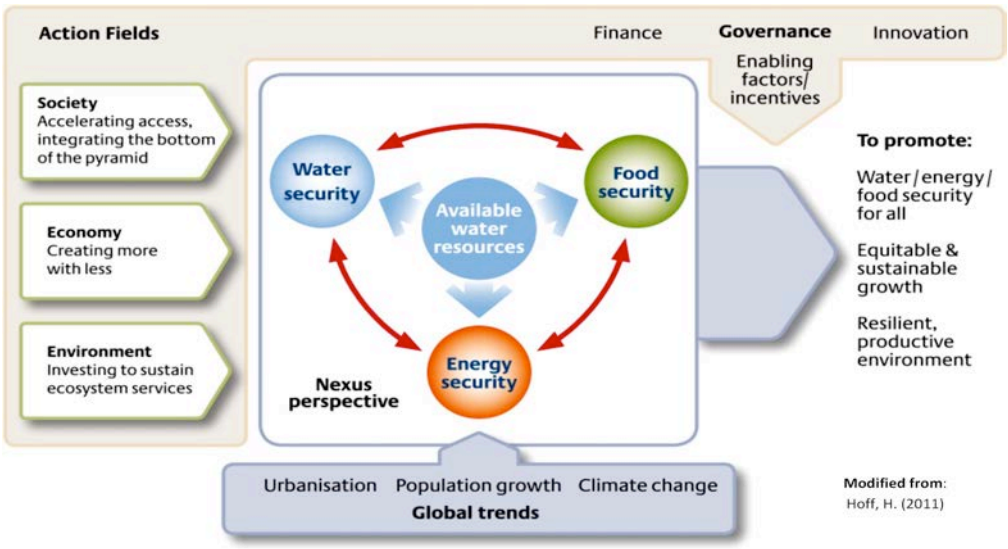


Figure 40. Water-Food-Energy (W-E-F) Nexus

In response to the global trend in adopting the W-E-F nexus approach, the National Water Security Framework considers the nexus as part of the SDGs. As a country we have a responsibility to drive alignment of our national agenda or focus areas linked with national

[121]Tamee R Albrecht *et al* 2018 *Environ. Res. Lett.* **13** 043002. The Water-Energy-Food Nexus: A systematic review of methods for nexus assessment.

priorities articulated though the NDP and other policies. This also extends to alignment with regional initiatives such as the SADC Secretariat's programme 8 on the W-E-F nexus and the African Union's (AU) Vision 2063 [122] among others. As a country, South Africa has a responsibility to champion the W-E-F nexus. The challenges that South Africa is facing make it urgent for the country to step up its approaches to sustainable development such as the W-E-F nexus. These include, but not limited to:

(i) poverty-unemployment-inequality nexus

(ii) rapid population growth,

(iii) rural to urban migration due to lack of job opportunities in rural areas,

(iv) water scarcity, which is being exacerbated by climate variability and change,

(v) increasing demand for food due to population growth and dietary transitions and increasing food insecurity among the rural poor,

(vi) increasing energy demand to meet South Africa' economic development goals, and

(vii) focus on agriculture, specifically expansion of irrigation, as a driver of rural economic development and employment creation

(viii) just transition to low carbon economy

Tackling these challenges requires coordinated efforts among different economic sectors, mostly water, energy and agriculture. The W-E-F nexus emphasises the inextricable linkages between the three sectors and that actions in one area often have impacts in one or both of the others. There are key challenges that are being faced across these three sectors. For example, conversion of productive agricultural land for industrial or residential use threatens food security. Other examples include the expansion of coal mining activities linked to energy generation in Mpumalanga, which threatens both water resources and food security; the drive to increase irrigated agriculture, which places pressure on available water resources and creates new demand for energy for pumping water. What these highlight is that, while all these initiatives have good intent to develop the country, lack of W-E-F nexus trade-offs could threaten their ability to translate into meaningful and sustainable development. The National Water Security Framework therefore has a responsibility to raise awareness about the WEF nexus interlinkages and to create a platform for discussion of practical solutions that include the negotiation of synergies and trade – offs linked to the W-E-F nexus issues. The W-E-F nexus presents an opportunity to promote integrated planning in a sustainable manner. It also presents a framework for directly achieving some of the SDGs such Goals 2, 6 and 7 with indirect potential to achieve SDGs 1, 8 and 9 through job creation and innovations linked to the W-E-F nexus sensitive planning.

[122] Agenda 2063 shows commitment to support Africa's new path for attaining inclusive and sustainable economic growth.

South Africa must continue to drive research, development and innovation linked to knowledge generation in context of the W-E-F nexus. The translation of this knowledge into actionable plans that can be adopted by policy makers remains the next frontier. Keeping it simple and practical will ensure that complexity does not further delay implementation, specifically given that the approach is now widely accepted as one of the suite of tools to systematically assess and address the inherent complexity of water, energy, and food resource interactions towards sustainable development.

5.6.2. Approach to Nexus implementation

Various approaches to W-E-F have been developed over recently, including FAO who's framing is within the broader vision of sustainable food and agriculture to achieve its mandate of eradicating hunger, reducing poverty, and sustainably managing and using natural resources and ecosystems (FAO 2013). Underlying the W-E-F approach is a holistic vision of sustainability that recognises and tries to strike balance between the different goals, interests and needs of people and the environment which explicitly addresses complex interactions and feedback between human and natural systems (Figure 41)[123].

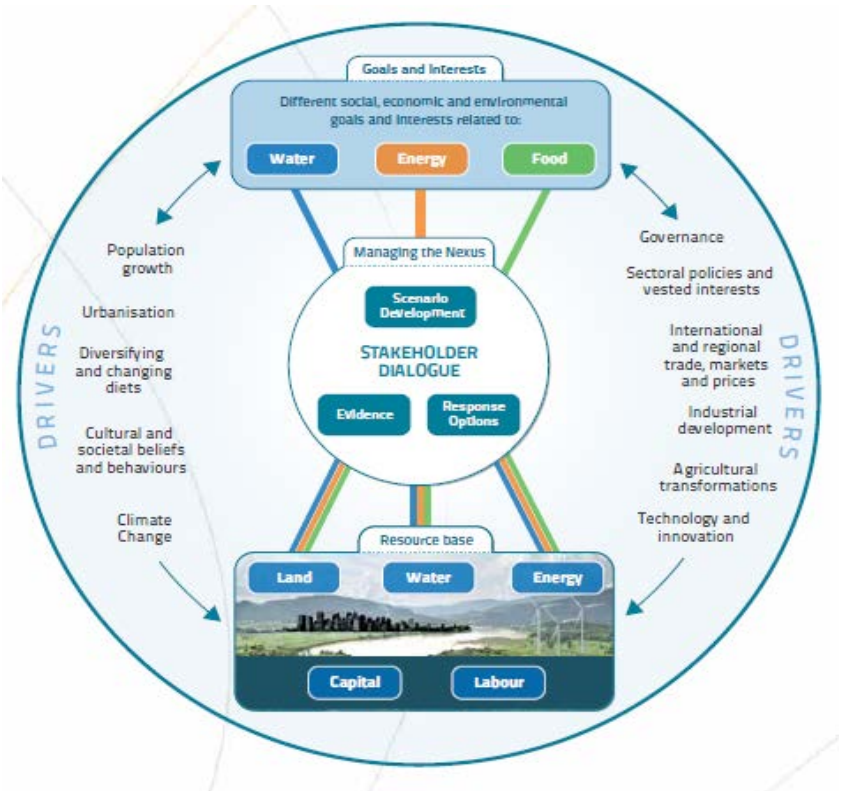


Figure 41. FAO's approach to Water - Energy - Food Nexus

[123] FAO. 2014. The Water-Energy-Food Nexus: A new approach in support of food security and sustainable agriculture.

From climate change adaptation perspective, the nexus approach can be used to create climate-smart policies that accomplish both adaptation and developmental goals (Figure 42)[124]. There is no doubt about the necessity of the need for a shift in policy approaches from a sectoral focus, which can result in competing and counterproductive actions, to an integrated approach with policy coherence among the sectors that uses knowledge of the interlinkages to maximize gain, optimize trade-offs, and avoid negative impacts. For South Africa and its positioning in Sub-Sahara Africa, given its maximum surface water resource development, this would include consideration of exploring large water transfer schemes beyond its borders with the specific aim of providing solutions for the W-E-F Nexus. With appropriate data and global or regional hydrological models coupled with socio-economic assessments, such mega-projects should form part of medium to long term solutions beyond a focus only on the engineered future water solutions in an attempt to address the increasingly uneven distribution, both in space and time. Hydrological systems need to be managed as hybrid systems – as regional water resources for human use as well as highly valuable ecosystems for the benefit of people and nature alike[125]. For South Africa, these approaches are generally catered for in the policies and legislative regimes and what is critical is moving towards critical analysis and implementation.

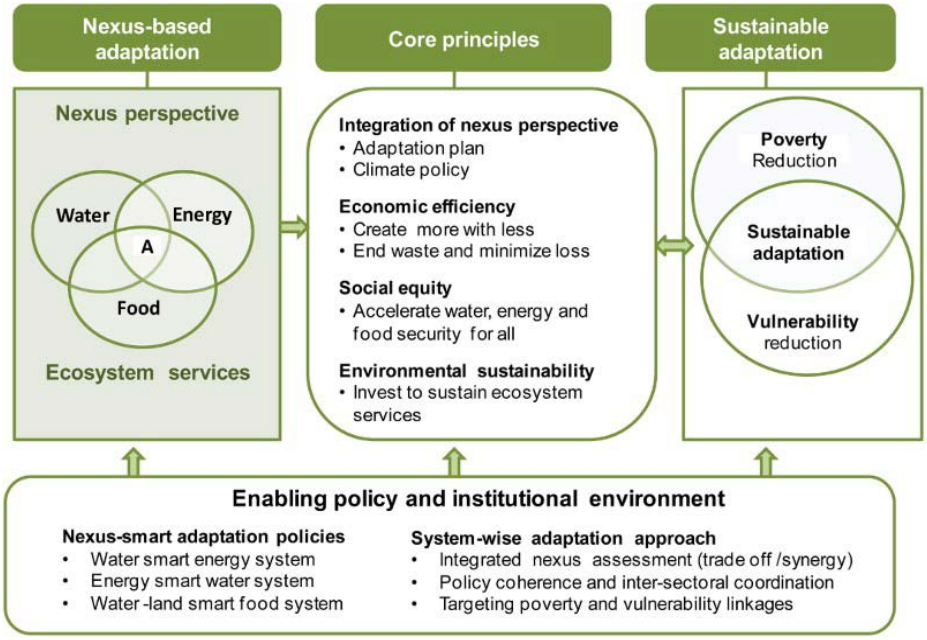


Figure 42. Nexus based adaptation framework

[124]Golam Rasul & Bikash Sharma (2016) The nexus approach to water–energy–food security: an option for adaptation to climate change, Climate Policy, 16:6, 682-702, DOI: 10.1080/14693062.2015.1029865

[125] Shumilova, O; Tockner, K; Thieme, M; Koska, A and Zarfl, C. 2018. Global water transfer megaprojects: A potential solution for the Water-Food-Energy Nexus? Frontiers in Environmental Science. Vo.6. Article 150

5.6.3. Recommendations

The drive to address the apex priorities of the NDP, namely, poverty, unemployment and inequality will be better achieved by using the W-E-F nexus approach whose activities have been factored into the SDGs, especially goals 2 (Zero hunger), 6 (Clean Water and sanitation) and 7 (Affordable and clean energy).

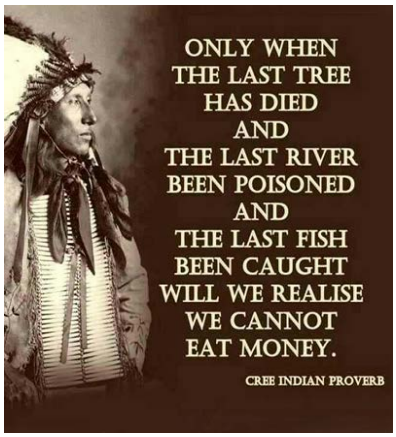
Nexus approach is essential in assessing the Environment-Land-Water-Energy-Human systems interdependency. The historical approach in which these systems were traditionally planned independently needs to be changed with water being made central.

Decision support frameworks need to be developed to influence the political, regulatory, economic, environmental, health, social factors and available technological advancement. The FAO approach is recommended for South Africa as it is premised on recognition of land, water, energy, environment, capital and labour as key components and directly linked to climate change and the notion of a just transition.

5.7. FOCUS AREA 6: ECOLOGICAL INFRASTRUCTURE

5.7.1. Introduction and background

Ecological infrastructure refers to naturally functioning ecosystems that generate or deliver valuable services to people, such as fresh water, climate regulation, soil formation and disaster risk reduction. It is the nature-based equivalent of built or hard infrastructure, and is just as important for providing services and underpinning socio-economic development. Rivers, wetlands and their catchments are crucial ecological infrastructure for water security and often complement built infrastructure. However, these benefits are often compromised by poor ecological condition. Investing in ecological infrastructure is a cost-effective method for enhancing and supporting investment in built infrastructure and supporting water yield.



Strategic Water Source Areas (SWSAs) are one of the major elements of ecological infrastructure for water security. SWSAs comprise 10% of South Africa's land area that contributes 50% of surface water supply. They are our water factories, supporting growth and development needs that are often a long distance away from the SWSAs themselves. When linked to downstream urban centres, these areas support at least 51% of South Africa's population and 64% of its economy. They are national assets, yet only 13% of their land area is formally protected.[126]

[126] Nel, J.L., Le Maitre, D.C., Roux, D.J., Colvin, C., Smith, J.S., Smith-Adao, L., B., Maherry, A., Sitas, N. 2017. Strategic water source areas for urban water security: making the connection between protecting ecosystems and benefiting from their services. *Ecosystem Services*, Volume 28, Part B, December 2017, pages 251-259.

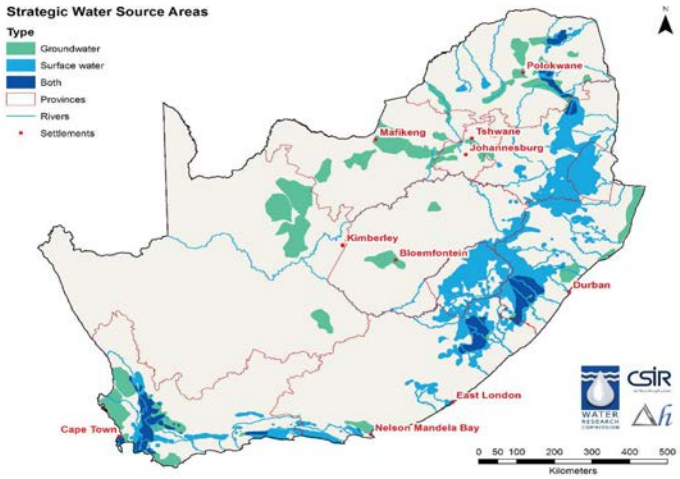


Figure 43. Strategic water source areas for surface water and ground water in South Africa[127].

SWSAs should be maintained in good ecological condition, i.e. as far as possible in natural or at least semi-natural state, with intensive land uses avoided as much as possible. Land uses that reduce stream flow or affect water quality (e.g. mining, plantations, overgrazing) should be avoided in SWSAs, wetlands in SWSAs should be kept in good condition or rehabilitated, and invasive alien plants should be cleared from SWSAs. A range of mechanisms is needed to ensure that land uses and other activities in these areas are compatible with their strategic water supply role, including land-use planning, various authorisations processes (environmental, mining, water), proactive restoration, and formal protection.

Wetlands are another key part of water-related ecological infrastructure. They play an important role in regulating the flow of water, supporting water quality, and preventing erosion. The National Biodiversity Assessment 2018 highlighted that wetland ecosystems face many pressures and are highly threatened, and emphasised that the restoration and protection wetlands will secure essential benefits and deliver large return on investment, including for water security.

[127] LeMaitre, D., Seyler, H. and Holland, M., 2018. *Identification, delineation and importance of the strategic water source areas of South Africa, Lesotho and Swaziland for surface water and groundwater.* Water Research Commission.

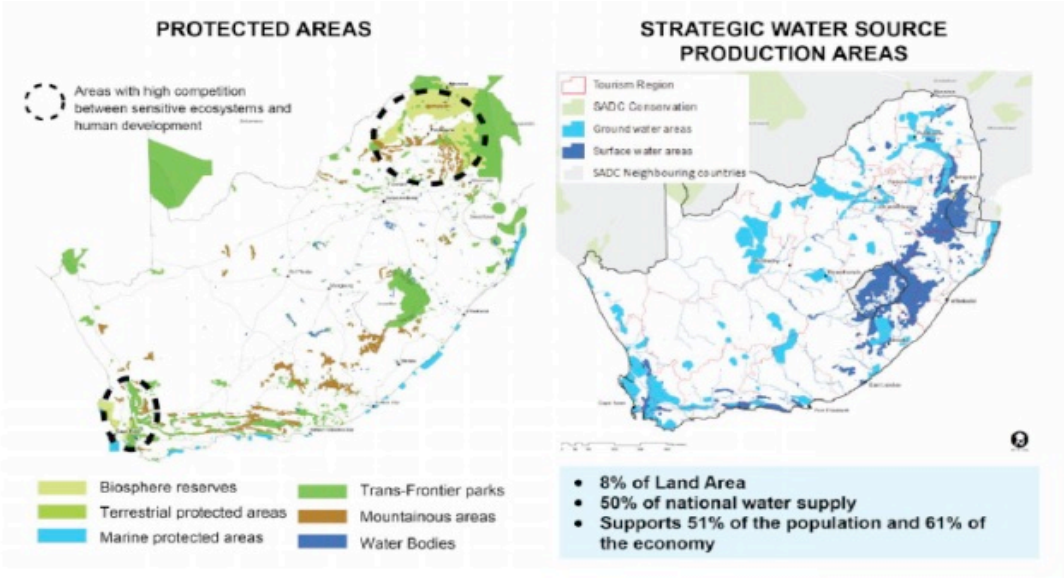


Figure 44. Ecologies, economies and spaces - national ecological infrastructure[128]

5.7.2. Policy Framework and Key Considerations

Ecological infrastructure is the nature-based equivalent of built or hard infrastructure (such as roads, ports, dams), and is just as important as built infrastructure for providing vital services that underpin social and economic activity. However, unlike built infrastructure, ecological infrastructure is generally seen as "free". This means that its true value is often under-appreciated and not taken sufficiently into account in planning and decision-making. Ecological infrastructure is currently an under-realised asset that can play a significant role in enhancing returns on investment in built infrastructure (such as dams), especially if the maintenance of ecological infrastructure is explicitly incorporated into the planning and construction of built infrastructure.

Like built infrastructure, ecological infrastructure requires maintenance and management, and in some cases rehabilitation or restoration. Investing in ecological infrastructure involves devoting time, effort, finances and making decisions that support the maintenance of functioning ecological infrastructure and the restoration of degraded ecological infrastructure.

The International Union for the Conservation of Nature (IUCN)[129] defined Nature-based Solutions (NbS) as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*". NbS are inspired and supported by

[128] Draft National Spatial Development Framework, 2019. DRDLR & DPME. Government of South Africa.

[129] Cohen-Shacham, Walters, G, Janzen C and, Maginnis, S (eds). 2016. Nature-based Solutions to addres global societal challenges. Gland, Switzerland: IUCN. Xiii + 97pp

nature and use, or mimic, natural processes to cost effectively contribute to the improved management of water. The defining feature is not whether an ecosystem being used is "natural" but whether natural processes are being proactively managed to achieve a water-related objective. A NbS uses ecosystem services to contribute to a water management outcome. A NbS can involve conserving or rehabilitating natural ecosystems and/or the enhancement or creation of natural processes in modified or artificial ecosystems.

Investing in maintaining and restoring ecological infrastructure provides multiple benefits to people and the economy, including enhancement of built infrastructure, better provision of services and in many cases creation of jobs. Ecological infrastructure is often located in rural areas, so these benefits can also support rural development.

Unlocking the potential of ecological infrastructure to contribute to water security requires scaling up investments in restoring and maintaining ecological infrastructure, with a focus on water related ecological infrastructure. To date the approach in South Africa has tended to be fragmented, so the full benefits have not been realised. Ecological infrastructure assets (such as SWSAs and other water related ecological infrastructure such as rivers and wetlands) should be managed proactively and strategically, and South Africa has excellent science to guide this.

Improved catchment management, strengthening systems of governance and increasing stakeholder engagement at catchment scale are all critical for support the delivery of services and the management of water related ecological infrastructure.

Quality of life is inescapably linked to environmental conditions and how they are affected by human activities. A key concept is that of ecosystem services – defined as the benefits people derive from natural processes, such as the delivery of clean water and air, the habitat for biodiversity and the provisioning of food and fibre. As the land surface and water bodies are progressively transformed due to climate change, land use change, resource extraction and pollution, the plotting of a sustainable path requires a deep and predictive knowledge of the underlying processes and their limits. Climate variability, including phenomena such as El Nino-induced drought, is an on-going and probably increasing feature of the South African environment. Poorer rural communities are particularly vulnerable to environmental hazards. Understanding how to increase societal resilience to such disturbances, and protect the natural resource base ('natural capital' and 'ecological infrastructure' are key notions here) from damage during extreme events, is crucial.

UN's UNEP highlights that "The Environment at the Heart of the Agenda" for 2030 indicating that the 2030 Agenda is a fundamental shift from today's growth-based economic model to a new way that targets sustainable and equitable economies and societies worldwide, and greater public participation in decision-making, in line with Principle 10 of the 1992 Rio Declaration. It is an agenda that aims to replace unsustainable consumption and production patterns with sustainable lifestyles and livelihoods that benefit all. Central to the agenda is the understanding that a healthy, well-functioning environment is crucial for humankind to prosper.

Ending poverty (SDG 1) can be achieved by integrating economic development, social protection and environmental health. Environmental poverty – resulting from lack of access to natural assets, inadequate management of resources and exposure to ecosystem degradation and pollution – leads to greater vulnerability and a loss of resilience in communities. An increasing world population will make it even more challenging to provide basic services to the poor.

UNEP's International Resource Panel[130] estimates that consumption of natural resources will triple by 2050. Sustainable development will need to maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and as a source of public benefits.

Human rights and the environment are inextricably linked through the right of every citizen to a clean, healthy and productive environment[131]. Sustainable development implies universally meeting basic needs and extending everyone the opportunity to fulfill their aspirations to live in dignity. In the 2030 Agenda, meeting those basic needs is linked to access to natural resources. For example, in Goal 2, access to food is linked to access to land, which in turn is linked to poverty reduction (Goal 1) and gender equality (Goal 5). Goal 6 addresses the natural resource 'water' in terms of the environment (water quality, restoration of ecosystems), social (access to safe drinking water) and economic aspects (water-use efficiency across all sectors). This emphasis on the links between the three dimensions exists in all 17 goals, making the agenda truly integrated.

What does this mean in terms of SA's Water Security Framework? In this context the integrated catchment management which is a holistic approach focusing on both water and land management, as the two are inextricably connected, is necessary to ensure the integrity of the ecosystems. Whilst substantive work has been done such as determination of the reserve at national level, implementation of working for water programme, programmes run by individual organisations and institutions such as Cape Nature, the South African Environmental Observation Network (SAEON) among others, integrated catchment management has largely been hampered by lack of coordinated effort resulting from catchment management agencies not being created and catchment strategies not properly developed.

5.7.3. Recommendations

In order to ensure water security, valuing (measuring) ecosystems services as an economic part of water infrastructure has become essential and must be incorporated in the assessment of the extent to which the water security is achieved. This will also incentivize the private sector as has been the case with commitments made by the National Business Initiative (NBI)[132].

[130] http://www.resourcepanel.org/

[131] Source: http://www.unep.org/post2015/heart.php

[132] National Business Initiative. 2016. Business Action in support of the NDP. Action Plan v1.

Ecological infrastructure must become an integral part of reporting across the board both in public and private sector.

5.8. FOCUS AREA 7: WATER AND SPATIAL PLANNING

5.8.1. Introduction and Background

This focus area considers the key elements of spatial planning and how this is intricately linked to water security both historically and into the future. This is also related to the movement of people, goods and services and in turn socio-economic development. In considering this focus area questions need to be asked regarding the extent to which we are able to seriously look into developmental planning such as:

- Going beyond the scarcity and basic services and look into potential for economic growth;
- Ensuring that the spatial planning is deconstructed and reconfigured to unlock new growth potential;
- A mix of various sources that encourage optimal and sustainable provision of water;
- That looks systematically into
  - all national, regional and institutional planning and assessments;
  - Research and development needs;
  - Water allocation, use and regulation; and
  - Addressing the redress as a result of homeland system challenges (Figure 45)

In the recent past pronouncement indicating that up to 40% of the municipalities are not financially viable have implications on the ability of water boards to recover their money from water sales and thus battling with Municipalities non-payment. The question that needs to be asked is whether the current configuration of local government as presented by the demarcation process is the best outcome taking into account historical spatial configuration. From a water perspective, serious consideration should be taken to relook at the current configuration to ensure that municipalities and any other institution meant to address implementation of the country's development agenda is a "going concern". This will come with reconsideration of COGTA space versus that of water institutions.

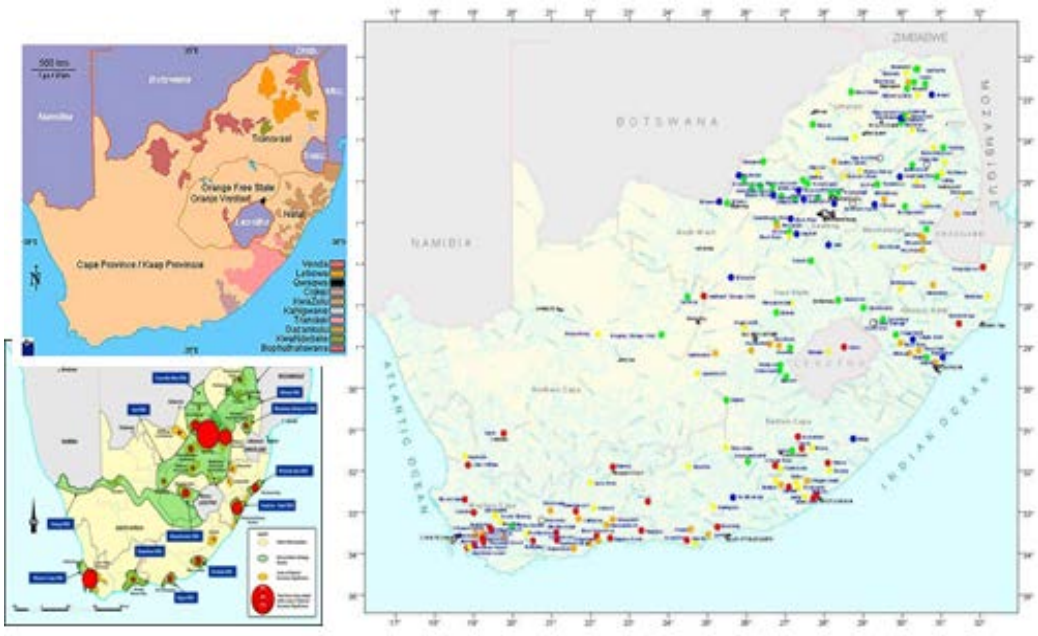


Figure 45. Distribution of major dams in South Africa (DWS) vs. development nodes and former homelands

As has been noted from comments on the NSDF that in its current form falls short of providing sufficient guidance for departments, spheres of government or municipalities. It does not sufficiently guide the different roles and responsibilities that will be required in its implementation. It is currently fairly broad and does not provide enough direction. For instance, it encourages rail infrastructure, but is not specific on where the focus for this should be. It calls for support of water stressed areas, but does not specify where these are, but just gives examples.

Figure 46 shows that major water sources in South Africa cover some of the areas that are known to have high level of poverty. This must be contrasted with the development nodes/zones that currently characterise the current spatial planning as reflected in Figure 33. It is critical that the National Water Security Framework is anchored around the NSDF to ensure alignment in terms of practical interventions.

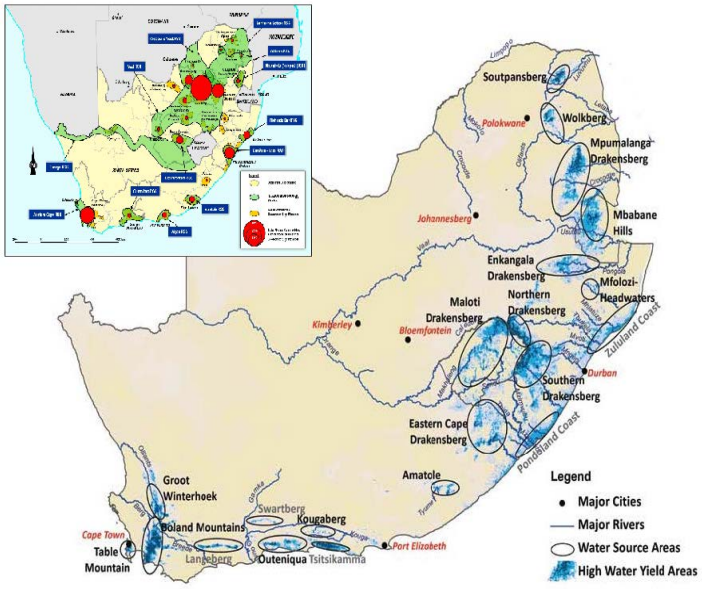


Figure 46. Water Source Areas showing major Rivers, and cities[133]

In going forward, bold decisions need to be made in respect of spatial planning and find a way to highlight issues as they relate to water especially given the many examples within the water sector in respect of flaws brought by apartheid spatial planning. The silo approach must be broken and institutional arrangements made to foster complementarity in terms of mandates and the ability for cross-subsidisation.

Policy instruments created to change the water access landscape such as decoupling of water licencing from land ownership as well as the policy principle of "use it or lose it" and the commitment to move away from water trading must be implemented taking into account the problem of spatial planning. Current debates on land appear to resonate with this.

Water resource management cannot be separated from spatial and land use management. It is crucial for water security that water infrastructure and ecological infrastructure that is important for water security are considered in spatial planning and land use management in South Africa.

5.8.2. Policy framework

The chief legislation dealing with spatial planning and land use management in South Africa is the Spatial Planning and Land Use Management Act, 2013 (SPLUMA). The overall purpose of SPLUMA is to provide for a uniform, effective and comprehensive system of spatial planning and land use management in South Africa. It, inter alia, enjoins national and provincial government, as well as each municipality to prepare spatial development frameworks (SDFs) for their respective jurisdictions. SDFs set out the development vision of an organ of state spatially. Local and metropolitan municipalities are ultimately responsible for giving effect to SDFs through their land use schemes (LUSs). LUSs are composed of land use scheme maps

[133] Source: WWF, 2013

where land units are grouped into land use categories, and land use scheme regulations, which set out the development rights for each one of the categories. Decisions to amend LUSs are taken by Municipal Planning Tribunals or authorised officials in a municipality.

It is incumbent on national, provincial and local government to include important water infrastructure and ecological infrastructure that is important for water security, such as strategic water source areas, in their SDFs with appropriate accompanying policy direction on land use in those areas. Land use that is not compatible with the functioning of water infrastructure or the conservation of ecological infrastructure, for instance, should be discouraged.

In preparing LUSs, municipalities should take into consideration the geographic location of water infrastructure and ecological infrastructure that is important for water security when categorising land units. It should also consider the land uses that are incompatible with the functioning of built and ecological infrastructure when allocating development rights to the areas where such infrastructure is situated.

5.8.3. Key Considerations

Municipalities should appoint persons with expertise in water resource management as technical advisors to their Municipal Planning Tribunals to ensure that Municipal Planning Tribunals have access to water-related expertise when faced with decisions that could have an impact on water resources in their jurisdictions. Those persons can, for instance, be members of staff of the Department of Water and Sanitation or relevant catchment management agencies. Appointing public sector employees as technical advisors to Municipal Planning Tribunals would not have financial implications for municipalities. It would also enhance co-operative governance.

Provincial governments play an important supporting role in municipal planning and land use management. Provinces therefore have an important supporting role to play in ensuring that municipalities consider water resource management in implementing their obligations relating to spatial planning and land use management."

SWSAs are examples of ecological infrastructure that must be considered when formulating spatial planning policy and making land use decisions. The Water Research Commission has prepared a management framework and implementation guideline for managers and planners to aid organs of state, most pertinently municipalities, to take appropriate land use decisions in strategic water source areas.

The draft NSDF has further incorporated the map of SWSAs into its Eco-Resource Production and Livelihood Regions. Amongst the guidelines provided in this section, the draft NSDF indicates the following "pursue effective management and custodianship of national strategic water source production region". Other lower order plans (e.g. provincial and municipal spatial development frameworks) should align with this national framework. – The trusteeship doctrine espoused in the national water policy and legislation allows for this kind of approach in terms of protection of resources even at lower level. This is a critical part of

the water security framework that is expected to ensure equity and reduced. In addition, the principle of "total value chain ownership" will then apply at different scales.

5.8.4. Recommendations

The NWSF must be anchored around the NSDF as the key framework for development in the country in line with spatial planning and land use management. The NSDF provides an opportunity to address inequality and spatial disparities both in terms of redressing the past and ensuring equity in future.

Participation in IDP and related processes by all spheres of government and role players will lead to improved spatial planning, thereby ensuring water security.

5.9. FOCUS AREA 8: ENABLING THE WATER SECURITY PLANNING, IMPLEMENTATION AND MANAGEMENT

This focus area has been identified to focus on, among others, issues of governance, policy and legislation, investment in human capital as well as institutional setting in terms of the country's level of readiness to ensure and enable water security, especially within the NEXUS context. For the NWSF implementation to be sucessful, institutions must be created urgently without delay. In order to enable planning for and implementing programmes to ensure water security, mechanisms need to be in place to address institutional, regulatory and policy requirements and implications.

5.9.1. Institutional framing and geopolitical boundaries

Institutionally speaking the water sector management is generally based on multilevel governance and relations between water resources on one hand and provision of water and sanitation services on the other. The interdependencies of various levels make water management a seemingly straightforward set up yet it is highly complex despite globally accepted general practices. Institutional configuration can often make or break the implementation of the water programmes as evident from recent developments in South Africa were policy and legislation are regarded as among the very best and at cutting edge, yet implementation remains elusive. Recent parliamentary proceedings through the Portfolio Committee on Water and Sanitation as well as Standing Committee on Public Accounts (SCOPA) are a case in point where issues of poor governance became apparent when corruption, incompetence and lack of accountability were identified as key problems currently. It is for this reason that the National Water Security Framework must as a matter of cause seek to clarify the institutional framing and ensure that the roles and responsibilities are articulated upfront at different levels of scale and across the full water value chain. That will ensure a focussed intervention that takes into account the respective roles in the value chain. Figure 47 illustrates the global configuration.

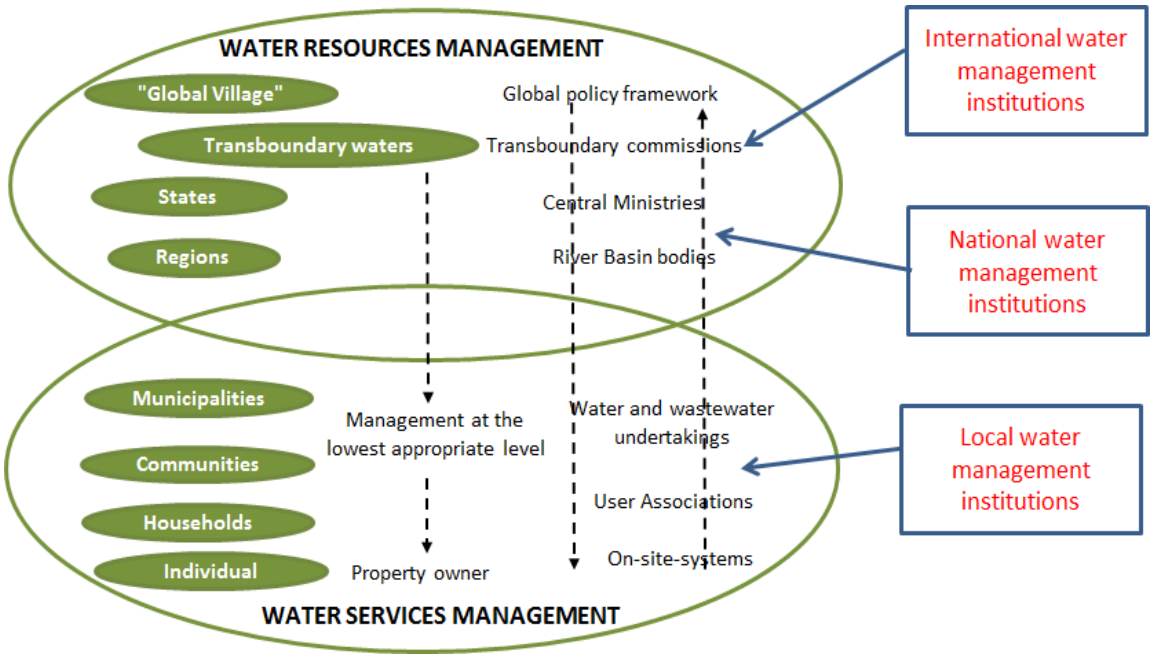


Figure 47. Global configuration of multilevel institutional governance framing for water resources and water services

The above has long been recognised in South Africa as reflected in the National Water Policy of 1996 and to some degree in the earlier RDP Policy framework of the ANC on Water and Sanitation (1994)[134]. The RDP policy framework had already regarded the right to access clean water as a fundamental policy principle of water resources to ensure "water security for all". It recognised the economic value of water and the environment and advocated an economically, environmentally and politically sustainable approach to the management of water resources and the collection, treatment and disposal of waste. This approach came through when among the earlier conceptualisation was the slogan "*Some for All Forever*", which in a way suggests deemphasizing scarcity or abundance and clearly biased towards rights based and integrated approach. Further, the following were already identified as critical:

- Spatial planning and water to recognise geographic limits to water availability and creation of the reserve;
- Long term environmental costs, including as a result of interprovincial and transboundary water sourcing/transfers; and
- Restructuring of the line Department and its role in building local and provincial agencies as well as ensuring effective oversight.

It is clear were consistent, focussed and well considered policies which had a long-term outlook, yet they are still not effectively implemented at least if not for other reason, at least to test them.

[134] African National Congress (1994). The Reconstruction and Development Programme – A policy framework

Figure 48 shows the geopolitical and sectoral boundaries that need to be fully aligned to ensure national water security.

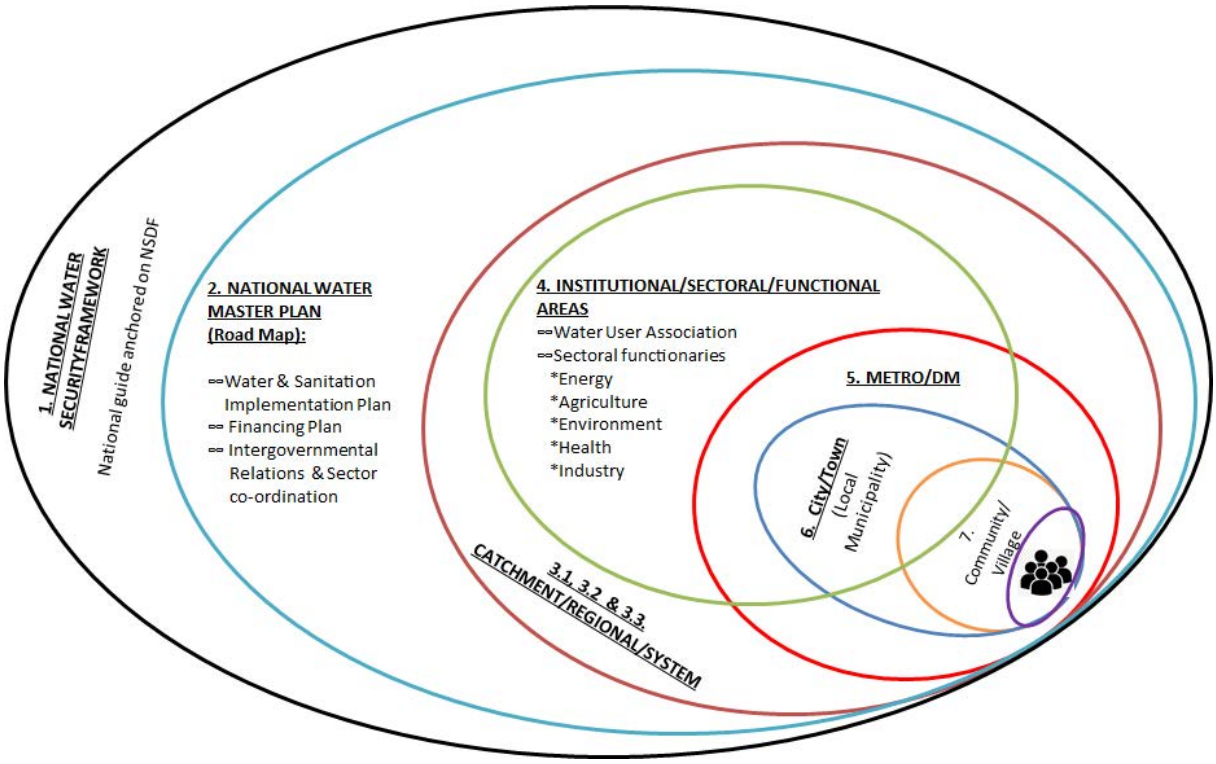


Figure 48 The NWSF in relation to institutional and geopolitical boundaries

Through the NWSF we should be able to ask why the line department is seemingly still at analysis and assessment stages in respect of implementation of institutional arrangements as envisaged in the policy and legislation. For instance, in the case of CMAs, progress has been seriously impacted by decisions that kept changing over time such as recent proposals for one vs. nine CMAs that appeared to be unnecessary in that a debate of that nature was exhausted when the decision was made to bring the CMAs down from 19 to 9 as convincingly presented in the 2013 NWRS2.

On the other hand, as reflected earlier, creation of Water Infrastructure Management entity was conceptually accepted during the policy discussions since 1994 and several decisions taken which included gazetting the agency for public debate and commitments through the NDP. Yet we are far from establishing this and current estimates are unclear in terms of when this will ever happen after commitments were made for gazetting in 2020, suggesting lack of commitment in that what has been happening has been simply "*kicking the ball down the path*".

Further, the question to be asked is why as a country are we able to sign up to institutional framing regionally as in SADC and lead the policy debates globally regarding governance and service delivery in water, and yet remain unable to establish the very same policies we

advocate nationally? In order to simplify the process, it could be possible to work with existing structures and facilitate implementation. Existing legislation, strategies, guidelines, etc. are already comprehensive.

Legislated tools through which the institutions operate include (Integrated Development Plans (IDPs), Water Services Development Plans (WSDP), CMSs, NWRS, etc. In addition, non-legislated plans which would form part of input to water security include, provincial local government development plans.

5.9.2. Enabling water security through effective institutional arrangements

South Africa's institutional reform and realignment strategy was published in 2007 and elements of this strategy were articulated in the National Water Resources Strategies (2004, 2013) and the National Development Plan (2011).

Institutional arrangements should be set up so that lower levels of authorities have agency in both: (1) establishing their own respective "rules of the game"; and (2) also give their say in articulating policies at the upper-echelons[135]. Along those lines, institutional decision-making processes should be governed by the principle of subsidiarity, that is, a central authority should only perform those tasks that cannot be performed at a more local level. The systems of water governance that are well decentralised are conducive to the practical implementation of policies.

There are several key approaches and principles that are essential foundations to establishing institutional arrangements that support good water governance:

- Institutions should be transparent and open, especially when it comes to policy decision-making and finances;
- Systems of communication and inclusiveness ensuring that stakeholder engagement is maintained and can be enhanced must complement these transparency mechanisms;
- With time water issues seem to only intensify in complexity, policies must therefore be developed in a way that the interconnectedness between different actors and various dimensions is adequately highlighted;
- The different systems involved in water governance should also work towards equitable and ethical solutions. Legal and regulatory frameworks should always aim to be fair to all voices raised by myriad of interest groups and seek for equity between women and men.

Four main institutional functions that are essential to achieving strong institutional arrangements, and thereby, also conducive to good water governance, include:

- Regulation and enforcement which deals with institutions that are responsible for the regulatory, implementation and assessment roles;

[135] http://www.gwp.org/en/learn/iwrm-toolbox/Institutional_Arrangements/

- Outlining the roles and features of public, private and community based water supply and sanitation service providers;
- Coordination and facilitation bodies (i.e. transboundary organisations for water resource management, national Apex bodies, civil society organisations, river basin organisations, and impact assessment committees);
- Finally, capacity building, dealing with entities and platforms that can help to enhance the institutions themselves and by the same token, improve water governance at large.

Institutional arrangements are key to social equity, economic efficiency, and ecological sustainability in water management. They rely on an enabling environment to be effective and sustainable, and the necessary management instruments cannot be fully realised without the appropriate system of institutions, particularly regarding stakeholder participation.

In contrast to the traditional vision, institutional arrangements that are founded on IWRM principles work towards a greater long-term goal alongside fulfilling their own respective institutional functions. Institutions should orient their specific individual functions in ways that can best serve the broader shared objectives. When guided by the IWRM paradigm, institutions do not see themselves as separate and/or dominant players but rather as components of a team within a system. As part of this collective, institutions walk alongside each other towards the mutual strategic goal of providing an environment promoting water security for all.

5.9.3. Enabling water security through effective water management and governance

While governance may be seen in narrow political and administrative terms as decision-making by "the government", good governance actually requires that all institutional actors involved managing water resources, including citizens, organisations and private entities, work in a common direction. Poor governance leads to increased political and social risks, institutional failure and lowered capacities to deliver. Therefore, good water governance requires clear legal frameworks, comprehensive water policies, enforceable regulations, institutions that work, smooth execution and citizen-based mechanisms of accountability, as well as strong interconnections between these entities. Water problems are often caused outside of the water sector; it is "good governance" in general rather than simply "good water governance" that is needed. According to the FAO[136], water governance relates to the enabling environment in which water management actions take place: that is,

- the overarching policies, strategies, plans, finances and incentive structures that concern or influence water resources;
- the relevant legal and regulatory frameworks and institutions; and planning, decision-making and monitoring processes.

[136] http://www.fao.org/land-water/water/watergovernance/en/

Effective water governance promotes responsible actions and measures to protect and ensure the sustainability of water resources and to optimize the services and benefits obtained from those resources.

While operating and performing their respective functions, institutions must be accountable, efficient, responsive and sustainable. To begin with, good institutional governance call for accountability; which is, in the process of doing, each institution must be able to explain and take responsibility for actions taken in line with their obligations defined by the appropriate legislative and executive powers. With recognition and backing of their legal status, institutions can function properly – thereby using their "convening power" supported by their respective jurisdictional mandate. Economic efficiency calls for serving more with equity and minimum waste. Appropriate price regulations and standards for limiting damage to the environment should be specified in that sense. Lastly, in order to be responsive and sustainable, policies must deliver what is needed on the basis of demand, clear objectives and evaluation of future impact and, where available, of past experience.

In order to ensure good control, South Africa could consider doing so through a functional regulatory regime where separation of responsibilities is clear across the board.

The enabling environment essentially consists of "rules of the game" that are laid out as to achieve a sustainable balance between the social, economic and environmental needs for water. These rules can be defined by the use of: (1) Policies; (2) Legislative Frameworks; and (3) Financing and Investment Structures[137]. The latter is covered in a separate focus area on infrastructure and finance.

The enabling environment is determined by national, provincial and local policies and legislation that constitute the "rules of the game" and facilitates all stakeholders to play their respective roles in the sustainable development and management of water resources and provision of services. The purpose for such enabling environment is to provide a set of solid foundations establishing the priorities and best ways which can help water governance structures reach their goals, while balancing out the social, economic and environmental demands for water resources. IWRM must be seen as a guiding strategy in creating the tools of this enabling environment, i.e. policies, legislative frameworks and financing structures. The roles and responsibilities are defined in Table 4 and Table 5.

Setting up a proper enabling environment entails that stakeholder involvement cannot be understood as limited to the realm of government institutions. Since the "rules of the game" apply to everyone, private companies, NGOs, community-based organisations, women and disadvantaged groups in particular, as well as other sections of civil society should all be provided with genuine opportunities to actively participate in formulating these collective baselines.

Women play a central part in the provision, management and safeguarding of water and a special effort should be made to consult them in these efforts. All these organizations and

[137] http://www.gwp.org/en/learn/iwrm-toolbox/The-Enabling-Environment/

agencies have an important role to play as there exist many different perspectives on enhancing access to water, bringing about equilibrium between conservation and development, and treating water as a social and economic good.

Regardless of how they are defined, water management and governance involve different opinions or views, and discussions inevitably add details until the definition becomes cumbersome. From basic concepts perspective, water governance involves a broad set of enabling and regulating functions that support and oversee the organisations that use resources to manage water for human and environmental needs. Governance requires policy setting to create mechanisms to empower and control the functions and outcomes of the water management processes. As in the case of recent developments in South Africa as stated earlier, governance failure manifests in the failure of delivery.

A second concept is that management and governance involves similar set of tasks but they are applied differently and at different levels. Such tasks include setting policy, empowering, planning and organising, directing, financing and controlling. To illustrate, water policy is set by national organisations and by local governing boards, but the policy has different purposes.

A third concept is that management and governance processes must be applied in appropriate ways to the different sectors of water resources management. For example, to manage and regulate the withdrawal of water supplies is a much different problem than to apply the same task for flood control or hydroelectricity.

Table 4 provides brief comparative roles of management and governance for seven distinct sectors of water management and cross-cutting sector (multi-purpose and area-wide management)

Table 4. Management and governance roles for water resources[138]

WATER SECTOR	MANAGEMENT ROLES	GOVERNANCE ROLES
Public and industrial supply	Utilities and other systems provide water supply	Ensure access, regulate allocation and quality, empower utilities
Wastewater and environmental water quality	Provision of removal and treatment of wastewater and environmental water quality	Ensures access, regulate dischargers and water quality
Storm water and flooding	Provided by organisations for storm water and flood control from urban areas and sites. Managed well it can be a useful source.	Ensure services, regulate flooding and nonpoint sources, ensure preparedness
Irrigation and farm drainage	Provide raw water and drainage systems in irrigated and rain fed zones	Regulate allocation and drainage, empower irrigators, oversee organisations

[138] Grigg NS. 2011. Water governance: from ideals to effective strategies. Water International, 36:7, 799-811, DOI: 10.108/02508060.2011.617671

Instream flow control	Coordinates flows for hydropower, navigation, recreation, fish and wildlife	Establish instream flow, control diversions and discharges
Groundwater management	Manages groundwater development and use	Regulate groundwater withdrawals and protection
Area wide and multi-purpose management	Provides coordination and river basin planning though multi-purpose agencies	Empower and coordinate river basin and other multi-purpose actions

Some examples of division of roles are highlighted below[139]

Table 5. Examples of division of typical governance roles

Sphere	**Typical Role**
Local water management	○ Local water policy ○ Urban drainage and flood control ○ Municipal water supply authority ○ Regional water and sanitation authority (large cities) ○ Community water management
Integrated catchment management	○ Water and environmental monitoring ○ Stakeholder coordination
National Water Infrastructure	○ New reservoir development ○ Management of existing reservoirs – large dams and conveyance systems ○ Options analysis ○ National systems operations ○ Inter-catchment /Interbasin transfer management – systems balance
National policy planning, regulation and oversight	○ National strategic planning - including international water governance issues ○ Development of regulations ○ Policy development and management ○ Licencing and authorisations – supported by strong compliance monitoring and enforcement as well as good catchment management ○ Resource (Land, water & environment) auditing – to assess if reserve determination is achieving intended results/objectives ○ Reserve determination and instream flow regulation and control

A national Water Security Framework is meant to allow policy development and enable empowerment which can lead to the establishment of mechanisms for planning and implementation that are critical for the regional water supply in a growing economy.

[139] see also ANNEXURE B - Institutional Roles and Responsibilities Matrix

While it is difficult to generalise about the requirements for water governance to enable water security, a conceptual framework for it is available; cases and example demonstrate how governance and management must work in tandem with technical approaches to solve water problems. The solutions will inherently involve multiple institutional elements and organisational types, including multipurpose, river-basin and regional organisations, which expand the possibilities for success through integrated water management (IWM).

In the South African situation where policy, legislation and strategies on water have not been fully implemented governance becomes a key issue requiring a focussed and urgent attention. Figure 49 shows institutional value chain based on current configuration. Desperate situations of water management become evident when viewed through the lens of governance. They illustrate multiple forms of interactions among the functional elements of management and governance at different levels of government.

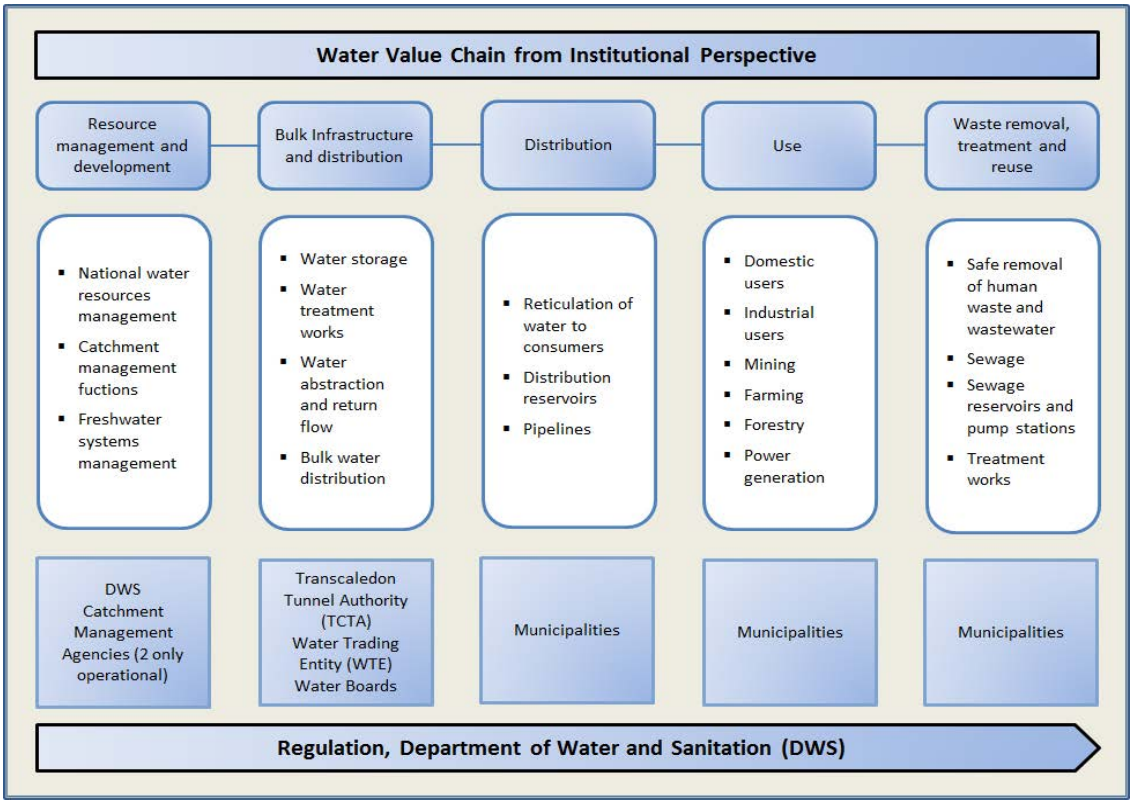


Figure 49. Institutional value chain based on current configuration

Principles of effective water governance:

- Multilevel and multidimensional policy;
- Capacity building, empowerment and control;
- At local level, implementation and regulatory responsibilities are not always separated clearly;
- Empowerment and transparency of local communities.

Figure 50 also shows a logical clustering of the institutional framework that is based on the latest understanding of the policy and legislation as envisaged from initial development through to recent reviews which is further articulated from a functional perspective in Figure 51.

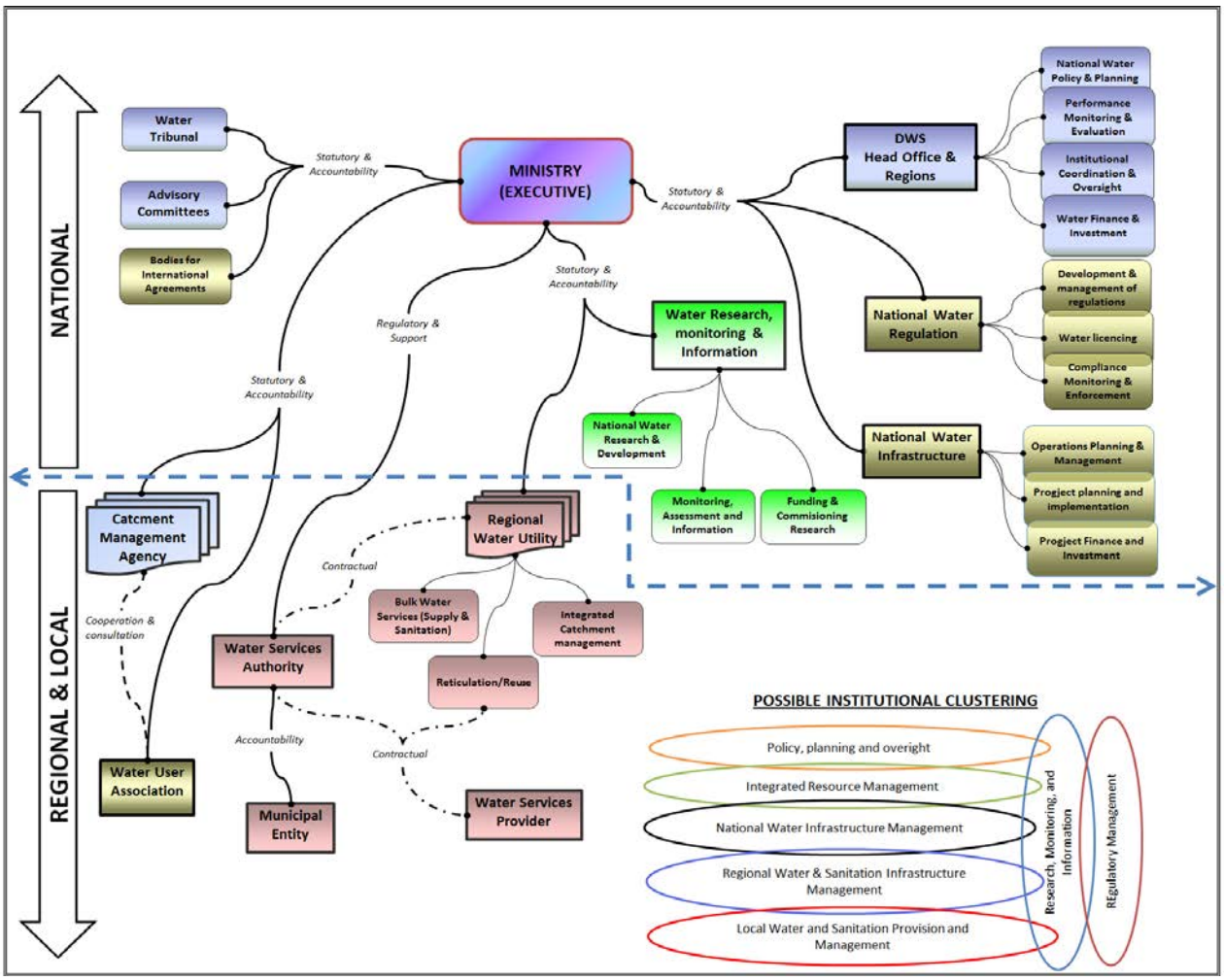


Figure 50. Institutional arrangements under the National Water legislation (NWA, WSA, WRA) adjusted to reflect legislative and policy prescripts and intent.

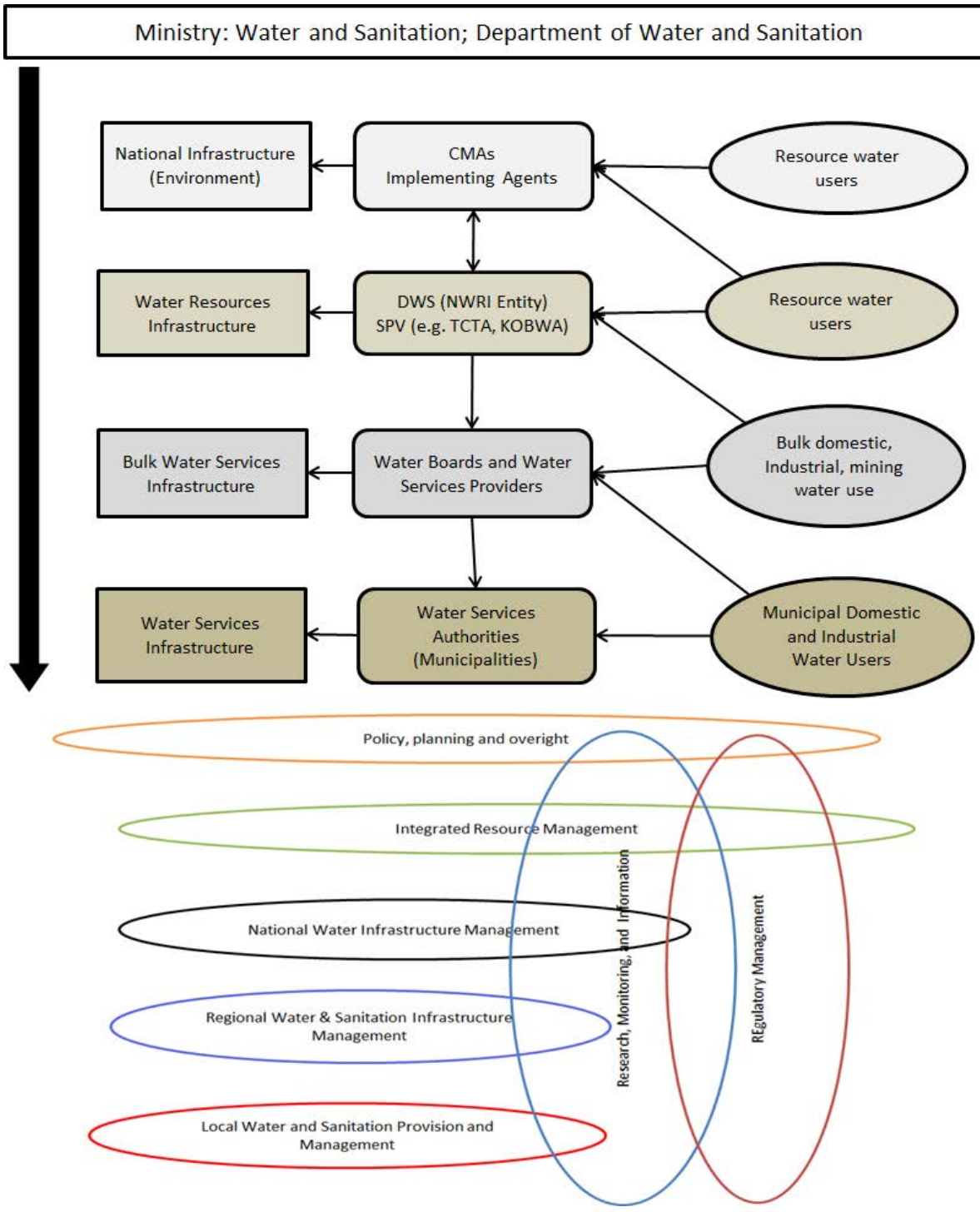


Figure 51. Institutional clustering aligned with current understanding and future requirements proposed for immediate implementation[140]

Flowing from institutional arrangements reflected in Figure 50 for the purpose of the Water Security Framework institutions proposed for immediate implementation or strengthening are highlighted in Table 6 below.

[140] Modified from Ruiters and Matji, (2015)

Table 6. Institutions according to water and other relevant legislation requiring immediate implementation to enable water security in South Africa

ENTITY/INSTITUTION	OVERALL FUNCTION	COMMENTS/REMARKS
Ministry of Water and Sanitation	• Executive and overseas all entities. • Set Policy framework and link to overall national executive mandate as custodian of the water resources and overall processes. • First line of appeal when allocation or regulatory disputes occur	In recent times the specific role of the executive has become blurred as a result of overreach into the operations of the Department as an Entity and the entities reporting to the Minister through the respective governing boards.
Water Tribunal	• Established in terms of sec 146 of the NWA as an independent body with jurisdiction over the whole country to appeal administrative decisions taken in terms of the legislation. It is meant to reconsider administrative decisions on merits of the case and should not apply the law to disputes. Disputes on application of the law should be dealt with at the High Court	The functioning of the water tribunal has been hampered by level of control that different ministers of Water have wanted have over the years and appears to have lost its original intent.
Advisory Committees on Water	• Established to advice on particular issues and could exercise and perform powers, duties and functions assigned during establishment or by delegation.	
Department of Water and Sanitation	• Planning, policy and regulatory management. • Water governance and leadership	It is assumed that the regulation function will fully be located within the Department with national (decompose allocation -recall spatial planning as well) water allocation, compliance monitoring and enforcement as well as long-term strategic planning and sector leadership/oversight. The Department's function will retain a national function with a regional footprint. The original plan was to have a streamlined Department with team of about 3500 staff complement focusing on high level activities both regionally and nationally playing a more

ENTITY/INSTITUTION	OVERALL FUNCTION	COMMENTS/REMARKS
		regulatory and oversight/leadership role
Catchment Management Agencies (9)	Integrated catchment management ensuring democratisation and subsidiarity. Emphasis on local level integrated water resources planning and allocation – limit regulatory function to National Department and possible delegation to provinces and local government through ordinances/bylaws. Possibly overseeing Water User Associations as localised interest based organisations envisaged in the national water policy and legislation. Key challenge is that the Department got caught up in the problems associated with transformation of irrigation boards which was a transitional issue at the expense of deconstructing and reconstructing the local water management in line with the policy and legislative principles and intent	It is important to note that although these are funded through user charges, their primary purpose is integrated catchment management. Further, the argument that they are costly to run does not hold water because their footprint and activities are such that some of their activities are in general covered under the fiscus (recall 50%). The current argument may be based on the assumption of bloated regional offices which is a result of resistance to change in terms of letting go by regional incumbents!
National Water and Sanitation Infrastructure Management Agency	National Infrastructure Development and Strategic Asset Management. Funding from the balance sheet and ensuring cross subsidisation across the full value chain at national level	Important to leverage the infrastructure; Take into account the interconnectedness of the water systems in the country Include national systems planning and analysis (Current location in the DWS create a cumbersome and ineffective situation. National Department should focus on scenario and long-term planning)
Regional Water Utilities	Regional Water & Sanitation Infrastructure Management involving infrastructure of a regional nature	Relate to the National Infrastructure agency. How do they form a unitary system?
Water and Sanitation Monitoring, Information	Data and Information management in line with Chapter 14 of the National Water Act, Act 36 of 1998	Initial assessment indicate that an agency to deal with this functional cluster indicate that funding will come

ENTITY/INSTITUTION	OVERALL FUNCTION	COMMENTS/REMARKS
and Research[141]	as well as Chapter 10 of Water Services Act, Act 108 of 1997, and Water Research Act. Key functional areas: Knowledge generation and linking all water and sanitation institutions with institutions within the National System of Innovation and the national Research and Development Strategy Management of monitoring and assets such as national laboratories and hydrological and geohydrological monitoring infrastructure; Monitoring information systems development	from existing programmes and activities and savings from functional and institutional optimisation. Economic and business model – financing Water value capture – see French & Dutch models in terms of link to developing countries
Water User Associations	A cooperative association of individual water users or persons receiving water services or undertaking water related activities for mutual benefit[142]	In the past difficulty has been cited as transformation of irrigation boards. The momentum for creation of these may has been hampered by change in leadership and lack decisiveness.
Institutions for international water issues	Institutional bodies to implement an international agreement between South Africa and a foreign government.	These have been functioning and may need only strengthening in respect of capacity within South Africa. Consideration could be given to involve experts in support of government officials.
Local Water and Sanitation Infrastructure Management e.g. Water Services Authorities Link to IDPs See NERSA Model which allows for lower levels implementation	Remaining local activities that may be seen as "off the grid" type water and sanitation management which could be consolidated under local government sphere context – e.g. MISA with an expanded mandate.	This cluster needs to be further developed to address issues of alignment with national imperatives and potential operational jostling between national oversight and local service delivery Regulating through licensing to cover everything

[141] This should be linked with land resources research which linked to other line areas such as Agriculture and Environment.

[142] Thompson, H. 2006. Water Law: A practical Approach to Resources Management and the provision of services

ENTITY/INSTITUTION	OVERALL FUNCTION	COMMENTS/REMARKS
Water Services Committees	Established in certain or for communities where there is no effective or well-organised water services authority (WSA) or water service providers to provide the necessary water services in the area of concern.	Not to be confused with community-based organisations[143]. It appears that these have never really been utilise effectively, if at all.
Water Regulator	Established in line with legislative and policy requirements/prescripts to focus on development and management/implementation of national regulation of the full water value chain. Could be in the line Department or as an agency of the Department/Government based on principle of separation of responsibilities.	Focus should be on implementation of the current provisions of legislation as far as is possible and progressively build the appropriate institutional regulatory regime in no more than 2 years (end of 2021/2 FY). The process of establishment can be done in parallel with strengthening and ensuring implementation of current policy and legislation.

Implementation and strengthening of the institutions in Table 6 can go a long way to enable water security.

5.9.4. Enabling water security through ensuring robust regulatory regime

Current national debates on regulation and institutional arrangements suggest South Africa is grappling with implementing commitments made through the policy and legislation as envisaged at the dawn of democracy. Given the positive reviews of national policy positions it should not be difficult to decide and implement options that are available based on past and current experience. The point of departure should be that of ensuring achievement of NDP goals and water security vision within the context of the 3 apex issues of inequality, inclusive economic growth and poverty eradication.

Consultations on the national water security reveal the importance of a balanced approach to trade-offs based on the competing demands as expectations are varied and pulling to different directions:

- Communities expect secured supply and access for livelihood and participation in the economy, e.g. spending too much time accessing water and not do other economic activities
- Business expects security of supply for their economic activities (Farming, energy, mining, etc.), and emphasising *independent* regulator largely as a result of gaps in terms of implementing current policies and legislation;

[143] Thompson 2006

- ❑ Environmental conservationists focus on environmental flows and protection.

A closer examination of the above situation suggests a serious inclination towards the tragedy of the commons[144] exacerbated by the mismanagement, corruption and greed.

5.9.5. Enabling water security through capacity building

A secure water future will not be achieved without addressing the issue of capacity – the skilled people required to undertake the work. A skills gap analysis conducted by the WRC in 2015, looking at numbers of staff and their skills relative to required skills, showed significant skills gaps in water sector institutions, including DWS, CMAs, water boards and municipalities.

The Energy and Water Sector Education and Training Authority (EWSETA) is the skills development authority serving the water sector. However, it does not seem to be sufficiently assisting the challenges as they currently manifest. This is evident from the fact that a plethora of institutions has entered into the space of human capital development resulting in unnecessary duplication of effort at national level. It may be that another vehicle may need to be found where in the skills is located directly in the institutions of training and skills development such as TVETS, universities etc. to address the shortage of skills across the board. This may include closing down some of the "Academies" ran directly by line departments and their institutions so that their primary focus become on service delivery in line with their respective mandates. Further, the technical skills required for the line Department must be addressed urgently through attracting the right skills in the right proportions.

The NWRS2 (see Figure 5 in the NWRS2) identified water sector skills as one of the key cross-cutting domain themes to enable efficient and effective management of water for equitable and sustainable growth and development; and dedicated a full chapter. This was located within the frame of integrated water resource management and provision of services generally across the sector.

The importance of skills and capacity is further recognised in the NWSMP where it is identified that implementing it will require the right mix of skills and expertise in the water sector. This includes the capacity expressed as number of persons and skills expressed by qualification and experience required to fulfil the requirements in water resources and water services planning, management and operations. A critical need is to use the expertise of experienced water managers to mentor and develop younger and less experienced managers in the water sector including, but not limited to, the municipal sector.[145]

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[144] Chappelow, J. 2019 (Investopedia) defines the tragedy of the commons as an economic problem in in which every individual has an incentive to consume a resource at the expense of every other individual with no way to exclude anyone from consuming, resulting in overconsumption, underinvestment, and ultimately depletion of the resource. In the end it occurs when individuals neglect the wellbeing of society in the pursuit of personal gain.

[145] National Water and Sanitation Master Plan Volume 1: Call to Action v 9.4 27 March 2018

Box 9. Skills and capacity building

Skills and capacity building

A key challenge of the NWRS2 is to increase our skills and capacity within the sector for both water resource management and water services. Institutions must be appropriately staffed and resourced and towards this end we will continue to prioritise skills development, staff motivation and capacity building at all levels. Increasing our regulatory capacity to improve compliance and ensure that standards and license conditions are met is an integral part of strengthening our institutional framework and capacity.

NWRS2, 2013

As way back as during the development of new water policy and legislation the need was identified to ensure that South Africa's policy is grounded on proper skills and capacity; and in 1996 the WMO and UNESCO were invited to do an assessment of education and training needs for integrated water resources management in South Africa aimed at addressing the implication of the sector transformation. This process formed part of the development of a gamut of skills sets that were not available at the time in line with the new developments. Programmes such as FETWater came about and significant in-roads were made across the sector – however momentum seems to have been lost and due to various reasons the key casualty of this became the line Department itself which over the time has lost its capability to lead the sector.

Building capacity from an institutional and sectoral perspective is critical for enabling water security as well. Skills sets need to be accommodative of the variability of needs, complexities as well as geographical positioning and future needs. The skills need and strategy need to be re-evaluated in context of the NDP's commitment to building capable state. From the water sector perspective there has not been a careful assessment of skills needs other than commitment made in the NWRS2 and recently in the NWSMP.

5.9.6. Recommendations

The enabling foundation of the NWSF has been compromised over time and requires urgent attention. Key and immediate recommendations include:

Immediate implementation of the institutional framework as expected in policy and legislation and commitments already made.

Review of legislative instruments must be done as a parallel process to programmes

Water governance is intricately linked to stakeholder engagement and participatory processes as envisaged in the policy and legislation and must include high level of transparent processes and information sharing.

Enabling water security requires constantly building capacity in across the sectors. Skills asymmetry observed needs to be addressed by ensuring correct placement in government and public institutions and ensuring alignment with private sector needs.

5.10. FOCUS AREA 09: MANAGING WATER RISKS – PROMOTING PREPAREDNESS, BUILDING RESILIENCE AND EFFECTIVELY RESPOND AND RECOVER FROM WATER SHOCKS

5.10.1. Introduction and Background

Water-related risks arise from too much water, too little water, or polluted water. The occurrence of floods and droughts are expected to increase with a changing climate, with the Intergovernmental Panel on Climate Change (IPCC) predicting these water-related disasters to increase in both frequency and severity, as the entire global water cycle is affected by global warming.

Droughts and floods are prevalent hazards in South Africa. Recent climate variability scenarios suggest that there will be an increase in the frequency of extreme weather events. Drought has been gripping the country since 2015. Many parts of South Africa experienced the worst drought since 1921. Whilst rainfall brought much relief, it did not dissipate the drought completely and indeed some areas in the county still experience significant dry conditions and water scarcity. There is a need to recognise that water is not an unlimited resource. The prolonged drought situation is already having significant impacts on economic growth and on the well-being of everyone in the country. These impacts will be exacerbated if the water crisis is not addressed.

We are compelled to build resilience to ensure that South Africa will be better positioned to absorb future impacts caused by water shocks and to manage water risks more effectively and efficiently.

The 2019 Global Assessment Report lists global warming, growing populations, income inequality, environmental degradation and agricultural limitations as contextual risks that through stressors such as droughts, heat waves, international trade complexity etc. result (suddenly or gradually) in systemic failures in a society which increases their vulnerability, especially to disasters. There is a need for adaptive and integrative plans to reduce disaster risks with bottom up processes supported by top to bottom measures. In this regard, we need to employ an all of society approach in managing disaster risk which is key to sustainable service delivery and development. As such we need to heed the call of the Global Assessment Report to promote integrated disaster risk reduction across all sectors and disciplines.

Water management and development strategies have a pivotal role in reducing the exposure and vulnerability of people and assets to water-related extremes.

5.10.2. Legislation and strategic implementation

The National Disaster Management Centre (NDMC) plays a critical role to promote an integrated and co-ordinated system of disaster management with special emphasis on Disaster Risk Reduction, particularly through:

- Institutional Arrangements (Disaster Management Advisory Forums, National Joint Drought Coordination Committee, National Flood Coordination Committee)
- Disaster Management Planning: Support and guidance to organs of state in preparation of disaster management plans to ensure amongst others, implementation that provides for the developmentally-oriented approaches, programmes and projects that reduce disaster risks. Furthermore, to ensure that particular attention is given to the planning for and integration of the core risk reduction principles of prevention and mitigation into on-going programmes and initiatives.
- Seasonal Risk Profiling and Early warning information (in partnership with SAWS) to lessen impact of disasters within the communities.
- Promoting a culture of risk avoidance amongst stakeholders which is an integrated process of education, training and public awareness programmes supported by research empowerment programmes. When people know how to manage risks, they will be able to take action to manage such risks, thereby avoiding disasters.

The NDMC is established as a Presidential assigned function to a Cabinet Member. This function is coordinated through the implementation of the Disaster Management Act, 2002 (Act no 57 of 2002), as well as the accompanying Disaster Management Framework, 2005 across the three spheres of government. The objective of the NDMC is to promote an integrated and coordinated system of disaster management, with special emphasis on prevention and mitigation by national, provincial and municipal organs of state, statutory functionaries, other role-players involved in disaster management and communities.

Sustainable delivery of disaster management services requires a strong institutional basis across all spheres of government. Sector departments have a key role to play in disaster risk reduction and they are required to establish disaster management focal points to deal with risks impacting their respective sectors. Strategic partnerships must be established with private sector and civil society to optimise existing resources to maximise impact. Communities, including traditional leaders must be placed at the centre of all risk reduction measures.

Water is key in managing disaster and addressing climate change impacts, because water is the medium through which most climate impacts and many disasters such as droughts and floods are felt. To recognise this reality and to respond accordingly is essential. It also presents several development opportunities. Various adaptation measures that respond to climate variability, and build upon existing land and water management practices, have the potential to strengthen the resilience of vulnerable communities to climate change and to ensure water security, and thus directly contribute to sustainable development and the SDG's. Innovative technological practices and implementation of strategies at the appropriate levels are necessary measures to address the needs of adapting to climate change and variability, while at the same time managing water risks through enhancing preparedness and building resilience. Where adaptation responses are insufficient there is also a need to address loss and damage related to impacts such as water-related disasters.

Some of the key actions/ outcomes that are required to manage water risks include the following:

- At-risk communities need to implement hazard-specific early warning systems and evaluate effectiveness of their systems with respect to lead time and accuracy of forecasts and efficiency of dissemination.
- SA needs to understand trends in water related disaster impacts and must be able to make informed decisions as to investments in disaster risk reduction, preparedness and building resilience.
- Leaders must be are aware of the impact of disasters to vulnerable groups and must tailor policies to address the specific root causes of vulnerability.
- SA needs to reduce economic losses and improve livelihoods for vulnerable communities.

Disaster risk reduction and water security are thus not water sector issues, but societal issues. Encouraging all sectors to consider water risks in their policies and planning is the only way to ensure water-related disaster risk reduction. We need a "all of society" approach to prevent the creation of new risk; reduce existing risk; and increase resilience to withstand residual risk.

There is a need to strengthen the capacity of disaster management across the spheres of government to ensure that South Africa promotes and strengthens water disaster risk governance, invest in water disaster risk reduction to build resilience, enhance water disaster emergency preparedness for effective response and building back better in recovery (rehabilitation and reconstruction) to recover from water shocks. A capable, resourced and well-equipped NDMC is fundamental for the country to effectively implement disaster management services.

5.10.3. Recommendations

The NWSF needs to be anchored around the NDMF (in addition to the NSDF mentioned earlier) which has the convening mandate through the NDM Act on one hand and the SPLUMA on the other. It is therefore critical that the NPC should be formally included in the coordination set up of the NDMF.

Further the NDMC should be given the responsibility to "risk proof" the NDP generally and the NWSF in particular.

A toolbox for water related risk management is to include the OECD's approach to risk identification and management which should also forma part of the monitoring and evaluation.

5.11. FOCUS AREA 10: COMMUNICATION AND STAKEHOLDER ENGAGEMENT

5.11.1. Introduction and background

Communication and stakeholder[146] engagement are critical to ensure that cycles of planning for water security focus on priorities of key stakeholders and that important outputs and recommendations are owned or at least not ignored or rejected by the key stakeholders. The NDP as a generally accepted national tool available for long term planning provides an overarching direction within which the water security framework is located. The communication and stakeholder engagement strategy must be generated to be aligned with the needs of other work streams and to ensure that the necessary paradigm shift on planning for water security is internalised throughout the value chain and across various role players.

Before aiming to engage and influence stakeholders, it's crucial to seek to understand the people you will be working with and relying on throughout the phases of the implementation process. Sharing information with stakeholders is important, but it is equally important to first gather information about the stakeholders.

Communication and stakeholder engagement is about two-way communication and an open dialogue – the process must ensure that the NPC speaks to, listens to and collaborates with stakeholders to motivate, educate and reach the best possible outcomes for the NWSF in a way that promotes co-development of solutions and actions that are required for implementation with responsibility, ownership and accountability across the board. The communication and stakeholder engagement should link to other areas in the NDP implementation process.

Communication and stakeholder engagement, whilst a separate process at NDP as a whole, efforts must be made for messages not to be crossed with the line Departments within government generally or other social partners as they play a critical role in the implementation and holding each other accountable.

The strategy must enable key stakeholders to engage with each other, with the wider public and with organisations that have the responsibility for carrying out activities related to water security at different institutional levels. In context of Water security framework, this must be seen to be more than exchanging and sharing information, knowledge, experience and views but also involve debate, negotiation and joint learning that has the potential to build trust and social capital away from anecdotal to evidence-based decisions. Key to this is that ensuring water security will require serious and difficult trade-offs that will ensure proper pathways to a water secure South Africa.

[146] **Stakeholder**: an individual, group, or organisation that is, or could be, affected by a process or output, or that can affect that process or output. Stakeholders may share a common interest but possibly for different reasons (such as farmers, agricultural scientists, public servants, water resource managers or policy makers)

5.11.2. Principles and Approach

The communication and stakeholder engagement, whilst a separate process at NDP level, efforts must be made for messages not to be crossed with the line Department and the broader part of the NDP.

For stakeholder engagement to add value, stakeholders must be ceded the power to influence decisions and choices. Therefore, even if the final decision or choice may rest with those entrusted with jurisdictional mandates such as politicians or democratically-elected officials or bodies, or line Departments or private sector etc., stakeholders will only engage actively in a multi-stakeholder process if they believe that they can influence processes, decisions and choices that may affect them.

The following principles will be applied during the stakeholder engagement process:

- Invest in careful planning before engaging stakeholders;
- Identify and build stakeholder relationships to increase confidence across the relevant sectors, minimise uncertainty, and speed up problem-solving and decision-making. Where there is trust, people work together more easily and effectively;
- Consult early and often;
- On-going and regular communication;
- Maintain a productive relationship throughout the process;
- Use foresight to anticipate misunderstandings, and take simple and timely actions with stakeholders to significantly improve delivery;
- Stakeholders are important influential resources and should be treated as potential sources of risk and opportunity within the project;
- Manage stakeholders' expectations and priorities; and finally
- Manage roles and responsibilities by providing clarity about what is expected of people involved in the process.

5.11.3. Recommendations

A multi-stakeholder platform (MSP) needs to be established created under the auspices of the National Planning Commission anchored within the Secretariat and comprising different stakeholders to support the work of the commission in respect of National Water Security Framework implementation and coordination. The format could take the network model with MSP anchoring from the inter-ministerial platform of Water and Sanitation.

A specific recommendation includes the possibility of establishing the MSP in the form of a presidential advisory committee/commission which could be spearheaded by the principal custodian of Water and Sanitation supported by COGTA and other interested parties.

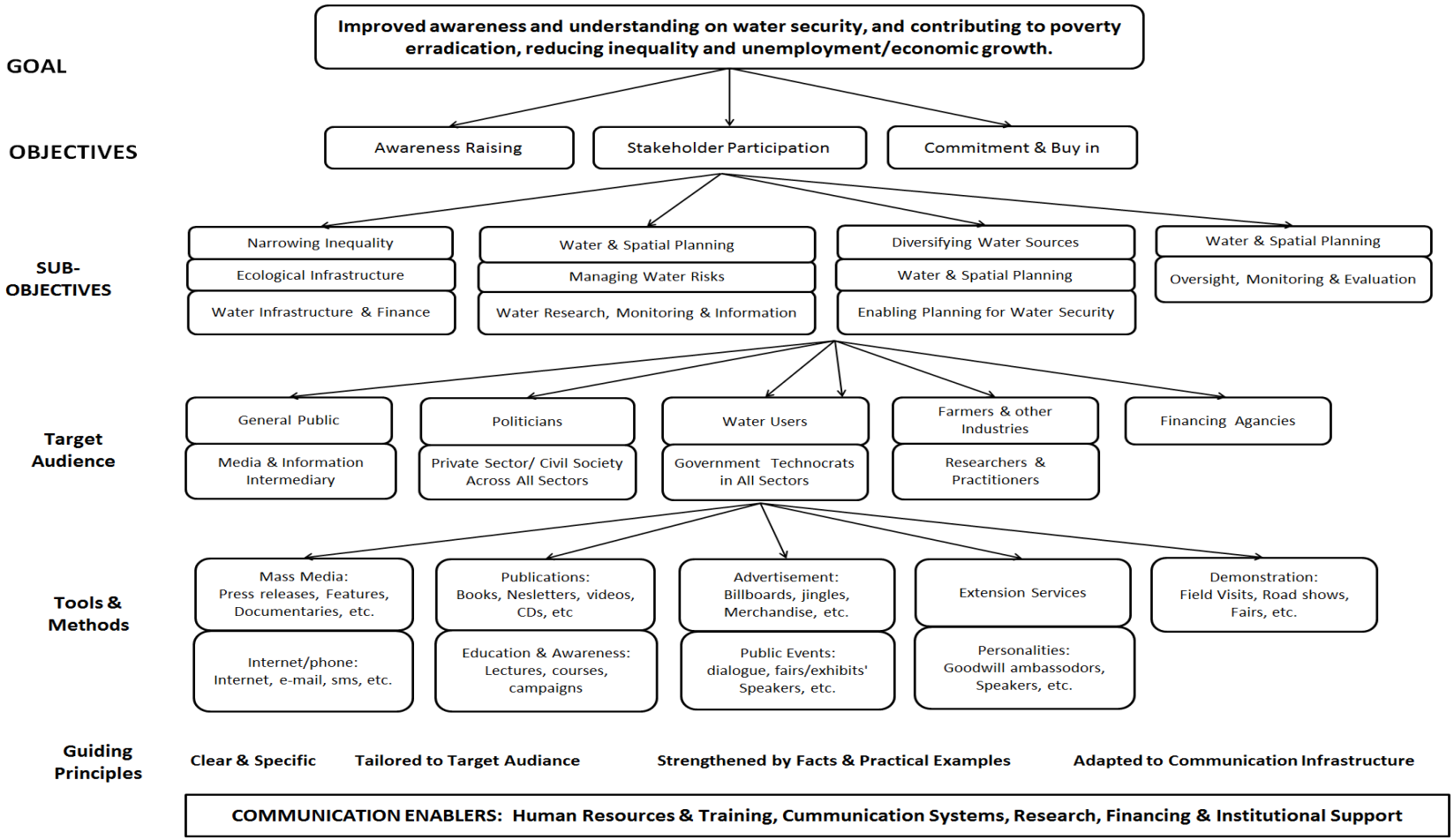

Figure 52. Conceptual framework for communication strategy[147]

[147] Adapted from SADC 2010. Regional awareness and communication strategy for the SADC water sector.

6.
OVERSIGHT, MONITORING AND EVALUATION OF PERFORMANCE

If there is one area where equity is crucial and essential,
I think it should be the issue of water.

Kofi Annan

6.1. MONITORING AND EVALUATION

As presented earlier in this document, water security has spatial and temporal dimensions. Spatially it can range from individual family unit to a community or village, town, district, province, country level or continentally. It can vary from spatial unit to another or seasonally to a year, a decade or century. The framework for monitoring must take these dimensions into account.

From a water security perspective, immediate interventions needed include aspects such as development of a *Monitoring and Evaluation System (MES)*- that will include development of indicators at outcome and impact level in order to monitor and evaluate programmes beyond processes and focus on whether:

- Policy and legislation are producing the correct enabling environment including its regional and local dimensions;
- The national objectives articulated through the NDP and the Water Security Framework are being achieved;
- Delegation of powers within the sector (national, regional, CMA, local government etc.) is effective;
- Responsibilities that the president delegates to the minister, who in turn delegates to the institutions that report to his/her are performed.

Three key criteria are to drive the monitoring of water related planning and implementation at NDP level, namely

- Economic Growth measured by GDP growth contributed by or through water and
- Eliminating or reducing the inequality gap measured in terms of the HDI, focusing on livelihoods locally through to national and reflective of addressing past imbalances in a measurable manner.
- Poverty alleviation, addressing inequality and unemployment

Table 7. Framework for Water Security Assessment for South Africa

IDEA/AREA/KEY DIMENSION		ISSUE	RESOLUTION/AT WHAT POINT (WHEN) TO BE ADDRESSED	WHAT IS THE CHANGE WE NEED TO SEE – WHAT RESULTS IN TERMS OF IMPACT LEVEL	HOW DO WE MEASURE THAT, I.E. WHAT IS/ARE THE INDICATOR(S)	RESPONSIBLE AGENCY
1.	National Water Security	Extent to which the country has progressed towards national water security. A snapshot at any given time needs to be developed. Peace and stability at national and regional level	Continuous assessment and development of the water security situation (every 5 years with selected regular reporting at every level from national through to local community – ref. Figure 48)	Improved water security in SA – to address the current status of freshwater stress; Resilience in respect of water security; Alternative water sources optimally utilised	State of water security (national, provincial, local); See example of items measured Lautze et al	DPME, DWS, Stats SA, DoD, COGTA, NDMC
2.	Water Endowments (Water Resources?)					
2.1	Natural resource and infrastructure stock/system)	Scarcity, availability of resources, shortage frequency; Biogeophysical limitations/parameters (resource variability and stress); Virtual water etc	Opportunities and risk assessment; "water stock"; Assess choices favouring water security (e.g. hydropower in terms of INGA and not water transfer)	Optimally operated water resource infrastructure; Sufficient water available or secured – storage and conveyance systems in relation to ensuring water security; Level of ability to implement or implementation in and of itself – planning and asset management included.	State of water endowment ("water stock")	DWS, DAEFF, DoD, Stats SA, NDMC, COGTA, DME

IDEA/AREA/KEY DIMENSION		ISSUE	RESOLUTION/AT WHAT POINT (WHEN) TO BE ADDRESSED	WHAT IS THE CHANGE WE NEED TO SEE – WHAT RESULTS IN TERMS OF IMPACT LEVEL	HOW DO WE MEASURE THAT, I.E. WHAT IS/ARE THE INDICATOR(S)	RESPONSIBLE AGENCY
2.2	Natural and Ecological Infrastructure/ Environmental flows (Environmental Water Security) Ecological Infrastructure including Strategic Water Source Areas (SWSAs)	Ecosystems degradation and pollution; ecological goods and services (Link to endowment) Role of Ecological Infrastructure not recognised and the value of ecological infrastructure not quantified, Investment in restoration not taking place effectively	Opportunities and risk assessment; valuing ecosystems goods and services and impact on balance sheet Opportunities and risk assessment, Opportunity to use natural capital accounting (NCA) to highlight the value of ecosystem goods and services	Reduced degradation level; Restoration & rehabilitation; Natural resources sustainability – link to ensuring integrated catchment management. Healthy ecological Infrastructure Restoration and rehabilitation; Natural resources sustainability – link to ensuring integrated catchment management	Cost-benefit analysis Price value of ecological goods and services (In relation to restoration and rehabilitation); To what extent does this impact on the balance sheet? Natural capital accounting (NCA) for water and ecological infrastructure assets and the services that they provide	DWS, DEAFF, DPME, DED, Stats SA, SANBI, CMAs
3.	Water-related Extremes and triggers for change (Floods, droughts, pollution, climate change etc)	Flood, drought, climate change; triggers for change; Resilience to water-related extremes.	Risk assessment on flood, drought and impact of climate change; analysis of triggers & water security pathways	High level resilience; "drought proofing"; "water banking"; protection of infrastructure; Link to desertification etc. disaster management issues	Impact studies and assessment of pathways to water security (Space & time)	DPLG, DEA, DAFF, DWS, LG, SAWS, ARC, NDMC, COGTA
4.	Water utilisation and socio-					

IDEA/AREA/KEY DIMENSION		ISSUE	RESOLUTION/AT WHAT POINT (WHEN) TO BE ADDRESSED	WHAT IS THE CHANGE WE NEED TO SEE – WHAT RESULTS IN TERMS OF IMPACT LEVEL	HOW DO WE MEASURE THAT, I.E. WHAT IS/ARE THE INDICATOR(S)	RESPONSIBLE AGENCY
	economic development					
4.1	Human-water system (Water utilisation)	Water Supply and Sanitation Livelihood and wellbeing; urban water systems; regime shifts as a result of anthropogenic influences and implications for water security; Water use	Water vulnerability atlas; water accounting etc.		Water use per unit economic activity; Water use efficiency change over time Human well-being (HDI), Composite indicators for this.	DRDLR, DWS, DoH, DHS, STATS SA, DSD
4.2	Water finance and investment)	Infrastructure development, O&M, financing; water pricing Challenges of cross-subsidization (Financial sustainability of sector, raising funds for infrastructure) Need to have self-sufficient institutions to leverage its own asset base	Investment modelling; risk assessment; long-term planning; Tracking financial flows	Financial Sustainability	Return on investment both from fiscus and funding from elsewhere What the line Dept. is to achieve line by line.	NT, DWS, DBSA Stats SA, COGTA
5.	Water intelligence (data, information & research)	Research, monitoring and information Data curator-ship/banking	Water accounting, innovation, water data and information National information systems; Valuing water	Verification of 98% allocation; Both services and water resources;	Investment levels; Cost-effectiveness of data Information & knowledge	DWS, WRC, DST, CSIR, ARC, SANBI, SAEON, SAWS, CMAs

IDEA/AREA/KEY DIMENSION		ISSUE	RESOLUTION/AT WHAT POINT (WHEN) TO BE ADDRESSED	WHAT IS THE CHANGE WE NEED TO SEE – WHAT RESULTS IN TERMS OF IMPACT LEVEL	HOW DO WE MEASURE THAT, I.E. WHAT IS/ARE THE INDICATOR(S)	RESPONSIBLE AGENCY
				Sectoral water use vs. allocation vs actual needs.	flows (sharing, access, etc) Availability of data and information (including adequacy); Data quality innovation	
6.	Water governance (administrative and institutional system)	Enabling water planning and management for security; institutional and sectoral capacity; Effective policies & legislation; Enforcement of regulations	Institutional model; Establishment of institutional arrangements; policy and legislation development, implementation and review; Building capacity across the water value chain	See example from OECD 12 principles – efficiency, effectiveness etc.	Degree of policy implementation; Effectiveness and efficiency of institutions; Institutional capacity development across the value chain	DWS, DPME, COGTA, DEAFF

6.2. DATA AND INFORMATION SOURCES FOR ACHIEVING WATER SECURITY

National water monitoring, research and information must provide the primary data and information as well as first line assessments that will form input to secondary and tertiary requirements from regulatory regime (compliance monitoring and enforcement), accounting for water (see Stats SA programme) through to operational and national planning needs.

6.3. PROCESSES AND SPECIFIC INTERVENTIONS

The Water Security Framework needs to be produced regularly as a living document to be revised as new information and knowledge is obtained and NDP is implemented;

The Master plan or implementation plan should aim specifically at addressing the questions in the NWSF – Not to be confused with “normal” run of the mill strategies like NWRS and other mandated strategies.

6.4. APPROACH TO ASSESSMENT

6.4.1. Water Security as a complex challenge

In dealing with the challenge of water we must accept the need for a paradigm change where we appreciate that the scarcity or supply and demand are no longer the main drivers of water security, but rather a complex set of elements such as human and community security in terms of vulnerability, national security, water resources security, food security, energy security and climate security and so on.

The approach to assessing the challenges of water, therefore requires of us to regard water security from a complex system perspective and use robust tools such as strategic foresight or scenario planning as well as complex adaptive systems that allow us to measure and predict future development paths and challenges away from silo thinking towards a long term and collective systems or nexus approach that is integrative in nature.

6.4.2. OECD risk based approach

In general risk concepts have normative appeal and provide an explicit means of addressing the variability that is intrinsic to hydrological, ecological and socio-economic systems. Risk analysis provides essential evidence to enable choices between alternative courses of action[148].

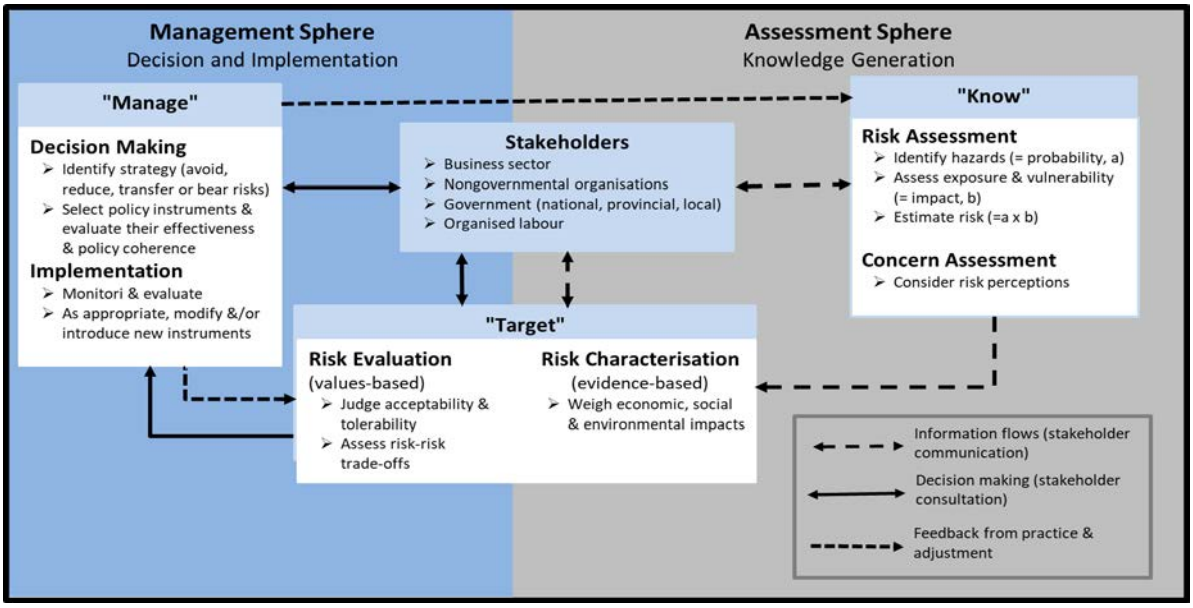

Figure 53. The OECD's "know" target and "manage" water risk management approach.

OECD's approach to risk management is based on the "know", "target" and "manage" water risks summarised in **Error! Reference source not found.**. Of importance to note is that the a pproach is meant to manage the trade-offs beyond the technical or hydrology-based risks

[148] Hall J, Borgomeo E. 2013. Risk-based principles for defining and managing water security. Phil Trans R Soc A 371: 20120407.

(hence value and evidence-based considerations). Water risks can be catastrophic whether quick like flash flood or an insidious drought whose impact can be cumulative over time.

6.4.3. Gap Analysis for continuous improvement

There is a large number of methodologies, tools and indicators for assessment and measurents used in the water sector in general. However one of the key principles is that of ensuring alignment between the national goals of the NDP to the global measurements, particulalry as this will ensure the required transparency and allows for international best practice. These tools need to be robust enough to address the national assessment of impact of various programmes.

In addition to the risk based approach mentioned earlier in this document, the OECD has developed 12 "*must haves*" water governance principles for governments to get economic, social and environmental benefits which apply to all levels of government regardless of water management functions, water uses and ownership models. These approaches can be modified and adapted for use at all scales from National, line Department/sector leader through to local level. They must be carefully tested against commitments made in addition to the key tests of improved livelihood measured in terms of GDP per capita and narrowing the inequality gap.

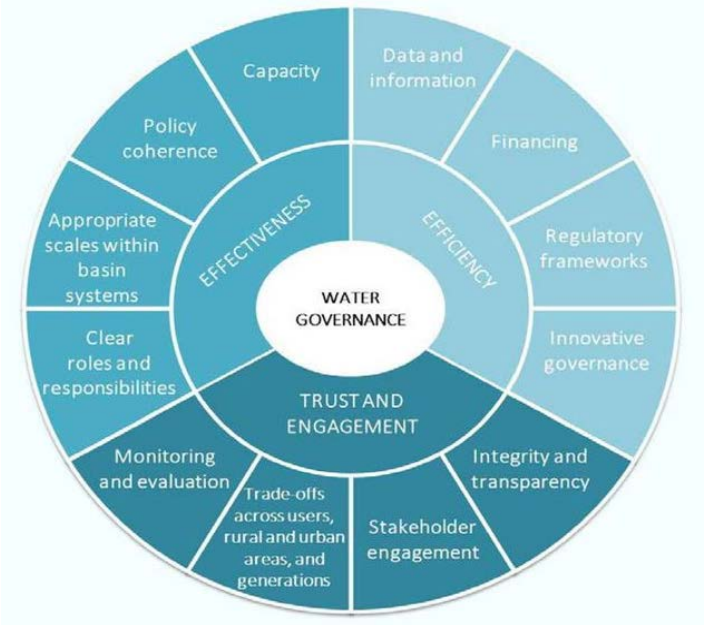

Figure 54. Water governance to be applied at all institutional levels

The approach to gap analysis and bridging the gaps involves taking the above 12 principles and iteratively test them using the OECD methodology below with NPC constantly monitoring the outcome and impact in line with the NDP aspirations and goals.

Figure 55. Iterative gap identification and interventions

It is anticipated that the assessment will need to be systematically done across the sector from national through to local. As indicated in the section under challenges, the assessment tool is important in that it will address the serious concern of governance and leadership issues.

7.
CONCLUDING REMARKS, RECOMMENDATIONS AND NEXT STEPS

The best way to predict the future is to create it.

Peter Drucker

While many of the concepts embedded in water security are consistent with past water planning in the country, explicit formulation and use of Water Security Framework for South Africa reflects a departure from past approaches. This is informed by the developments over the years regarding focus on water security. The Water Security Framework is meant to capture in various ways our capacity to ensure availability and access to water by responding to various risks, vulnerabilities, insecurities, inequities and policy challenges that societies and ecosystems face in the short medium and long-term in line with the NDP vision.

A key consideration and a paradigm shift in respect of water security is the repositioning of water from narrowly restricting it to scarcity and abundance to a relational context within a hydro-social cycle. Such focus allows for a broader approach to water security that is inclusive and shifts towards sustainable and just hydro-social process beyond simple accessible and affordability to ensuring individual and collective or societal needs that effectively address the three apex issues of concern, namely poverty, inequality and unemployment (inclusive economic growth). It has been clear that through the consultation process there is consensus and commitment across the board to ensure inclusive participation and communities recognise the need for full participation and not just recipients.

The framework is the first of its kind in South Africa and meant to bring a fresh, internationally-legitimized, and inclusive approach to assessing and addressing South Africa's challenges and opportunities for managing its water resources and provision of services to harness benefits and mitigate risks. It also provides an encompassing perspective that provides several value-adds/comparative advantages over approaches utilized previously. These include among others the following:

- Serving as a guide to all other strands linked to water across the system in terms of long-term planning and support;
- Strengthening implementation and ensure that it is driven at a level that allows for holistic oversight and fostering cross-departmental integration;
- Ensuring national accountability linked to authority across the system, especially in areas where the value chain is driven from outside the line sectoral mandates;

- Providing greater recognition and emphasis on practical terms to dealing with the risk of the line Department getting caught up in relationship management and not carrying out its mandate;

Eight key principles have been identified as key success factors for the implementation of the NWSF, namely:

i. Source to sea across the water value chain
ii. Long-term view based on scenario planning and associated risks
iii. Policy and Legislation as starting point
iv. NEXUS approach to planning, implementation and management
v. Decision support from credible information and research results
vi. Mass balance approach to assessment and implementation
vii. Accountability with clear roles and responsibility
viii. Total value chain ownership concept in context of the trusteeship doctrine

In order to address the various dimensions presented, thematic areas where identified for framing and to guide the implementation, namely,

1. Narrowing the inequality gap – water as an enabler
2. Ensuring financial sustainability
3. Diversifying water sources
4. Water research, monitoring and information
5. Focus on key nexus aspects of water security
6. Ecological infrastructure
7. Water and spatial planning
8. Enabling the water security planning, implementation and management
9. Managing water risks: promoting preparedness, building resilience and effectively respond and recover from water shocks
10. Communication and stakeholder engagement

An assessment framework has been proposed with six indicators aimed at addressing the full spectrum of water security consideration that are in line with the identified key apex priorities, particularly in relation to growing and transforming the economy. Water is seen as cross-cutting in all aspects of human life and the NWSF is set to address this.

In ensuring the implementation of the framework, some general issues to be considered are restated, namely:

a) That the framework is meant to be based on the full water value chain and informed by empirical evidence;

b) It needs to be futuristic in nature and not reactive to short term needs only. It must answer the questions beyond 2030 yet ensure that what happens now is aligned to the long-term;

c) The framework must be clear and instructive … addressing the Source-to-Sea concept and contributed to by all institutions and social partners across the value chain.

d) It should not be confused with the line Department plans which largely only cover the area where the line Minister has direct control over the various role players. It must be sufficiently authoritative to get all and sundry obligated to follow in line with identified priorities as articulated and recommended by the NPC. The department's master plan must be confined to putting into effect the country's water security requirements and specifically respond to the questions as articulated in the Water Security Framework with a clear and deliberate view to address the three apex issues of poverty, inequality and unemployment.

e) In recognising the delays in implementing the policy and legislative model for water sector management reflected in incomplete implementation processes as well as lack of strategic and technical skills, a team at the highest level and independent of line department needs to be urgently put together to monitor the progress made to date and to lead a process of further refinement of the Water Security Framework especially given that an inordinate amount of time has been lost over the past few years. The team must be multidisciplinary in nature and able to strategically analyse and assess the implementation regime with the aim of unlocking all bottlenecks that may not be easily dealt with from line Department perspective and level within its jurisdictional mandate. This may include connecting the interdependency dots across the system and value chain such as energy-water-food nexus both horizontally and vertically. The team will lead the process of further development of the framework benchmarking with approaches done elsewhere like in Asia and OECD countries.

f) Decisions that have been delayed for technical or administrative reasons such as creation of a National Water Infrastructure Agency must be re-visited with the aim of clearing intended and non-intended consequences of such delays and focus on implementation as a matter of urgency.

g) A key recommendation that runs through inputs obtained through consultation process is that of accountability across the board from individual, institutional, through to national and collective.

Specific recommendations that form part of the next steps include aligning local government legislation and the national legislation, including Water Services Act timing and positioning in respect of legislative regime post establishment. Section 139 of the Constitution[149] provides

[149] https://www.gov.za/documents/constitution-republic-south-africa-1996-chapter-6-provinces#139. Provincial intervention in local government.

for intervention and needs to be looked at in terms of effective implementation taking into account that the challenges are beyond financial issues.

Roles and responsibilities need to be immediately unpacked taking into consideration respective roles and responsibilities reflected by the AG and NT and how these are listened to by the political space.

Given the lessons over the past 20 years since the National Water Policy and subsequent individual work done by the Department and researchers from across the country as well as internationally, further detailed assessments need to be done within a period of 12 to 24 months. The key for this would be to consolidate what has been learnt and ensure that the amendments address the shortcomings.

It is evident that one of the key risks in the sector is the enabling environment for water security. It is therefore important to immediately implement the institutional framework by establishing the institution for water management without delay. A series of steps are thus recommended which include:

- Assessing and taking stock of current difficulty in implementing policies and programmes;
- Building a national framework that will guide the national processes and provide a long-term view of ensuring water security;
- Positioning of the effective implementation by creating a centre of water intelligence beyond the narrow water business as usual, taking into account the importance of water in all aspects of human life, especially for the South African condition. This will further involve development and refinement of national indicators on water security and redirecting the various institutions mandated to carry out the water business, including stakeholders, public and private sectors as well as citizens;
- Creating a planning and monitoring framework that is robust to ensure that water related risks are avoided or mitigated; and
- Consultation process both during the development of framework and execution taking all role players and stakeholders along through a participatory process without losing focus.

GLOSSARY OF TERMS

TERM	DEFINITION[150]
Ecological infrastructure	Naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction.
Environmental flows	Refers to the water provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated.
Integrated Water Management	Defined by the GWP as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." It is based on the three principles: social equity, economic efficiency and environmental sustainability. Considering these principles means answering the following questions: • How will my decision/action affect access for other users to water or the benefits from its use? • Will my decision/action result in the most efficient use of the available financial & water resources? • How will my decision/action affect the functioning of natural systems?
Integrated water resources management (IWRM)	The coordinated development and management of water, land and related resources, to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
Mass balance approach	The law of conservation of matter states that matter (e.g. water) is conserved – that is, neither created nor destroyed. A mass balance is an accounting of a material for a specific system boundary. In other words, you are keeping track of all sources of the material that enter the system, all sinks of the material that leave the system, and all storage of the material within the system. This method is called the mass balance technique.
Nature-based Solutions (NbS)	IUCN defines this as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*"
Stakeholder	An individual, group, or organisation that is, or could be, affected by a process or output, or that can affect that process or output. Stakeholders may share a common interest but possibly for different reasons (such as farmers, agricultural scientists, public servants, water resource managers or policy makers)
Strategic Water Source Areas	These are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. In South African context these areas that comprise 10% of South Africa's land area that delivers 50% of the country's water.
Sustainable Development Goals (SDGs)	The blueprint to achieve a better and more sustainable future for all. The SDGs address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and

[150] Sources: National Water Act of SA, Global Water Partnership (GWP), UN Water, Water Research Commission (WRC), Water Governance Facility (WGF), Food and Agriculture Organization (FAO), https://www.iwapublishing.com/news/integrated-water-resources-management-basic-. IUCN

TERM	DEFINITION[150]
	peace and justice. The Goals interconnect and in order to leave no one behind, it is important that we achieve each Goal by 2030.
The reserve	This is defined in the NWA 36 of 1998 as the quantity and quality of water required to satisfy basic human needs by securing a basic water supply, and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource. The Minister responsible for water affairs is required in terms of section 16 of the NWA to determine the reserve for water resources in South Africa. Section 18 of the NWA provides that the Minister, the Director-General of the Department of Water and Sanitation, an organ of state and a water management institution must give effect to the reserve when exercising any power or performing any duty in terms of the NWA. The reserve for a water resource must therefore be taken into account when, for example, decisions are made on water use licence applications and when setting conditions for stream flow reduction activities in terms of the NWA.
Usufruct	This is a legal institution in which someone, who is not the owner, is given the right to use and enjoy the benefits and advantages of something belonging to another as long as the property is not damaged or altered in any way, for a certain period of time. It is by definition a limited right.
Virtual water	The volume of water required to produce a commodity or service. Virtual water will generally flow from water-rich to water-poor regions. Also known as embedded or embodied water, it refers to the hidden flow of water if food or other commodities are traded from one place to another.
Water allocation	Water allocation plans and agreements are designed to resolve international, regional and local conflicts over access to water.
Water endowments	The amount of accessible, reliable and sustainable water supplies to which a country and its citizens have access. The range from a water-scarce country to a water-abundant country (or region) is determined by the per capita water endowment or water availability statistic. Water endowments can be naturally occurring or managed.
Water governance	The political, social, economic and administrative systems that influence water's use and management. It determines the equity and efficiency in water resource and services allocation and distribution, and balances water use between socio-economic activities and ecosystems.
Water information	Datasets, indicators or systems with information relevant to the water sector. Data exchanges can be restricted to a closed group of stakeholders or the system may be open. Stakeholders may or may not contribute data and they can agree to exploit information with common objectives especially in the case of a national water information system.
Water security	Reducing water-related risks to a level at which water's benefits can be securely and sustainably realised.
Water-energy-food nexus (W-E-F)	The intersection of the water security, energy security and food security sectors, which are inextricably linked. Actions in one area more often than not has impacts in one or both of the others. The WEF nexus is increasingly recognised as a conceptual framework able to support the efficient implementation of the SDGs.

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The National Water Security Framework (NWSF) for South Africa is a culmination of extensive work over an extended period and is a result of analysis and synthesis from the work of the National Planning Commission (NPC), who's main task was to review and ensure the implementation of the National Development Plan (NDP) as intended.

This publication would not have been possible without the dedicated support and contribution from the experts during consultation process over an extended period of time and during the development of the framework in general. Contributors to the work are too many to mention as often what seems small may sound unimportant but in a way could become a tipping point. We are all indebted. Key contributors to the work of the Water Task Team are listed below.

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ANNEXURES

ANNEXURE A - Fundamental Principles and Objectives for a New Water Law in South Africa

The fundamental principles and objectives for the South African Law approved by Cabinet in November 1996 remain a good point of departure. These are grouped according to:

Principles	Explanation
• **Legal aspects of the water (Principles 1-4)**	Reflecting on commonality of ownership, right only to environment, basic service and authorisation to use. Most importantly ensuring that the law is consistent with the Bill of Rights.
• **The water cycle (Principles 4-6)**	Reflecting on and recognising the unity of the water cycle and the interdependence of its elements as well as the variability, unpredictability and uneven distribution of water.
• **Water resource management priorities (Principles 7-11)**	Key priority principles of "the Reserve" (environmental and basic human needs) as a right are introduced and focus is placed on the sustainable use and economic development. Further the international obligation is seen as one of the key aspect of mutual cooperation. A key observation to date is that it appears the planning regime plan around these as a norm rather than a minimum, hence the challenge of "stunted" growth.
• **Water resource management approaches (Principle 12-21)**	The principle of National Government as the custodian of all water resources is introduced and the need to manage all water holistically in broader context of integrated land management emphasised. It is further reflected that regulatory regime will include economic and other punitive mechanisms to avoid deterioration of water. Authorisation is to be timely and predictable and recognise infrastructure investment.
• **Water institutions (Principles 22-24)**	Institutional framework was seen as simple, pragmatic and understandable. It was envisaged that most of the activities will be delegated to the water management institutions such as Catchment Management Agencies or regional entities in a manner that allows participation locally hence subsidiarity principle
• **Water services (Principles 25-28)**	Basic water services, defined as the provision of potable water supply and the removal and disposal of human excreta and waste water are a right. Provision of water services is seen as functionally distinct from water resource management but is expected to be provided in a manner consistent with the goals of water resource management. Regulation of water services is to be consistent with and supportive of the aims and approaches of the broader local government framework

Principle 1 The water law shall be subject to and consistent with the Constitution in all matters including the determination of the public interest and the rights and obligations of all parties, public and private,

with regards to water. While taking cognisance of existing uses, the water law will actively promote the values enshrined in the Bill of Rights.

Principle 2 All water, wherever it occurs in the water cycle, is a resource common to all, the use of which shall be subject to national control. All water shall have a consistent status in law, irrespective of where it occurs.

Principle 3 There shall be no ownership of water but only a right (for environmental and basic human needs) or an authorisation for its use. Any authorisation to use water in terms of the water law shall not be in perpetuity.

Principle 4 The location of the water resource in relation to land shall not in itself confer preferential rights to usage. The riparian principle shall not apply.

The water cycle

Principle 5 In a relatively arid country such as South Africa, it is necessary to recognise the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to underground water, rivers, lakes, wetlands and the sea, and where the basic hydrological unit is the catchment.

Principle 6 The variable, uneven and unpredictable distribution of water in the water cycle should be acknowledged.

Water resource management priorities

Principle 7 The objective of managing the quantity, quality and reliability of the nation's water resources is to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use.

Principle 8 The water required to ensure that all people have access to sufficient water shall be reserved.

Principle 9 The quantity, quality and reliability of water required to maintain the ecological functions on which humans depend shall be reserved so that the human use of water does not individually or cumulatively compromise the long-term sustainability of aquatic and associated ecosystems.

Principle 10 The water required to meet the basic human needs referred to in Principle 8 and the needs of the environment shall be identified as "the Reserve" and shall enjoy priority of use by right. The use of water for all other purposes shall be subject to authorisation.

Principle 11. International water resources, specifically shared river systems, shall be managed in a manner that optimises the benefits for all parties in a spirit of mutual cooperation. Allocations agreed for downstream countries shall be respected.

Water resource management approaches

Principle 12 The national government is the custodian of the nation's water resources, as an indivisible national asset. Guided by its duty to promote the public trust, the national government has ultimate responsibility for, and authority over, water resource management, the equitable allocation and usage of water and the transfer of water between catchments and international water matters.

Principle 13. As custodian of the nation's water resources, the national government shall ensure that the development, apportionment, management and use of those resources is carried out using the criteria of public interest, sustainability, equity and efficiency of use in a manner which reflects its public trust obligations and the value of water to society while ensuring that basic domestic needs, the requirements of the environment and international obligations are met.

Principle 14 Water resources shall be developed, apportioned and managed in such a manner as to enable all user sectors to gain equitable access to the desired quantity, quality and reliability of water. Conservation and other measures to manage demand shall be actively promoted as a preferred option to achieve these objectives.

Principle 15. Water quality and quantity are interdependent and shall be managed in an integrated manner, which is consistent with broader environmental management approaches.

Principle 16 Water quality management options shall include the use of economic incentives and penalties to reduce pollution; and the possibility of irretrievable environmental degradation as a result of pollution shall be prevented.

Principle 17 Water resource development and supply activities shall be managed in a manner which is consistent with the broader national approaches to environmental management.

Principle 18 Since many land uses have a significant impact upon the water cycle, the regulation of land use shall, where appropriate, be used as an instrument to manage water resources within the broader integrated framework of land use management.

Principle 19 Any authorisation to use water shall be given in a timely fashion and in a manner which is clear, secure and predictable in respect of the assurance of availability, extent and duration of use. The purpose for which the water may be used shall not arbitrarily be restricted.

Principle 20 The conditions upon which authorisation is granted to use water shall take into consideration the investment made by the user in developing infrastructure to be able to use the water.

Principle 21 The development and management of water resources shall be carried out in a manner which limits to an acceptable minimum the danger to life and property due to natural or manmade disasters.

Water institutions

Principle 22. The institutional framework for water management shall as far as possible be simple, pragmatic and understandable. It shall be self-driven and minimise the necessity for state intervention. Administrative decisions shall be subject to appeal.

Principle 23 Responsibility for the development, apportionment and management of available water resources shall, where possible and appropriate, be delegated to a catchment or regional level in such a manner as to enable interested parties to participate.

Principle 24 Beneficiaries of the water management system shall contribute to the cost of its establishment and maintenance on an equitable basis.

Water services

Principle 25 The right of all citizens to have access to basic water services (the provision of potable water supply and the removal and disposal of human excreta and waste water) necessary to afford them a healthy environment on an equitable and economically and environmentally sustainable basis shall be supported.

Principle 26 Water services shall be regulated in a manner which is consistent with and supportive of the aims and approaches of the broader local government framework.

Principle 27 While the provision of water services is an activity distinct from the development and management of water resources, water services shall be provided in a manner consistent with the goals of water resource management.

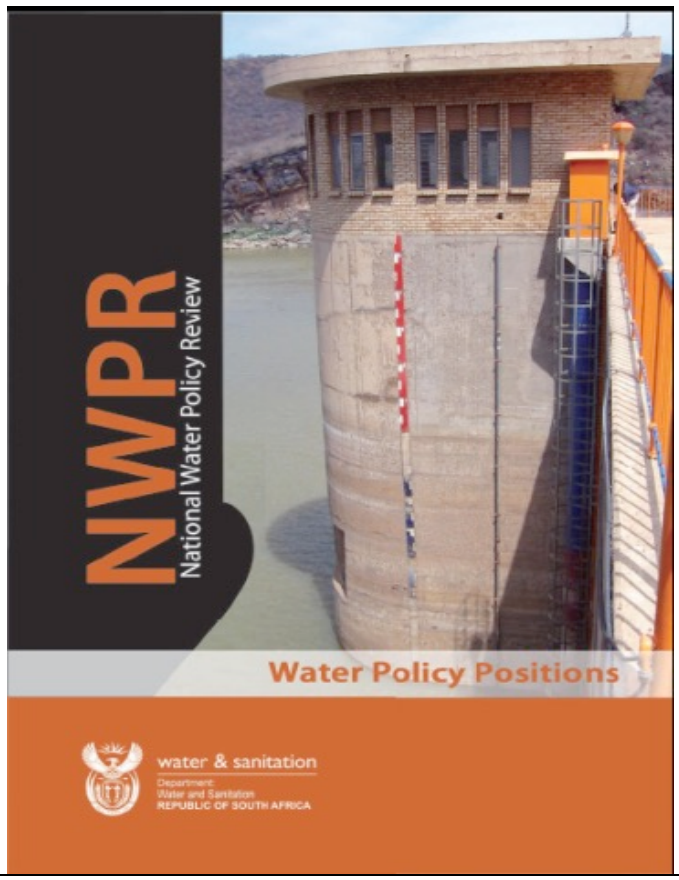
Principle 28 Where water services are provided in a monopoly situation, the interests of the individual consumer and the wider public must be protected and the broad goals of public policy promoted.

ANNEXURE B – Water Policy Positions Emanating from the 2014/15 National Water Policy Review

In 2013, then Minister of Water and Environmental Affairs, HE, Mrs Edna Bomo Molewa initiated a process of National Policy Review which was gazetted on 30 August 2013 for comments and subsequently signed and released in 2014 in its final form by then Minister of Water and Sanitation, HE, Mrs Nomvula Paula Mokonyana. The primary purpose of the review was to assess and address the unintended oversight and gaps in the policy as it existed, and provide the necessary amendments in the form of policy positions. These included:

- Financial and legal implications
- Developmental water management
- Dealing with the whole water value chain – from resource to consumptive and productive use to resource in a seamless fashion
- Establishing a national water strategy

The review provided positions on various aspects of the policy in the area of Water for equitable use and institutional arrangement



Key policy positions included:

- Doing away with water trading, and emphasis on use it or lose it principle;
- Prioritising social and economic equity in the reallocation of water;
- Adopting a multiple water use approach in planning infrastructure;
- Reaffirming the right to access basic water and sanitation service that is affordable;
- Free basic water supply to the indigent households;
- Economic regulation that is integral to social regulation applicable across the full water value chain;
- Establishment and functions of regional water utilities;
- Reaffirming roles and functions of water management institutions such as CMAs and WUAs
- Introducing other dispute resolution mechanisms to supplement mechanisms highlighted in the NWA; and
- Clarification of powers and functions of the water services authorities (WSAs) as well as appointment of board and chief executives of the public water institutions.

ANNEXURE C - Institutional Roles and Responsibilities Matrix[151][152]

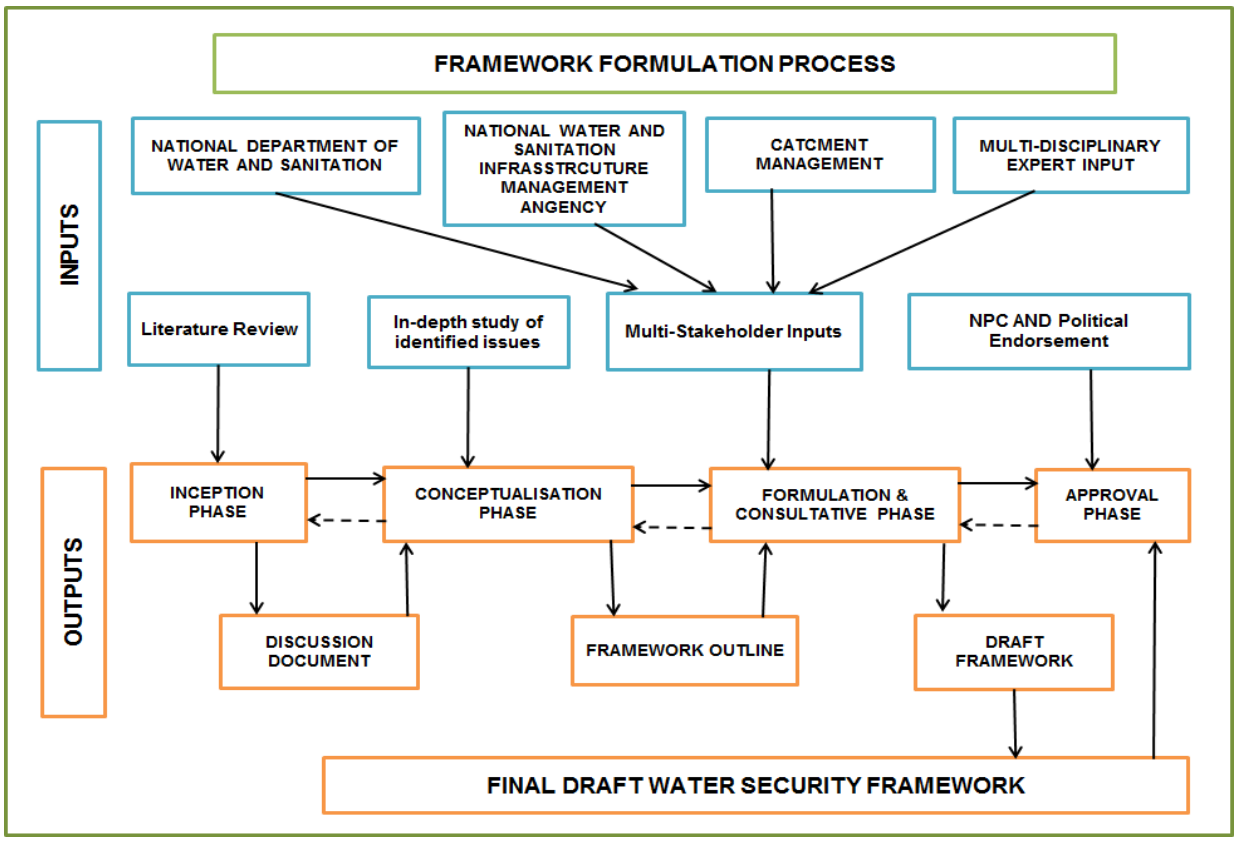
COMPONENT	REQUIREMENTS	TOOLS FOR INTERVENTIONS/MANAGEMENT[153]	INSTITUTION/ORGANISATION/BODY					
			DWS-Policy	DWS-Planning and Information	DWS-Regulatory	DWS-NWRI	Information Monitoring and Research	TCTA
Natural System (Rain, Rivers, Wetlands, Aquifers, Estuaries, Sea)	Secure sustainable use Reserve determination	Policies, legislation, frameworks, strategic/operational plans						
Raw water supply to Dam	Dam construction Inter-basin transfer scheme Infrastructure Trans-disciplinary skills & capability	EIAs Authorisations/licences Consultation/participatory processes		Integrated planning & allocation	Regulatory	Financing (Guarantee) Project conceptualisation oversight Construction		Off-budg funding a project managem
Water abstraction from Dam to user or treatment facility	Authorisation	Water Use Licence Information Systems (e.g. WARMS)				Regulation		
Bulk Water conveyance to Treatment Facility								
Water Treatment facility								
Wastewater management/treatment	Blue drop status	Regulations, strategy Compliance monitoring						
Water use -								
• Raw (Rain, River, Groundwater, Wetland, Estuary, Sea water)	Environmental protection	EIA, Licence, information systems						
• Treated								
• Reuse								
• Wastewater disposal/discharge	Green drop status	Regulations, operational strategy Compliance monitoring Information systems						
• Non-abstractive								
• Instream requirements								
Urban (local) water management								
Reticulation from bulk	Balancing storage Energy for pumping Infrastructure Skills and capability	Regulatory standards						
Urban runoff								
• Storm water								
• Flash floods								
• Rainwater								
Meteorological aspects								
Catchment management								
• Hydrological (quality, quantity, biogeophysical, groundwater/surface water)								
• Aquatic ecosystems and environmental flows								
Research and knowledge capital development	Coordination and funding water research and development	Legislation (Water Research Act)	Policy and national strategy development	Policy and regulatory oversight			Funding through levy	
Monitoring and information	Coordination, systems development, monitoring programmes development	Legislation (CH14 NWA, Ch10 WSA), regulation, monitoring programmes Institutional coordination mechanisms, operational strategies	Policy and national strategy development	Policy and regulatory oversight Funding from fiscus			Long term monitoring & information	

[151] This table is not exhaustive and may need to be cross-checked with sections on institutional arrangements and governance in the main document.

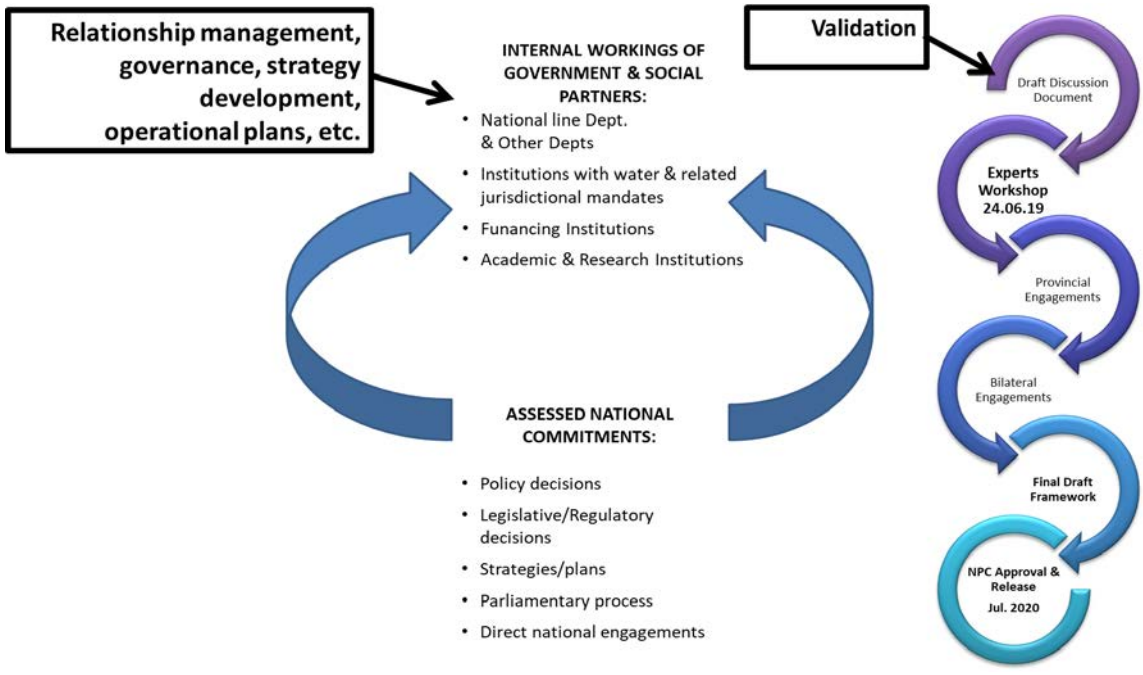
[152] Table to be completed as part of consultation process.

[153] Mainly approved and authorised tools through policy, legislation, regulation and institutional mandates

ANNEXURE D – Process flow for Water Security Framework Development[154]



Intense consultation and NWSF finalisation between June 2019 and July 2020



[154] Expected to be iterative process and producing a living document