PLANNING FOR WATER SECURITY

Role of Consulting Engineers

MP Nepfumbada, Rand Water

CESA Infrastructure Indaba

Southern Sun O.R. Tambo International Airport

05-06.03.2018

INTEGRITY CARING EQUITY EXCELLENCE SPIRIT OF PARTNERSHIP RAND WATER

Introduction And Context

- A lot is said on
  - why goals & aspirations articulated in the NDP haven been difficult to achieve, including
  - water sector perspective and
  - whether the NDP itself is the right tool to address the country's developmental challenges.
- 2015 DPME's National water diagnostic report and subsequent analyses reflect on and point to the challenges & potential solutions for effective implementation of the NDP goals and aspirations

➔BUT in the end the real questions remaining are:

- ❑ How do we pull it all together in a seamless and integrated manner to achieve NDP goals and objectives?
- ❑ What role can various sectors play to contribute to implementation?

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The NDP in Brief – Key Water "touch points" (Nexus Nature)

BY 2030:

- **Eliminate income poverty** – Reduce the proportion of households with a monthly income below R419 per person (in 2009 prices) from 39 to 0%
- **Reduce inequality** – The Gini coefficient should fall from 0.69 to 0.6

SOME ENABLING MILESTONES INCLUDE:

- Ensure that **all South Africans have access to clean running water in their homes – Sustainable Dev. Goal (SDG) Number 6.**.
- Establish a competitive base of **infrastructure, human resources & regulatory frameworks**
- **Increase employment** from 13 million in 2010 to 24 million in 2030.
- Realise a **food** trade surplus, with one-third **produced by small-scale farmers or households**.
- **Ensure household food and nutrition security**.

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The NDP in Brief – … (2)

ENABLING MILESTONES….

- Produce sufficient **energy** to support industry at competitive prices, ensuring access for poor households, while **reducing carbon emissions** per unit of power by about one-third.
- Make **high-speed broadband internet universally available** at competitive prices.
- Broaden social cohesion and unity while **redressing the inequities of the past**.
- Play a leading role in **continental development, economic integration** and human rights.

CRITICAL ACTIONS….

- A strategy to **address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes**.
- **Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.**
- **Public infrastructure investment** at 10% of gross domestic product (GDP), **financed through tariffs, public-private partnerships, taxes and loans and focused on transport, energy and water**.

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The NDP in Brief – …. (3)

- Interventions to ensure **environmental sustainability and resilience** to future shocks.
- A social compact to **reduce poverty and inequality**, and **raise employment and investment**.

KEY MESSAGE:

All of the above reflect the

- **MEGA-NEXUS Nature of Water in the NDP and water security context;**
- **Need for water to be prioritised as central to planning in all its manifestations**

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Water Diagnostics & Analyses – Key Issues (1)

ISSUE/AREA	COMENTS/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

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Water Diagnostics & Analyses – Key Outcomes (2)

ISSUE/AREA	COMENTS/OBSERVATIONS
Infrastructure asset management and functionality	• History of under-investment in asset maintenance and renewal and deficient management systems and record keeping • Concern about the 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

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Water Diagnostics & Analyses – Key Outcomes (3)

ISSUE/AREA	COMENTS/OBSERVATIONS

Infrastructure planning and development	• Whilst there is an elaborate inventory of planned projects to ensure water security, past records there are concerns about
	  o funding sufficiency,
	  o robustness of institutions, and
	  o decisiveness in implementing the envisaged infrastructure
	• Commitments made during conception of infrastructure tend to be irreversible once implemented. Given that resultant assets might have limited functionality outside the original “intent”, the robustness of governance during planning stage is critical.
	• Many municipalities fail to comply adequately with prescripts.
	• Poor planning maturity in most municipalities
	• Lack of coherent planning, amid increasing urbanisation and migration.
	• Factors like political interference, lengthy litigation processes, time constraints, limited skills, and inadequate alignment across the spheres of government, all contribute to deficient planning

Water Diagnostics & Analyses – Key Outcomes (4)

ISSUE/AREA	COMENTS/OBSERVATIONS
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.

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Water Diagnostics & Analyses – Key Outcomes (5)

ISSUE/AREA	COMENTS/OBSERVATIONS
Human and institutional capacity.	• 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

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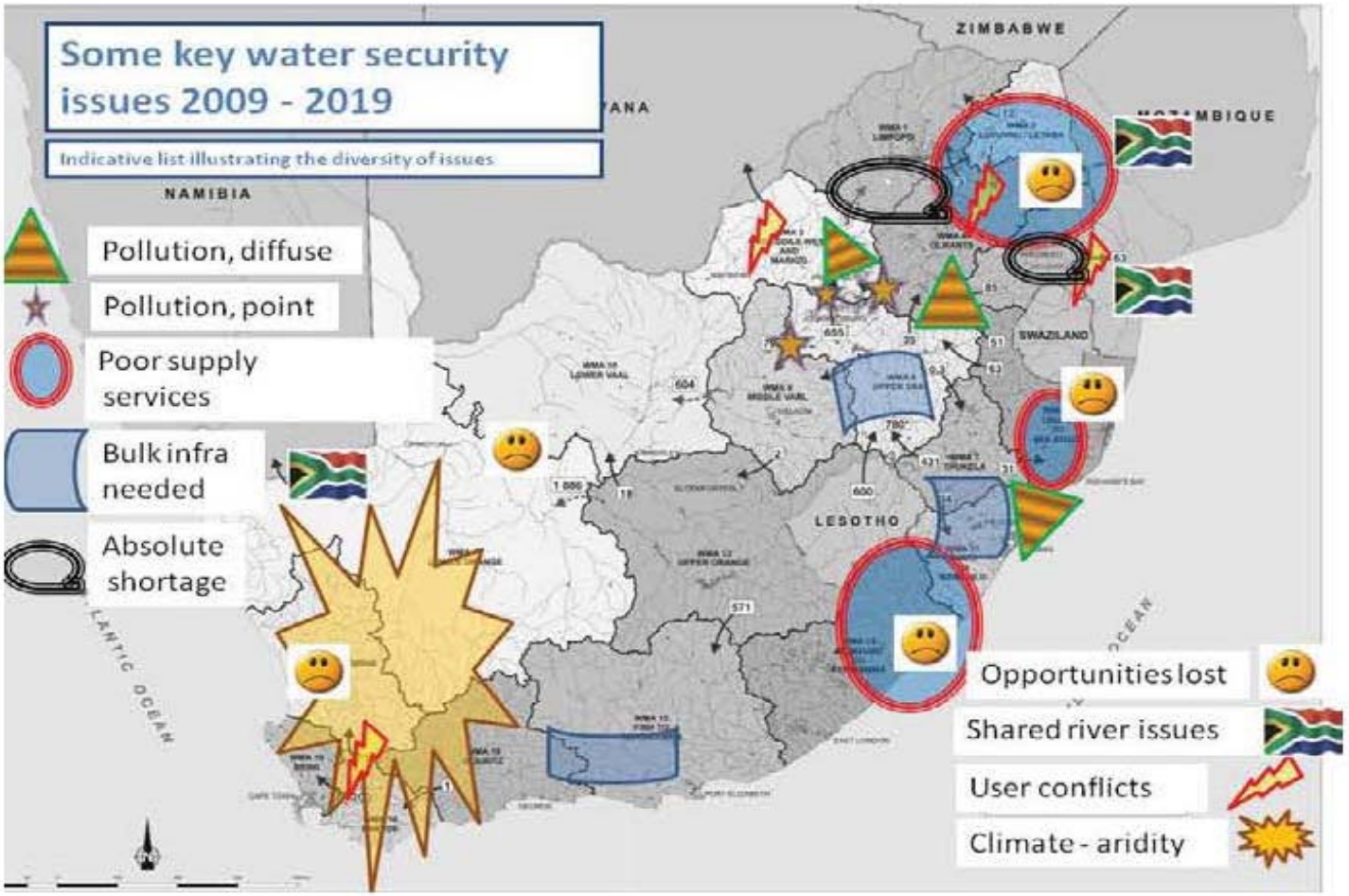
What was said in 2009 Already

- ***Opportunities and expected urgent actions – Source DBSA***



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Recent Headlines & Sound-bites!!

…the world might face a 40% water shortfall by 2030, affecting at least 1.80-billion people

According to current projections, water demand in South Africa will increase by 1% each year from 15-billion cubic metres a year in 2016 to 18-billion cubic metres in 2030, resulting in a 17% supply deficit. Already, 30% of the country's towns and cities have a water deficit and the situation is expected to be exacerbated by the effects of climate change.

Cremer Media, August 2017

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Recent Headlines & So… …ites!!

…the world might fa… …ll by 2030, affecti…

Accor… …in S… …5- b…

…icit.

Al… …cities have a w… …expected to be ex… …of climate change.

Cremer Media, August 2017

Key to note when we put these headlines is that almost every time there is a foot note that says….

- It will be so if such & such is not done or
- in order to get out of that the following need to be done

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SA's challenges: Africa's challenges

- *Safe drinking Water provision*
- *Access to adequate sanitation*
- *Foster cooperation in transboundary basins ("everyone lives downstream somehow")*
- *Develop hydropower to enhance energy*
- *Provide water for food security*
- *Meet growing water demand*
- *Prevent land degradation and water pollution*
- *Manage water under global climate change*
- *Enhance capacity to address water challenges*

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NATIONAL RESPONSE & INTERVENTION – WATER SECURITY FOCUS

Diagnostics

Why are we here?

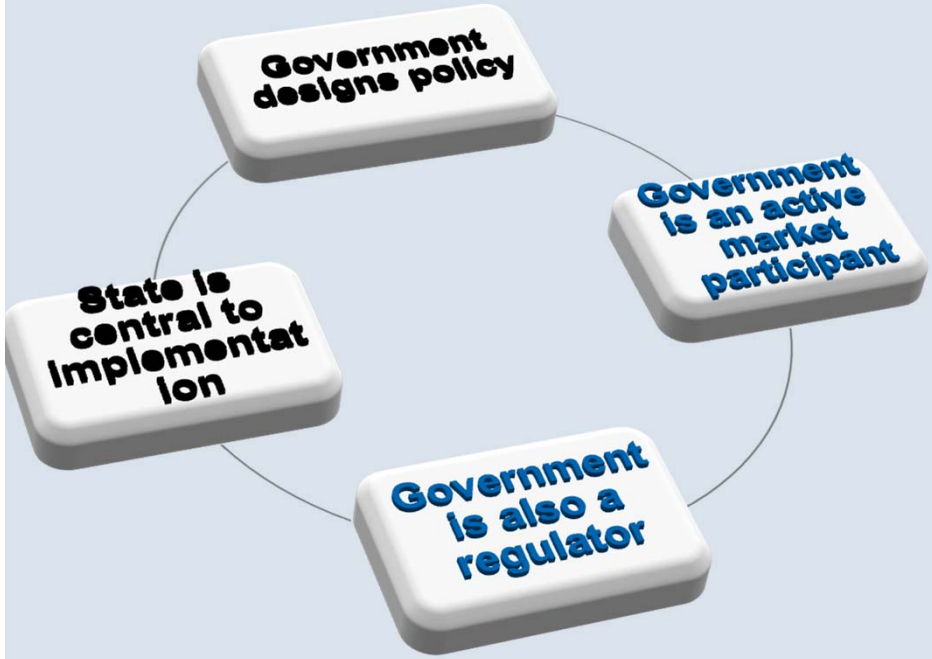
What is Water Security?

Why Water Security?

INTEGRITY CARING EQUITY EXCELLENCE SPIRIT OF PARTNERSHIP RAND WATER

Developmental State Context

Key pillars of the role of the State



Key Features of a Developmental State:

- A competent and neutral bureaucracy that ensures implementation.
- An institutionalised process where the bureaucracy and Government engages with other stakeholders.
- An established development framework and a comprehensive governance system to ensure the programme is implemented.

NDP ☺

For Water, developmental planning has to be a matter of course

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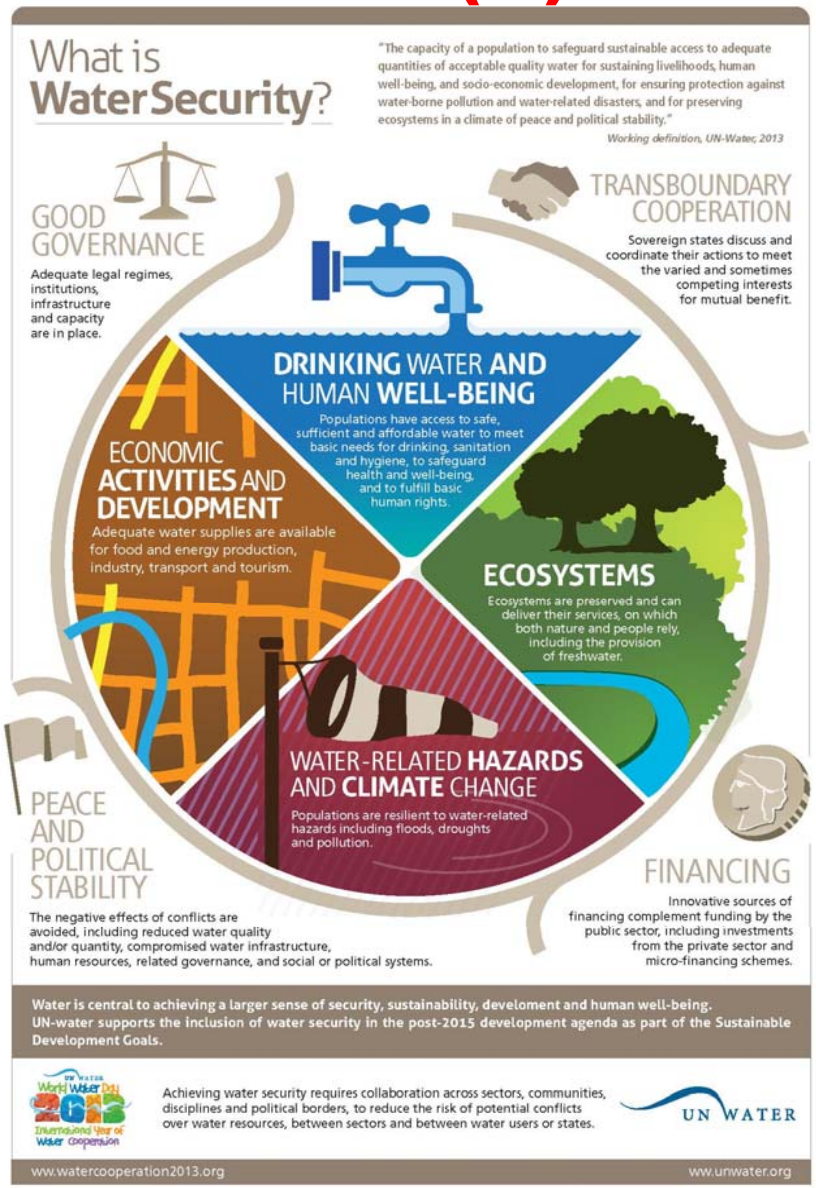
Water Security Context (1)

Definition of water Security

"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"

UN-Water



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Water Security Context (2)

3 Key aspects:

- **The hydrologic environment -**
  biogeophysical environment, mainly natural legacy inherited by society, reflecting the resource base;

- **Socio-economic environment –**
  economic structure and the associated behaviour of its actors which reflect natural and cultural legacies and policy choices.

  - In context of SA, this includes the legacy of inequity resulting from decades of exploitation, discriminatory policies & the resultant inequality, and the need for redress at fundamental level.

- The **future environment –**
  inclusive of sustainability, global change, and climate change and adaptation.

  - At the NPC level, this is critical to ensure that the country is positioned to manage long-term future implications beyond 2030, and not only focus on the immediate that's mainly about crisis management.

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Water Security Context (3)

- Human wellbeing must not negate the critical questions related to sustainability, ecosystem function, or other biogeophysical considerations, which are important to a recasting of water security;
- **Questions must move the debate beyond water supply** – hence full value chain and the hydro-social cycle;
- To this end some among us have strongly advocated a **paradigm shift away from material water *per se* as most of the challenges are not in the so-called *water box***;
- SA's policy & legislative regime has evidently been known to open such a window of opportunity and that for us the challenge has always been implementation whether due to capacity constraints, political will, commitment and so on.

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Why Water Security Framework? (1)

- First of its kind in South Africa
- Long term planning is critical – not crisis management
  (UK's example – 50 years from 2015 to 2065)
- Currently what informs performance plans at national level
- How does the country decide on specific interventions?
- Can we quantify the impact of project delays; and
- Spatial planning implications?

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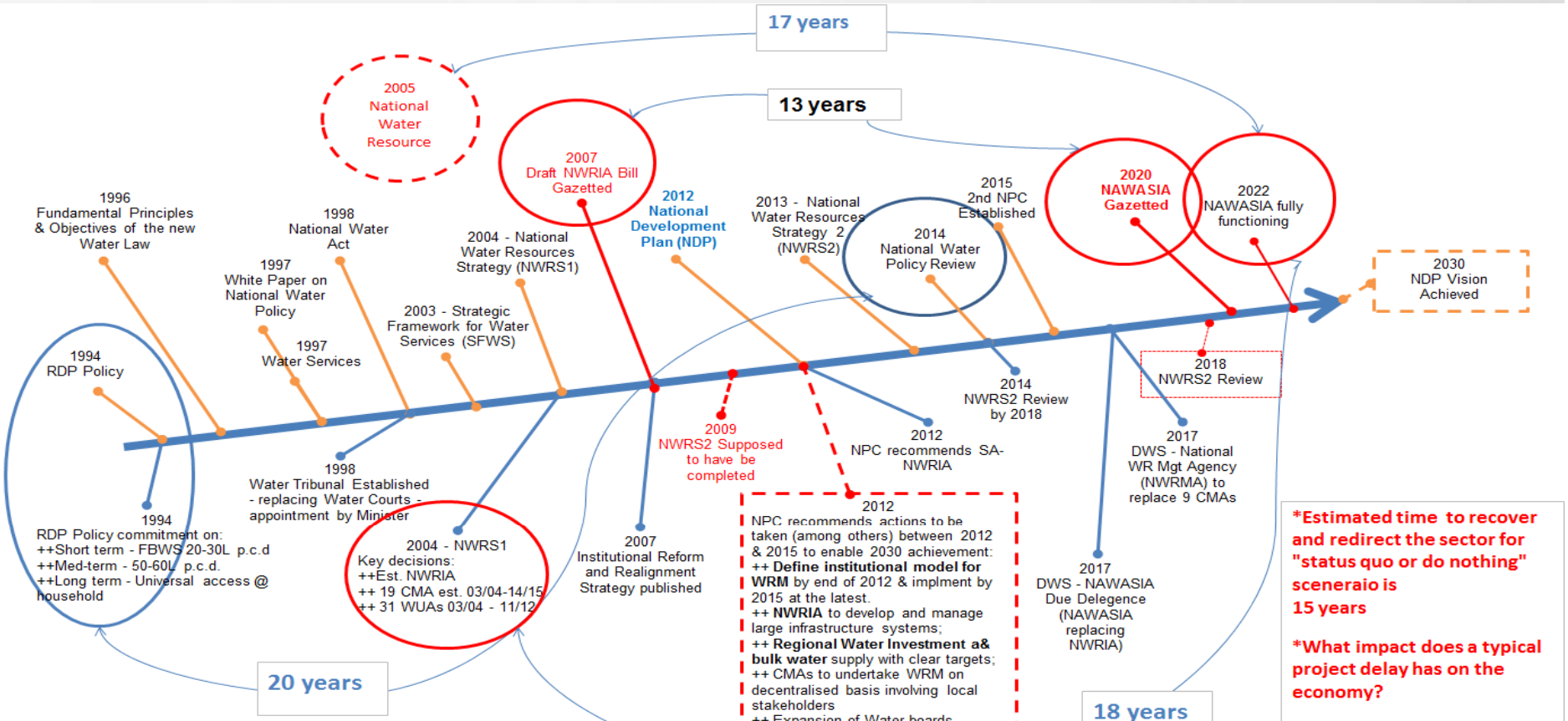
Why Water Security Framework?



KEY:

p.c.d ==> per capita per day

CMA ==> Catchment Mgt Agency

NWRS ==>National Water Resource Strategy

NWRIA ==> National Water Resources Infrastructure Agency

NWASIA ==> National Water and Sanitation Management Agency

FBWS ==> Free basic Water Services

WUA ==> Water User Association

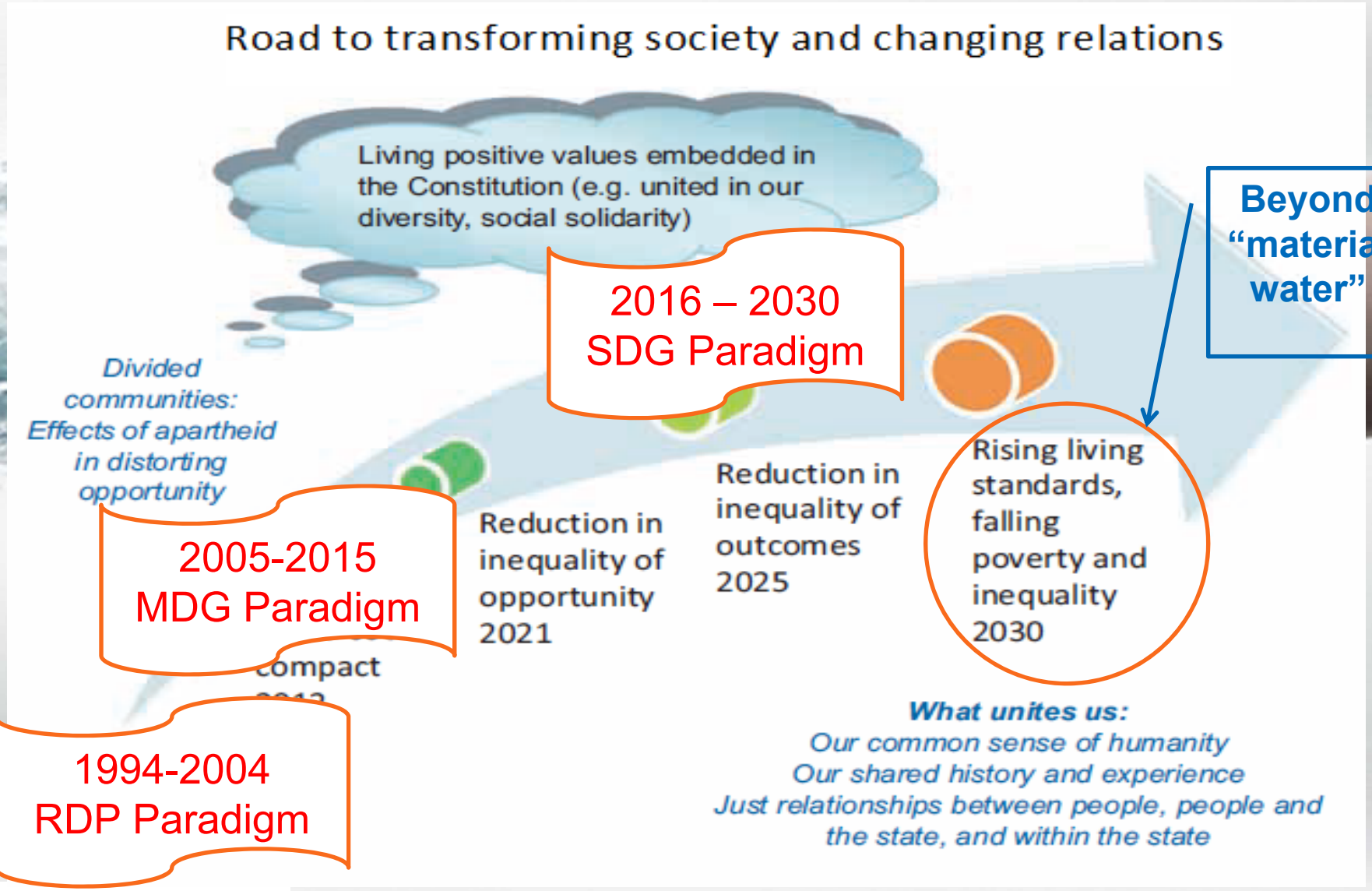
NWRMA ==> National Water Resources Mgt Agency

***Estimated time to recover and redirect the sector for "status quo or do nothing" sceneraio is 15 years**

***What impact does a typical project delay has on the economy?**

***What about the impact of delayed decisions or implementation?**

Vision - NDP



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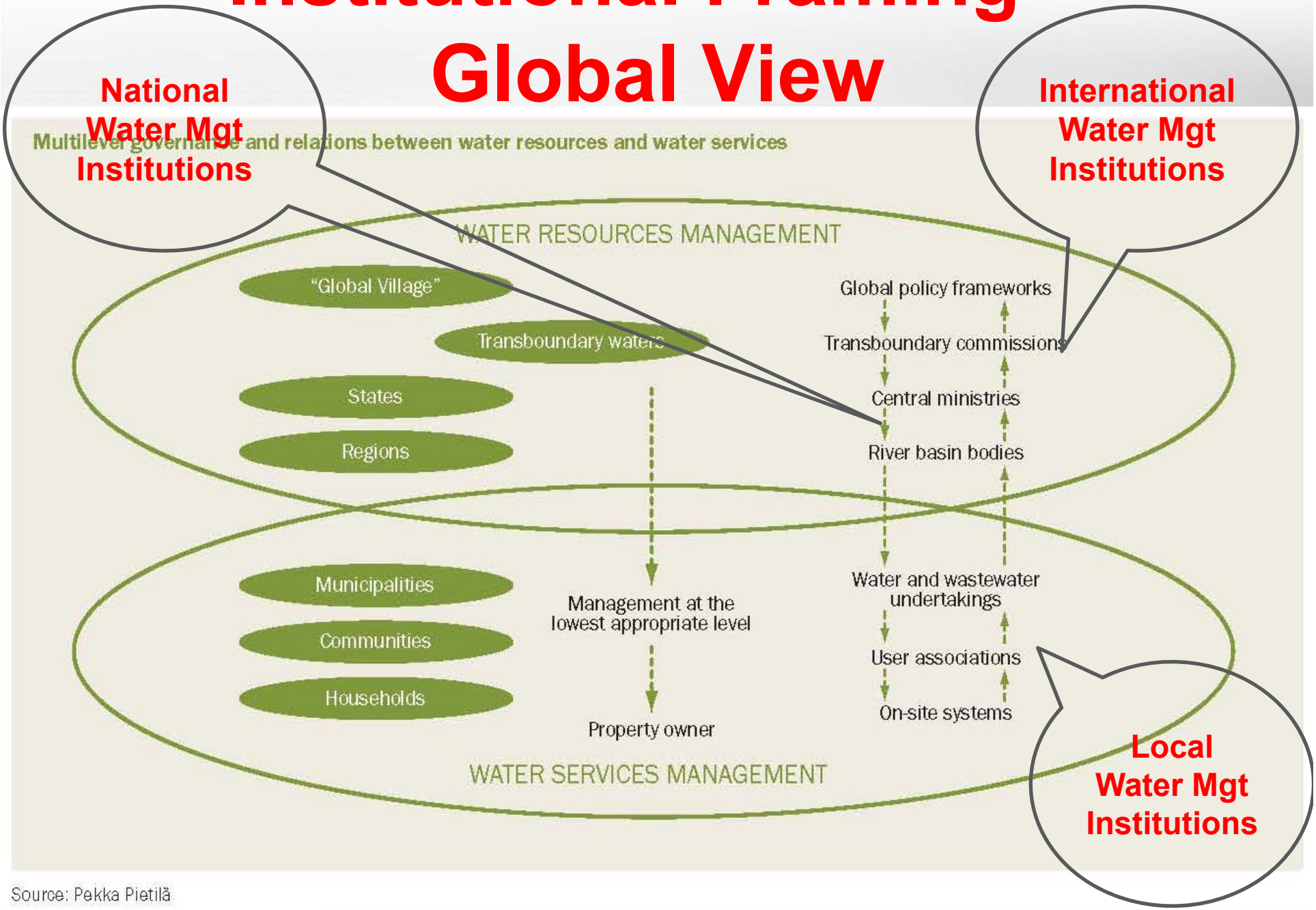
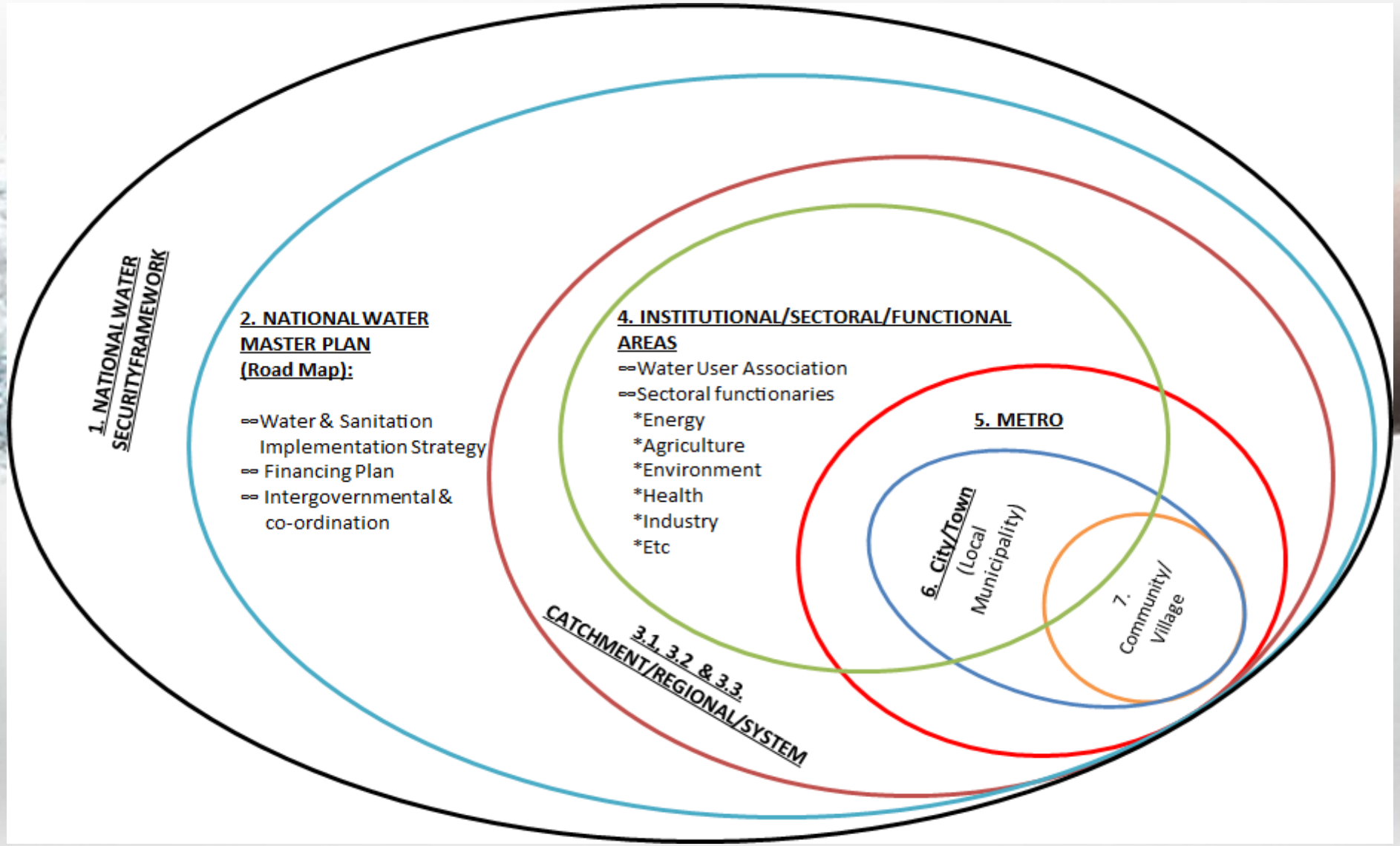
Institutional Framing – Global View



Source: Pekka Pietilä

Planning and Institutional Framing



Planning and Institutional framing

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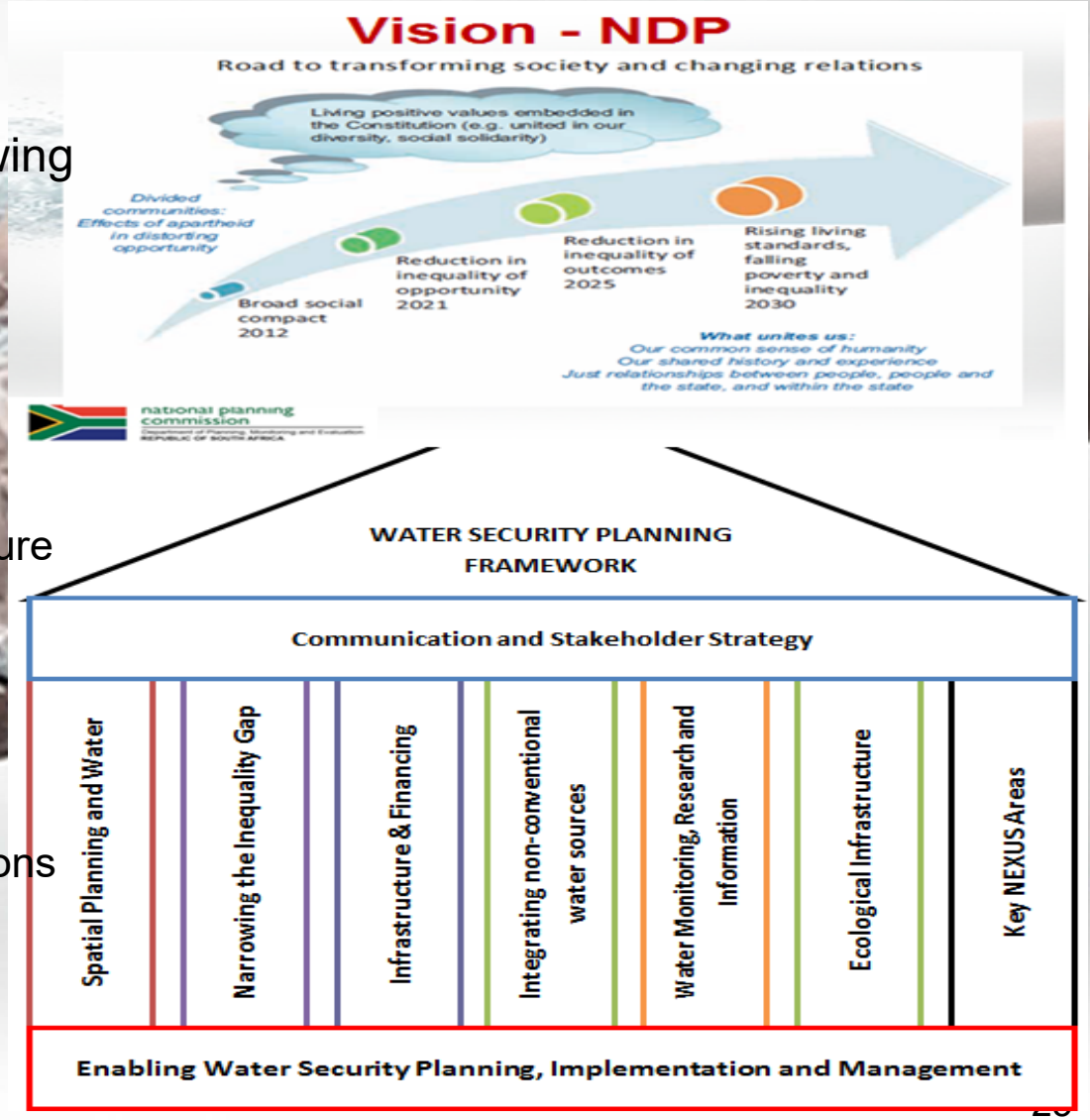
National Water Security Framework

- Structure: -
  Schematic representation of the Water Security Framework showing 9 supporting thematic areas
- Principles, approach & considerations:
  - Source to sea
  - Long-term view
  - Policy & legislation point of departure
  - Mass balance
  - NEXUS approach
  - Framework to be high level but instructive
  - Reflect urgent & immediate decisions for effective implementation



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Principles & Approach to Water Security Framework

- Water supply and use are considered from source to sea in a holistic or integrated manner across the water value chain from local, national.
- Policy and Legislation as starting point for mandated institutions with framework providing high level overview and guide for possible changes across the board.
- NEXUS approach to planning, implementation and management - water is central in many respects a limiting factor in terms of energy, food, health, economy, etc
- Decision support from credible information and research results – (Home grown intellectual capital associated with full value chain)
- Mass balance approach to assessment and implementation -to address spatial & temporal distribution and accounting for water in terms of water inflow, change in storage, depletion or process as well as outflow taking into account the quantitative and qualitative values
- Long-term view based on scenario planning and associated risks -

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WATER SITUATION - SOUTH AFRICAN CONTEXT

Natural elements

Behavioral

Historical

Financial & Infrastructure

Institutional

etc

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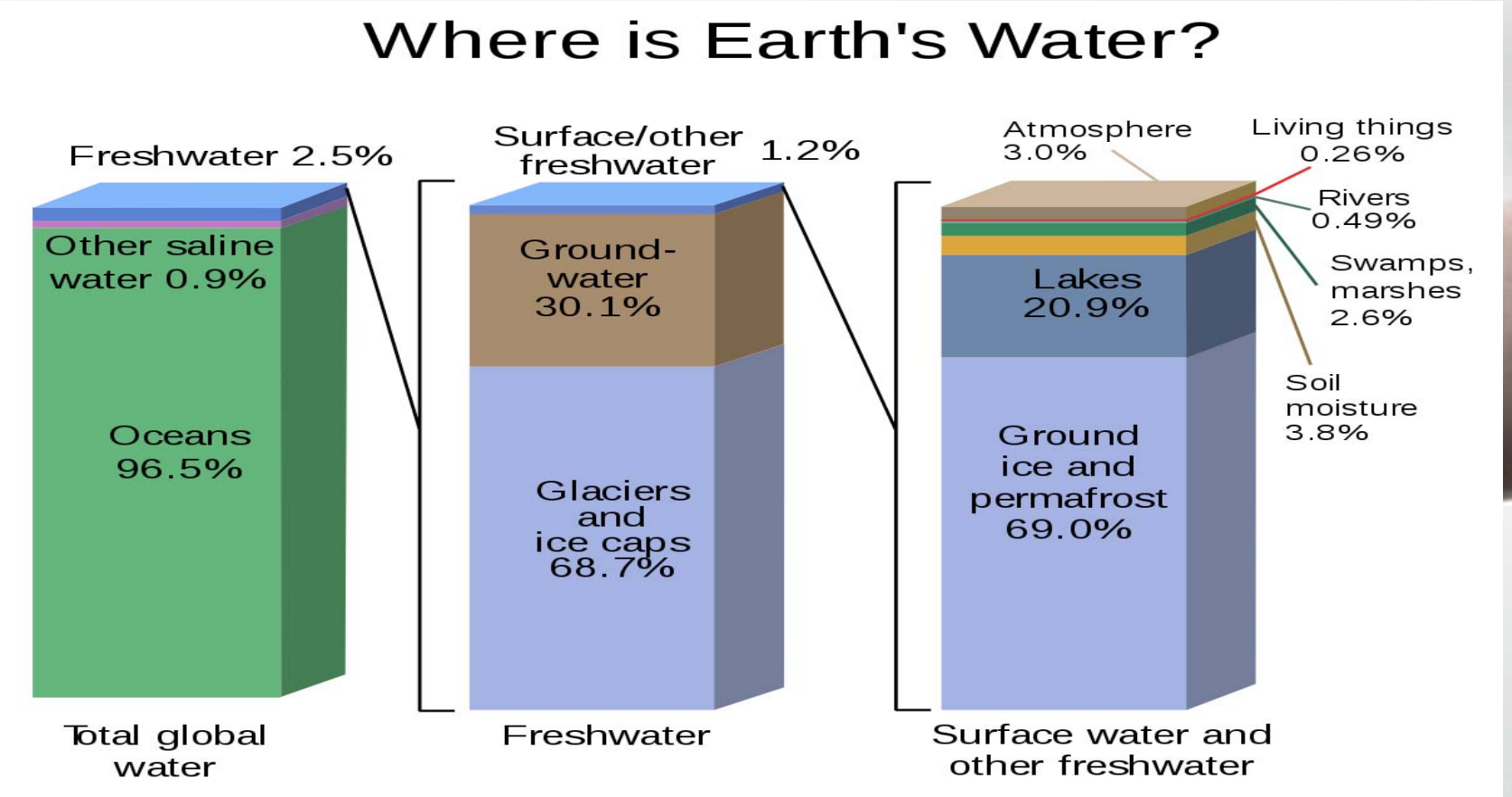
Global Overview



Message 2:

- Freshwater is a limited and finite resource

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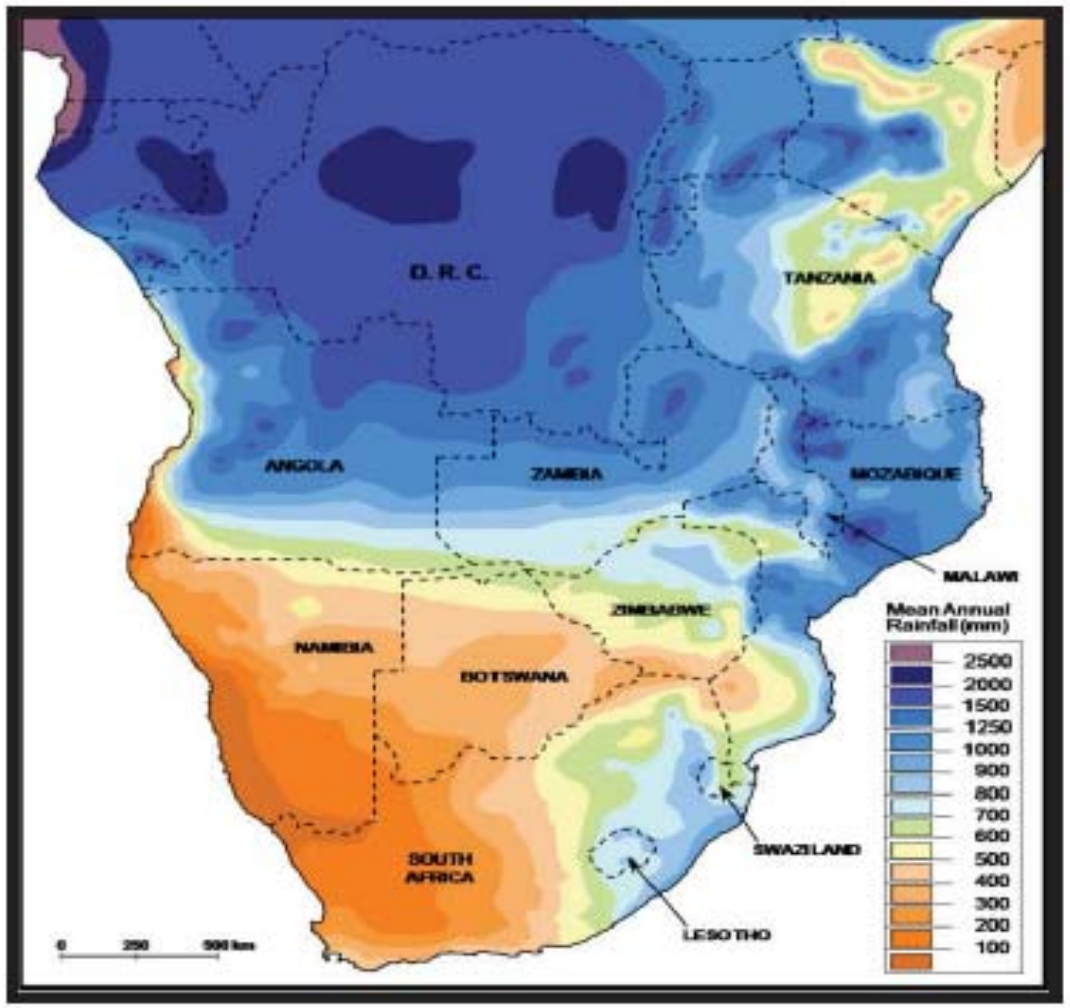
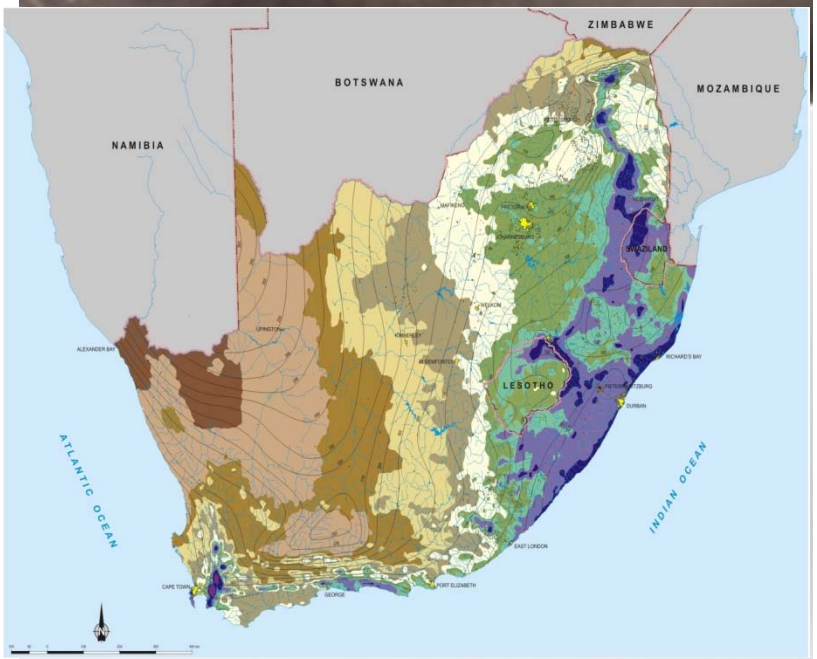
Overview - Rainfall pattern



Southern Africa Rainfall Distribution



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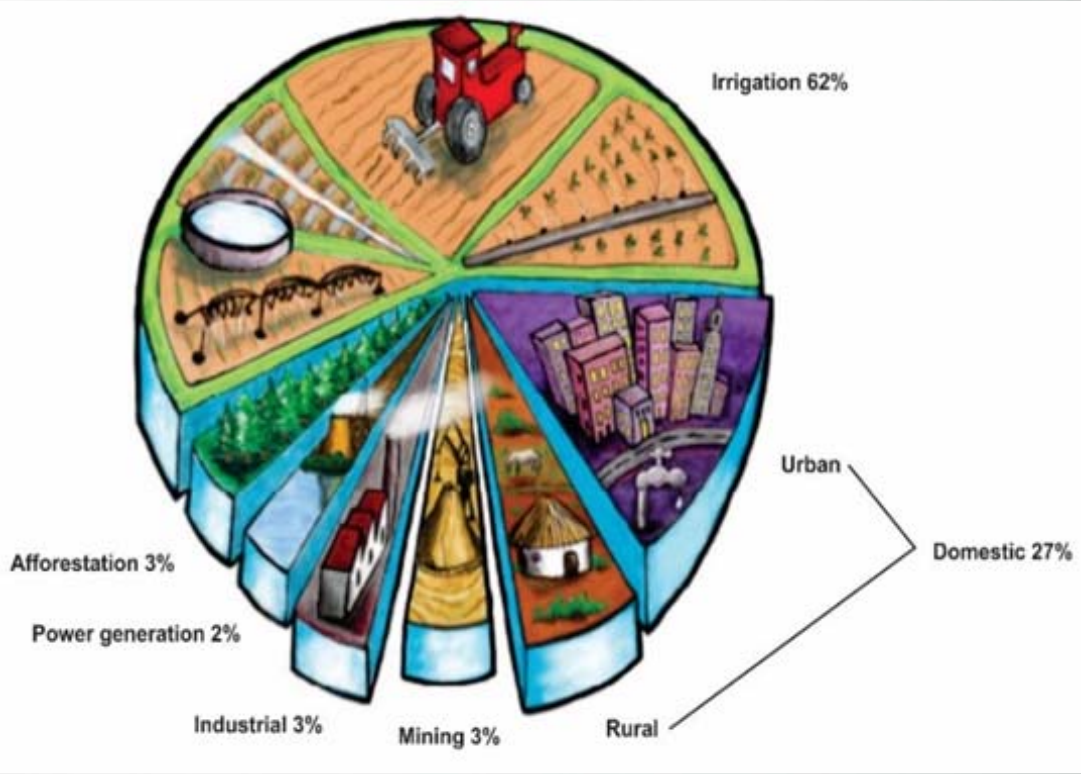
SA Water Overview

Water Allocation 6 key sectors:

- Proportion of water that can be recycled – 35% - **Substantive**!
- Measurements are based on allocation and modelled data
- 62% of the data is unmeasured or not monitored
- Need to cleanup and create 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 & surface



- **2% Power generation ☺ (water for energy)**
- **27% Domestic – most visible & impact readily felt;**
- **62% Irrigation – high economic impact**

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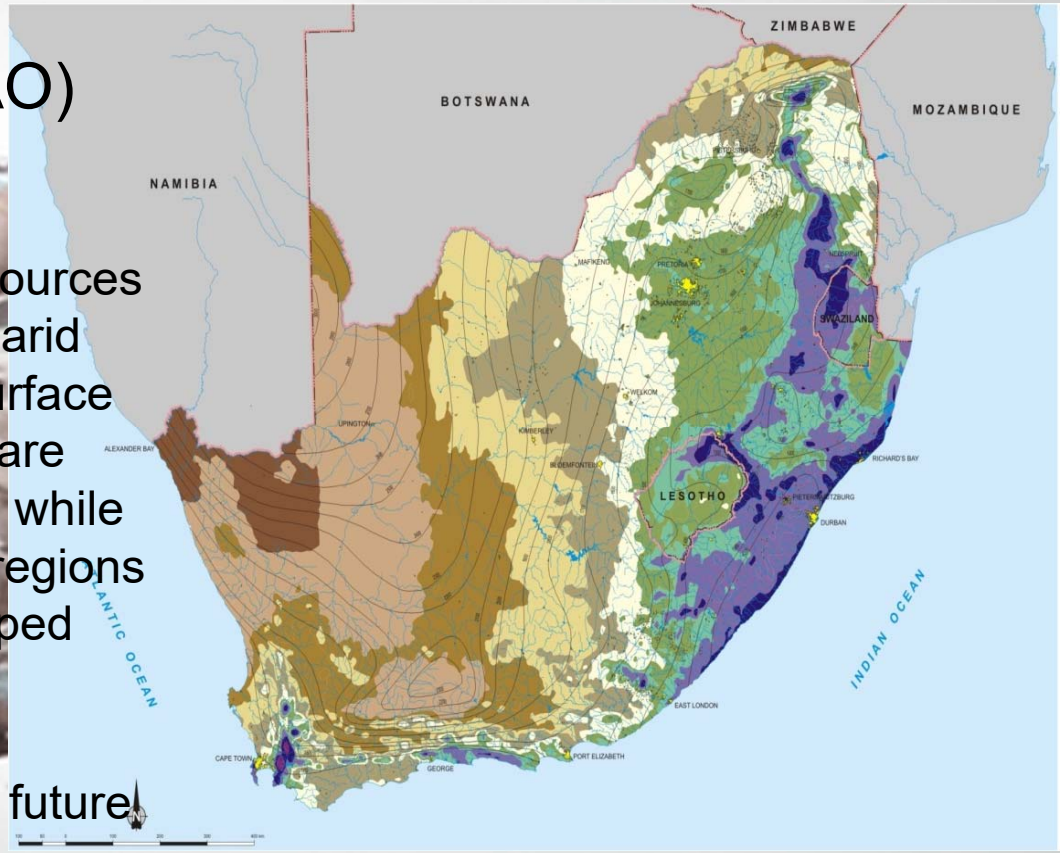
SA Water Overview

The country report on Aquastat database of the Food & Agriculture Organisation (FAO) states that for South Africa

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

- How do we use our data to predict future rainfall patterns – How robust are methodologies – SA is behind the curve on this kind of investment



Why do we still have Cape Town problem ?

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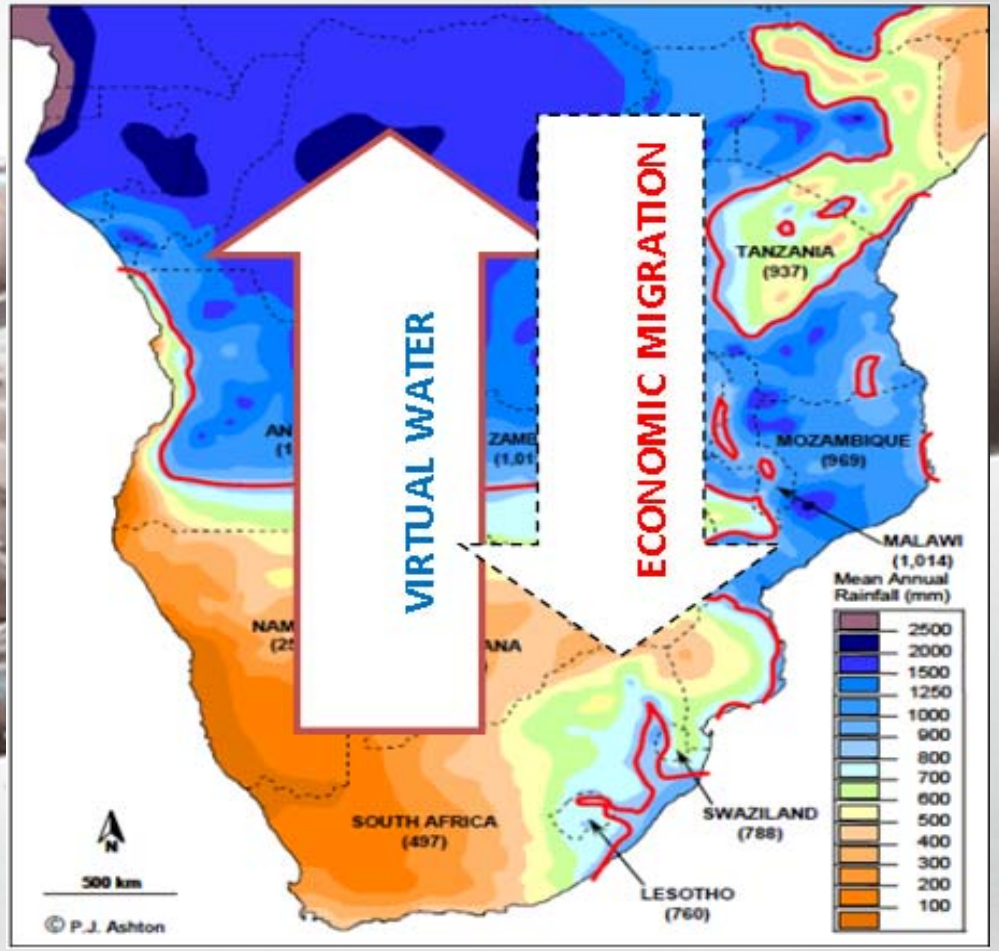
Water Situation – Demand & Use Dynamics

- 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;
  - The South has more diversified economies characterized by relatively higher level of development and political stability;
  - Water rich goods and services are exported from drier south to wetter north.



To what extent do we need to cast our technical, engineering & scientific solutions across the region?

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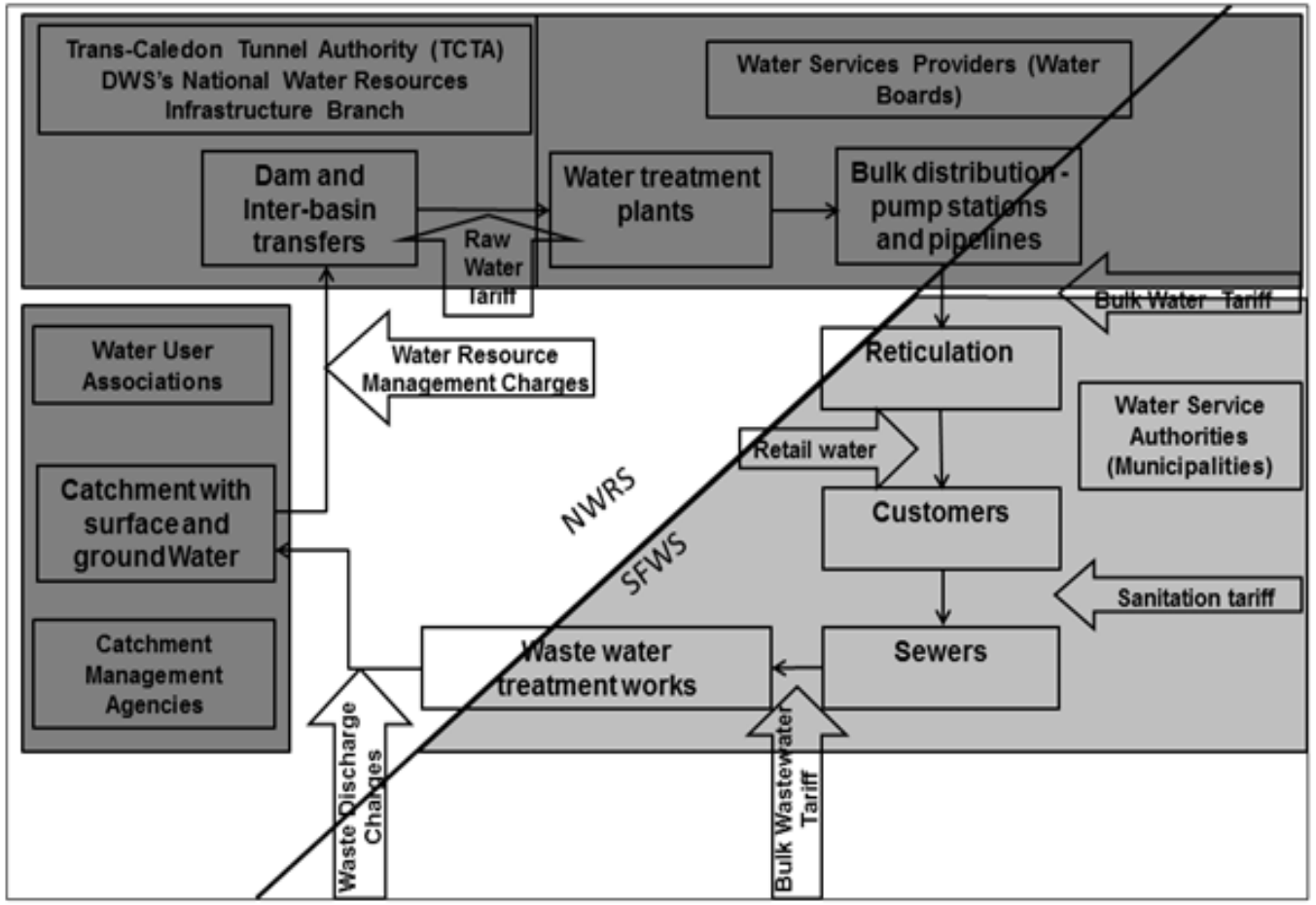
SA Overview – Finance & Infrastructure



Source: Ruiters and Matji, 2015

Financial flows and water infrastructure in South Africa

- Sources includes
  - provision via the Division of Revenue Act (DORA)
  - User charges as per pricing strategy
  - Funding raised from the markets

A lot of potential is locked in assets within the water resources infrastructure (Refer to Institutional Realignment delays)

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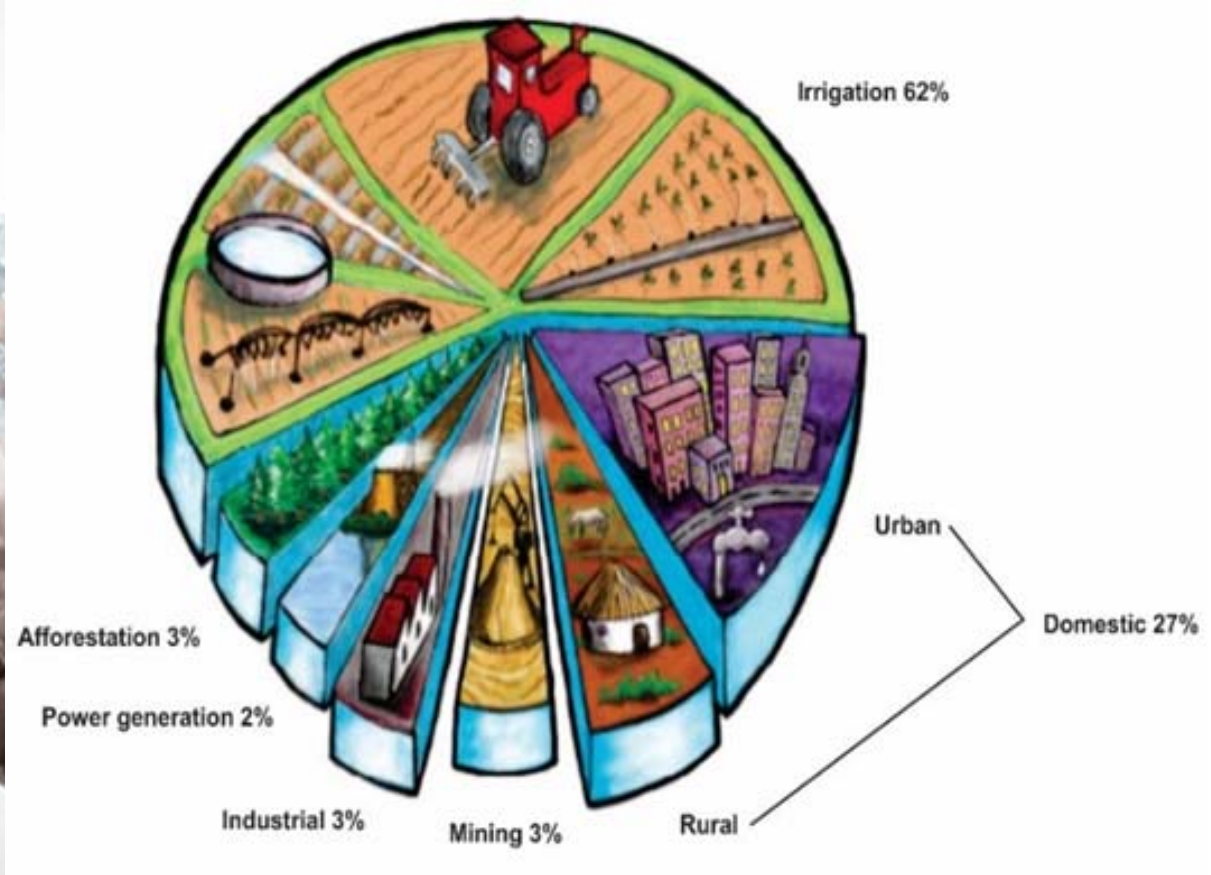
Water Situation - Behavioral

- How do we change the picture across the water use pie chart?
- What role can R&D play?
- To what extent can the economic model review contribute to the needed improve in water related economy?



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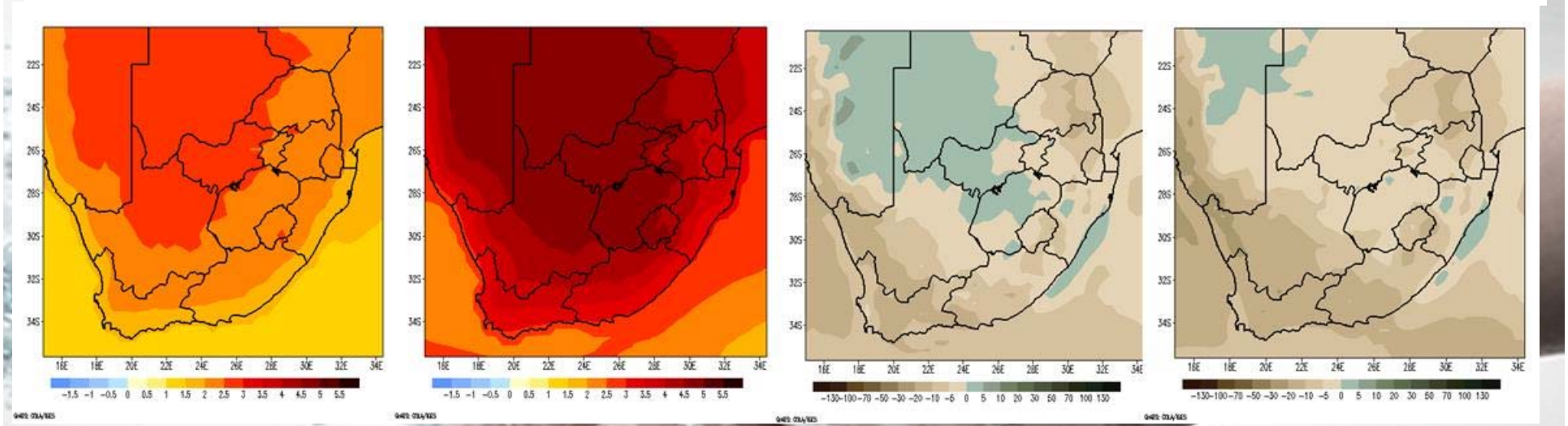
Water Situation: Clim. Change Projections

RCP 8.5 : Annual temperature change (ºC) relative to 1985 -2005

RCP 8.5 : Annual rainfall change (mm/month) relative to 1985 -2005

2046 – 2065 (+50 years)	2076 – 2095 (+80 years)	2046 – 2065 (+50 years)	2076 – 2095 (+80 years)



The current projections reflecting less than normal rainfall in October – November and December.
In the period January and February, above average rainfall is expected.

SAWS is currently putting together a Global Warming Atlas which is regarded as an extension of its forecasting, prediction and projection services;
Future Climate Change research will focus on "The weather of climate change" or climate variability within climate change;

These diagrams demonstrate the impact of global warming.
Over the next 80 years the Southern African region is anticipated to receive less than average rainfall.

THE NDP POSITIONING FOR WATER SECURITY

Strategic Choices to ensure water security

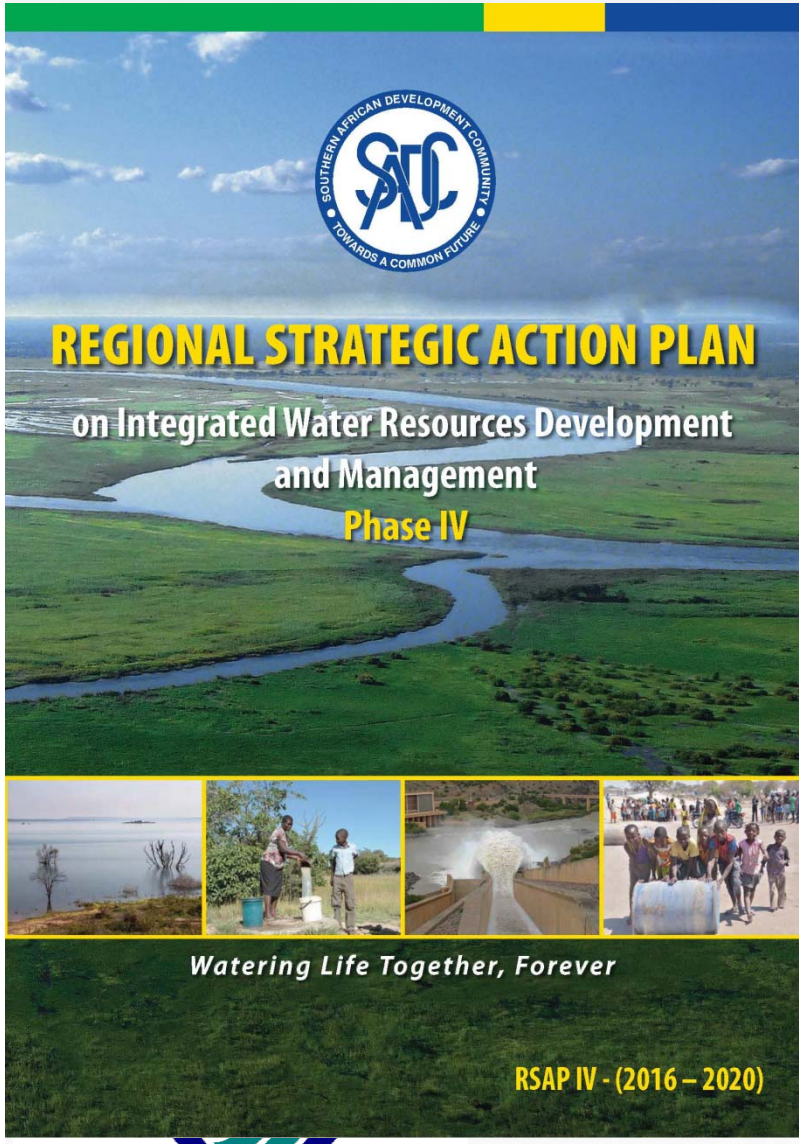
Future Gazing

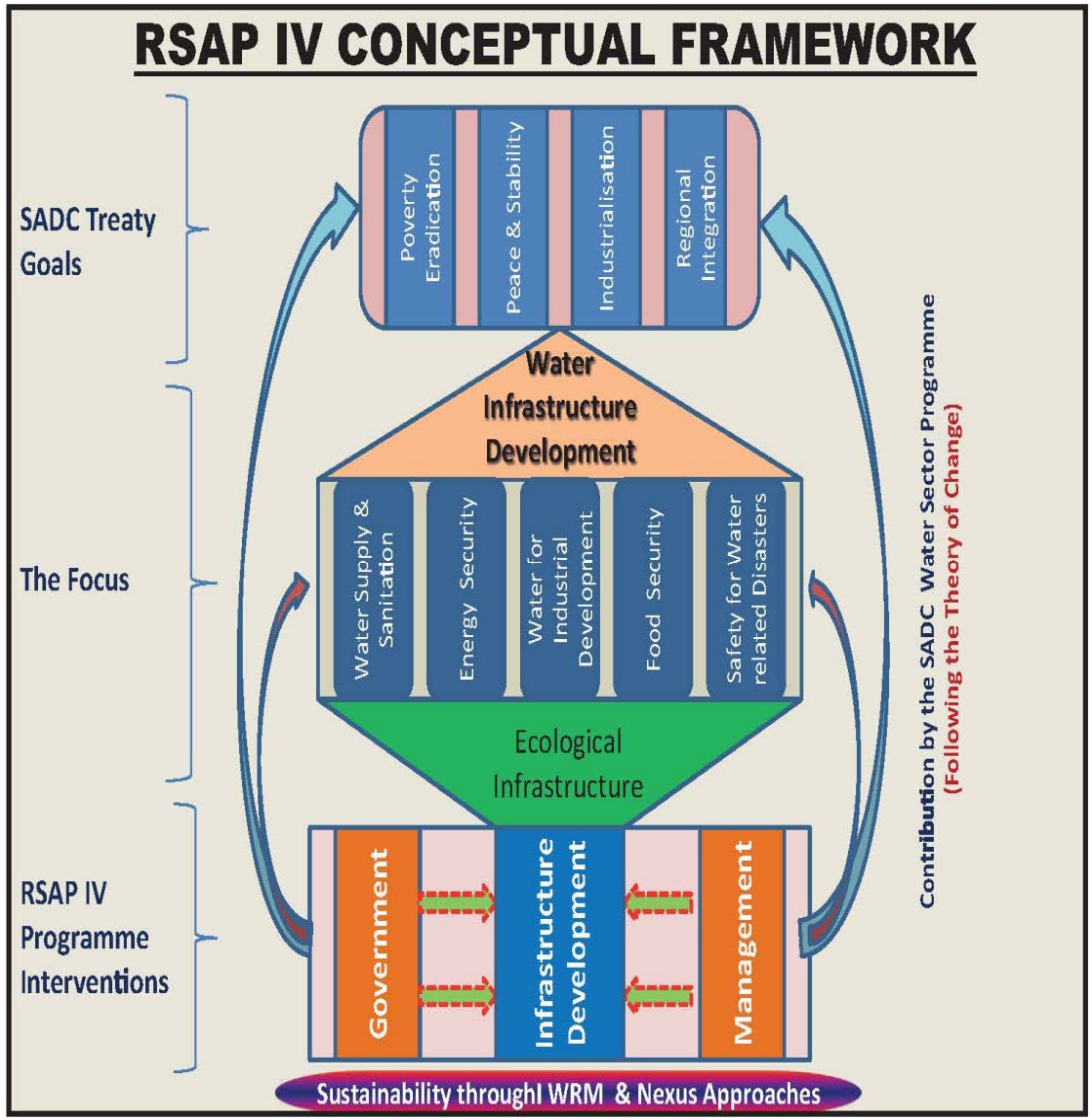
NDP planning and institutional framing

Implementation/Interventions

INTEGRITY CARING EQUITY EXCELLENCE SPIRIT OF PARTNERSHIP RAND WATER

The NDP in Regional context





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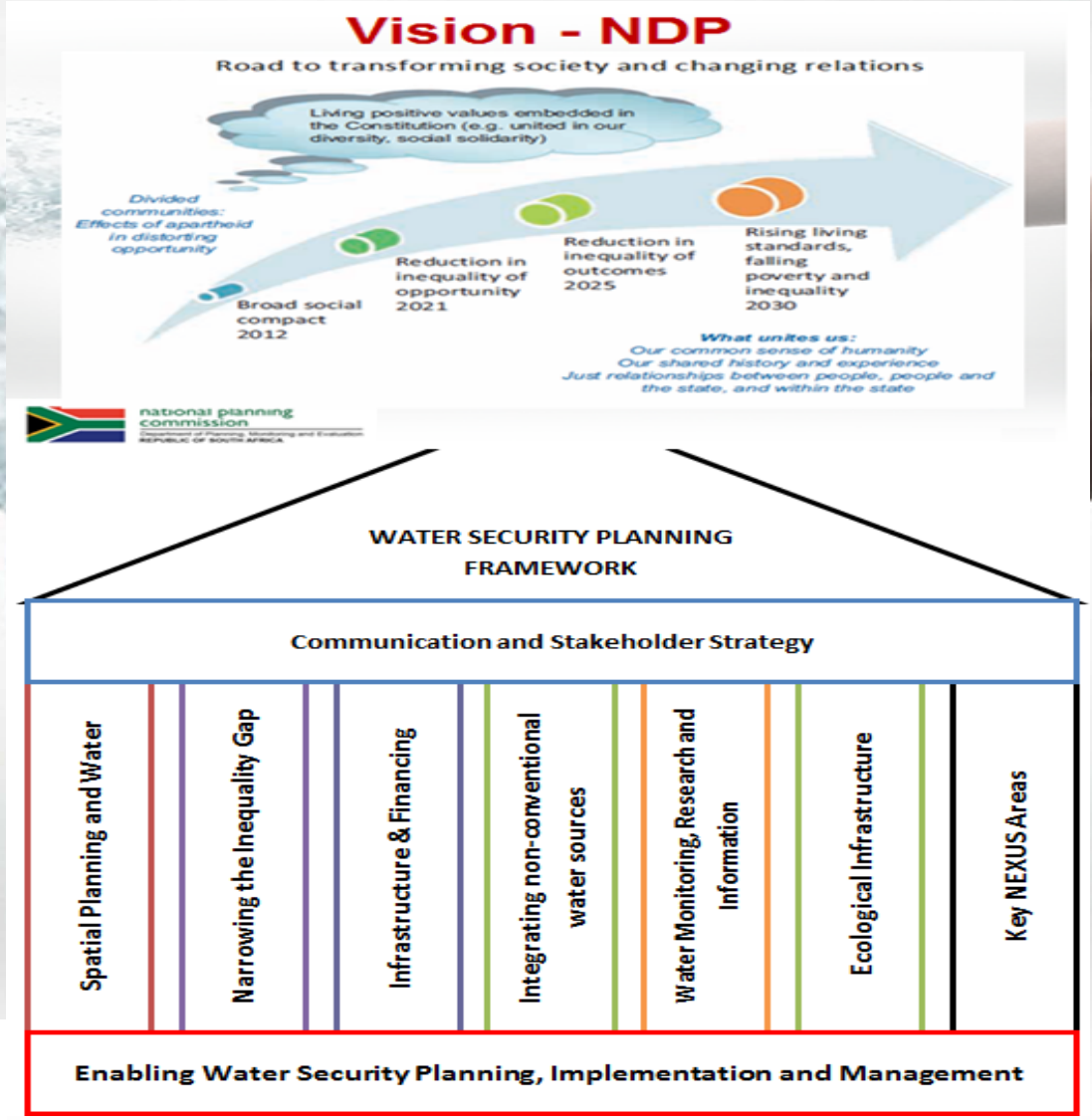
National Water Security Framework - Themes



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Theme: Enabling Water security: strategic choices

Despite South Africa's recorded success in delicately balancing expansion and demands of households and other use sectors, 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.

NWPDR, 2015

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Theme: Enabling Water security: strategic choices (2)

The NWDP identified a suite of opportunities and recommendations for sector-wide and migration into water security strategies:

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Theme: Enabling Water security: strategic choices (3)

ISSUE/AREA	COMENTS/OBSERVATIONS
Scaling-up non-traditional water augmentation	• Few opportunities remain given past developments & interbasin transfers. • New areas incl. aquifer exploitation, desalination, cross-border transfers – need various combinations within broader planning regime (Planning for Water Sucrity)
Enhancing demand-side management and conservation	• Widely embraced and well understood but implementation still not enough • Requires political leadership, commitment as well as strong line Departments capabilities • Measurable return on investment at all levels and high level of awareness beyond “feel good”

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Theme: Enabling Water security: strategic choices (4)

ISSUE/AREA	COMENTS/OBSERVATIONS
Innovatively pursuing universal service coverage	• water security must be viewed beyond primarily from the perspective of all people having access to adequate, safe and affordable water services. Generally a lot has been done well in South African Context • Services must move to livelihoods and economic development through a sophisticated combination of small scale and large scale infrastructure programmes taking into account financial flows
Proactively planning for strategic water infrastructure	• water-secure future requires careful long term planning drawing on the prioritised nodes of national growth and increasingly seek to influence the location of water in relation to potential socio-economic development • Such planning must include relooking at deconstructing the old spatial planning, taking into account new challenges of climate change

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Theme: Enabling Water security: strategic choices (5)

ISSUE/AREA	COMENTS/OBSERVATIONS
Increasing attention to water resource protection	• **Water security in parts of the country is severely compromised** by the deterioration of the quality of the limited water resources available • In the short term – **urgent interventions to stabilise deterioration** such as the Vaal System, Mine waste water and compliance monitoring; • In the long-term implement **measures for managing wastewater risks more robustly**, including reinforcement of compliance and assistance to municipalities and private operators of treatment works
Strengthening human and institutional capacity	• All levels of **water value chain required** for water security • **Strengthen existing skills development initiatives** from programme level to institutional level

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Theme: Enabling Water security: strategic choices (6)

ISSUE/AREA	COMENTS/OBSERVATIONS
Establishing quality assurance protocols for the front-end phase	• the **introduction of formal and independent reviews**, quality assurance, and due diligence protocols for the front-end phase of critical infrastructure investments • **a multi-dimensional definition of projects is essent**ial, proven technologies underpinned by good information - emphasise the importance of robust problem analyses and effective consideration of probable opportunities and threats, from the outset • **Institutional setting created in a manner to ensure sustainability**

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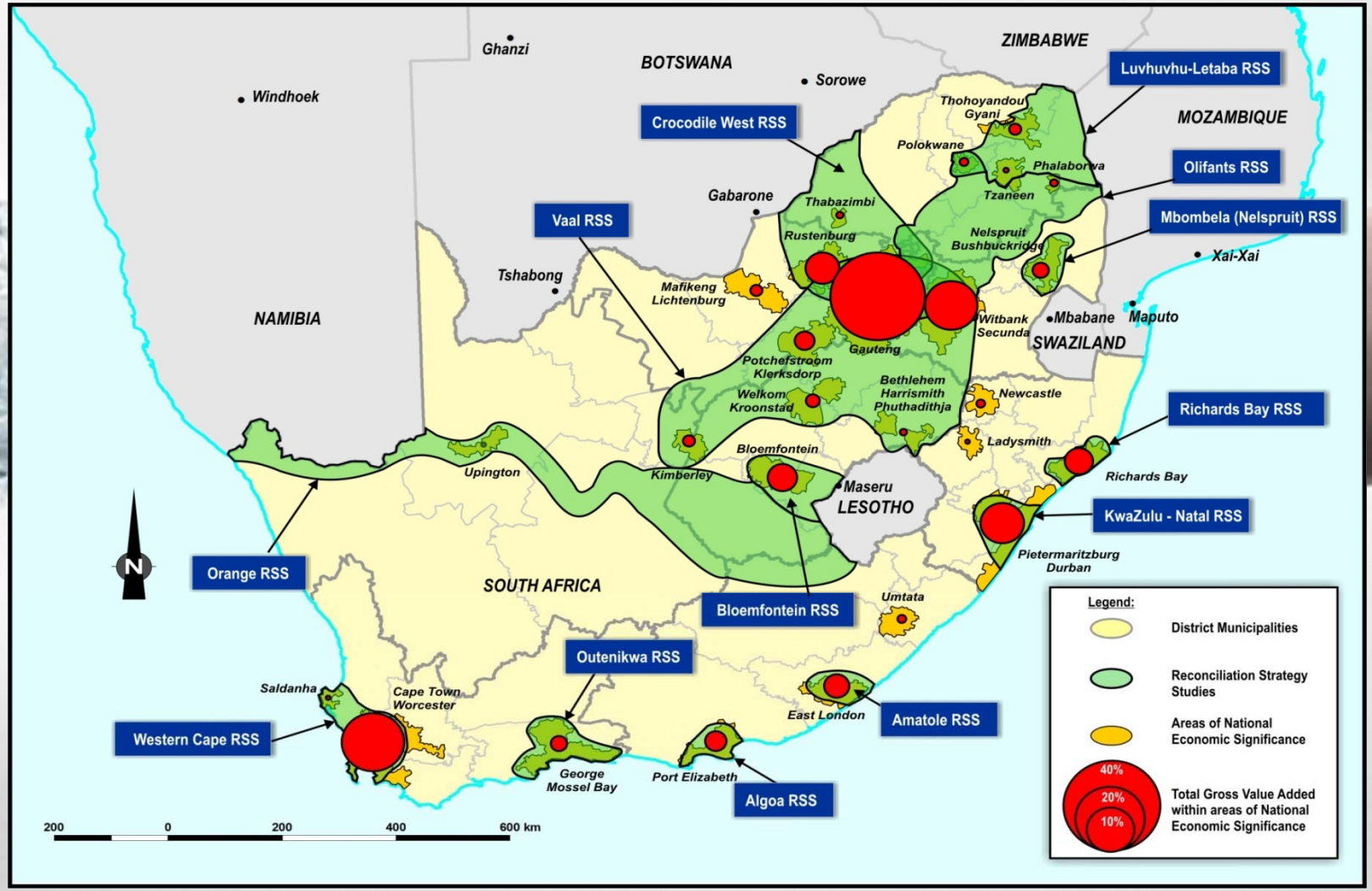
Theme: Spatial Planning & Water



Economic zones as drivers of development still reflecting apartheid spatial planning

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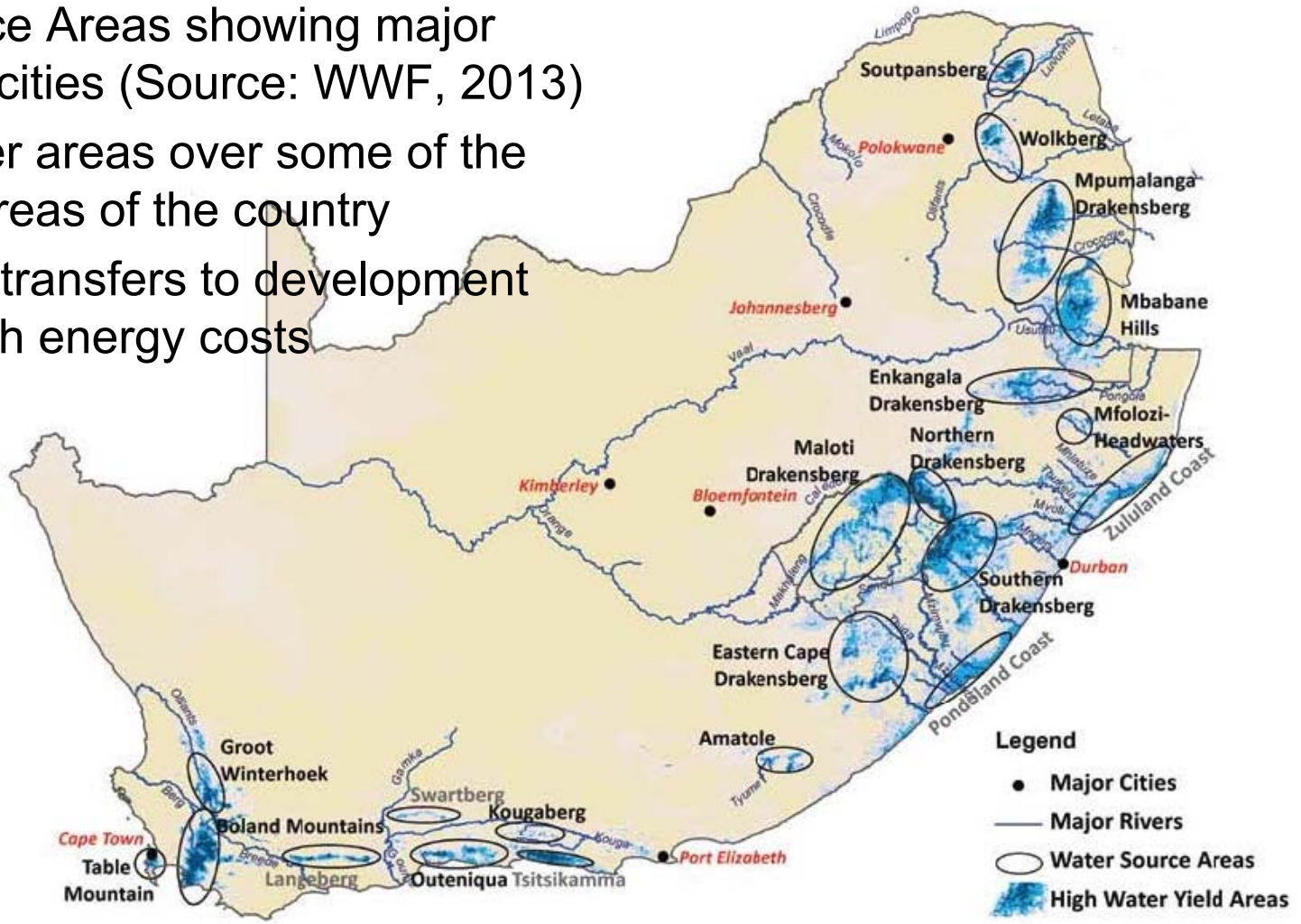
Theme: Spatial Planning & Water

- Water Source Areas showing major Rivers, and cities (Source: WWF, 2013)
- Source water areas over some of the most poor areas of the country
- Often water transfers to development zones at high energy costs



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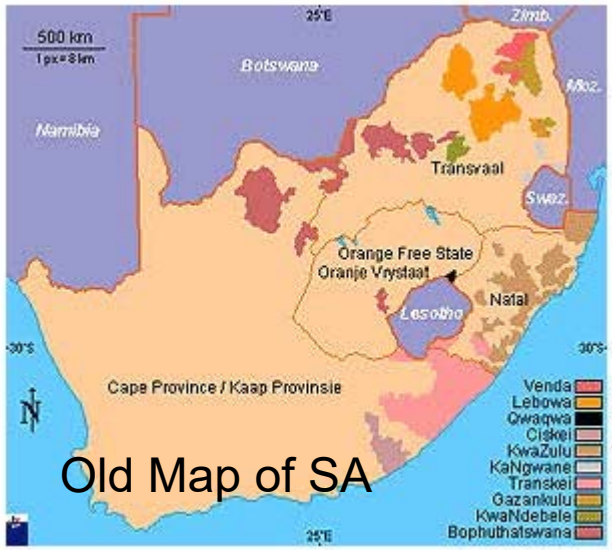
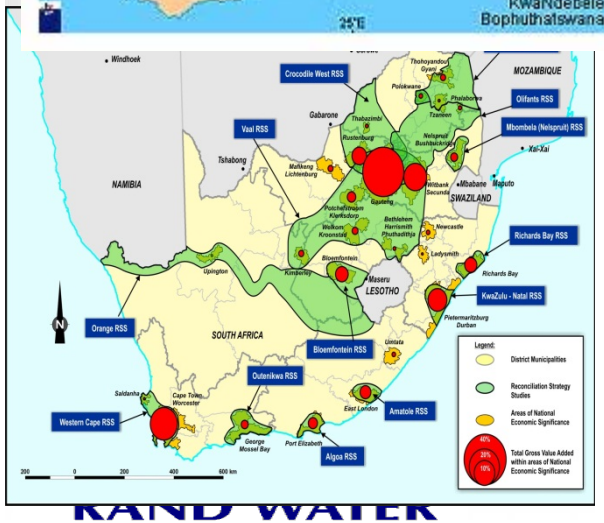
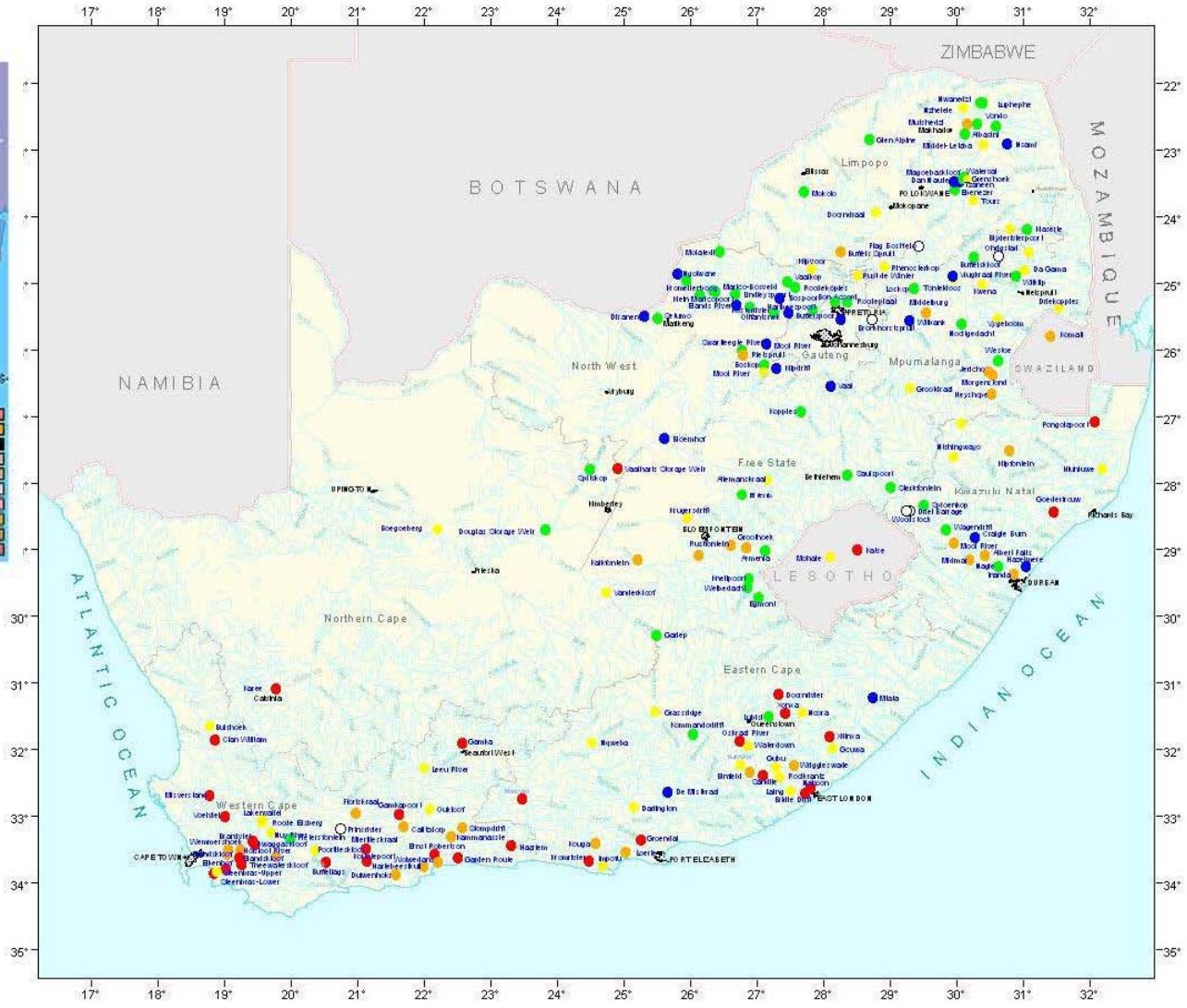
Theme: Spatial Planning & Water

Distribution of major dams in South Africa (Source: DWS) vs.

- development nodes
- Former Homelands







Theme: Infrastructure and Financing for Water Security (1)

- Water infrastructure in SA is mainly funded through a combination of loans on the basis of user charges (water tariffs) and government grants (primarily through the municipal infrastructure grants) with little private equity and investment in the water infrastructure generally NWRS2, 2013
- The impact of water infrastructure and associated financial flows on the economy is 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 & communications technologies.

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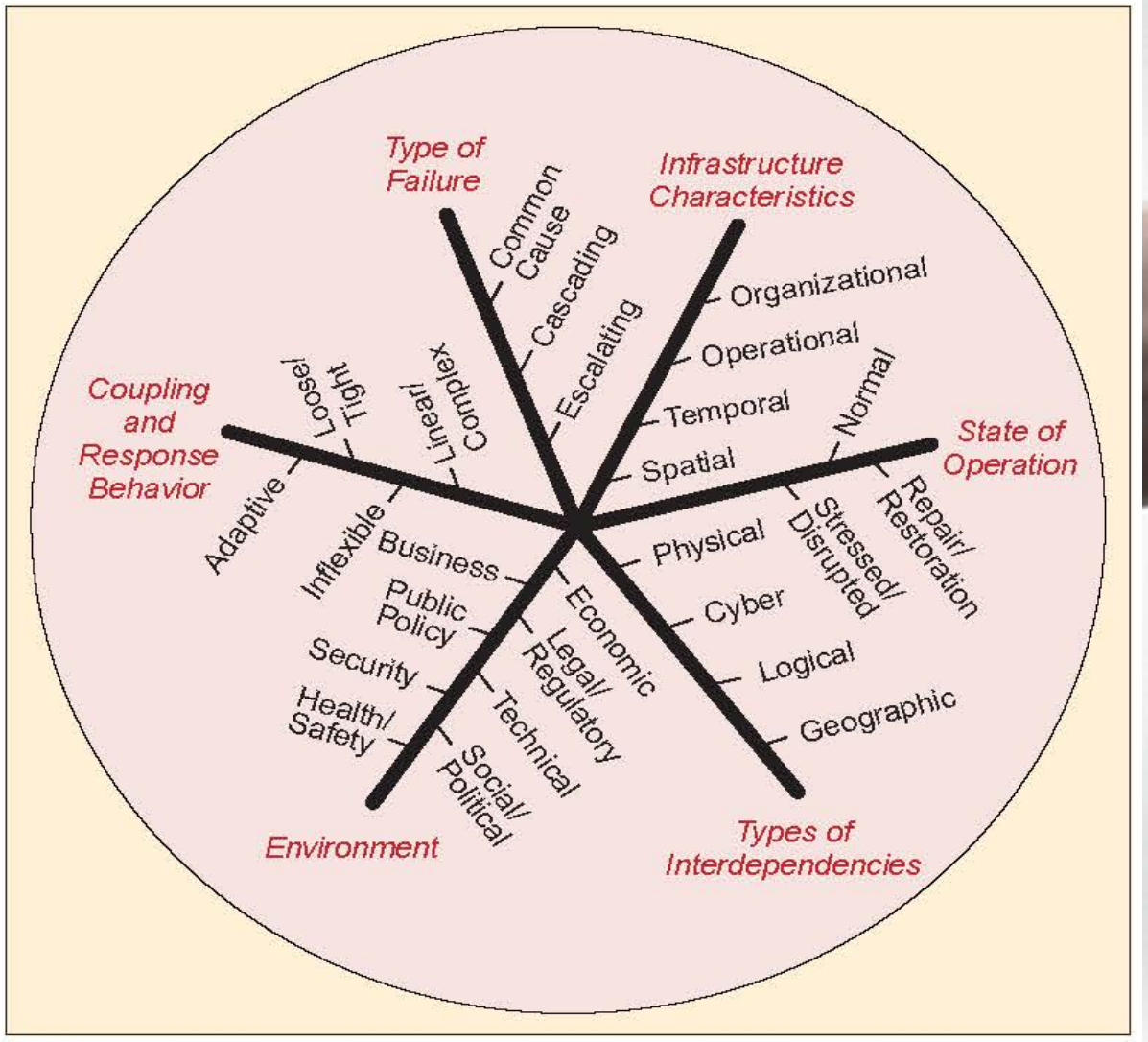
Theme: Infrastructure and Financing for Water Security (2)



Dimensions for describing infrastructure interdependencies, Rinaldi et al, 2001

Theme: Infrastructure and Financing for Water Security (3)

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;

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Theme: Infrastructure and Financing for Water Security (4)

The following need to be considered …:

- **Strengthen legal and regulatory regime** in the water space starting with separation of regulation from implementation. The NDP proposes assessing independent regulatory regime. 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 contribution of ecological infrastructure to the balance sheet. Such models should attract private equity for various components of the value chain without compromising the total system/model.

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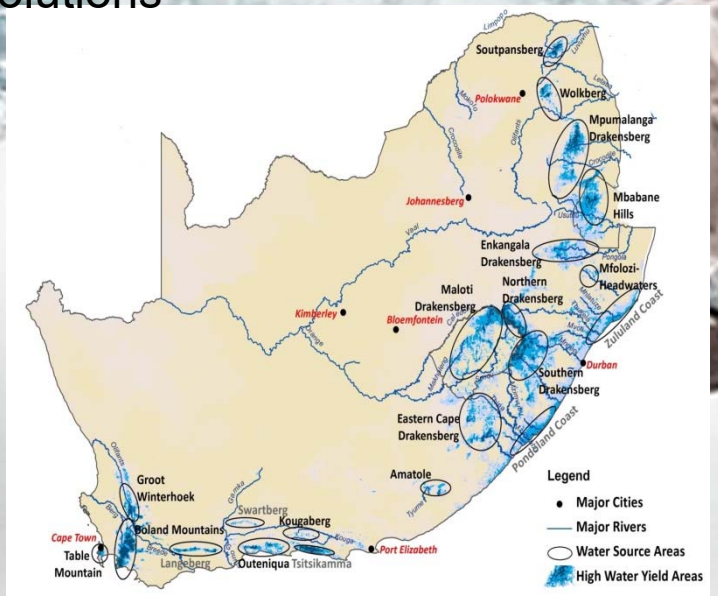
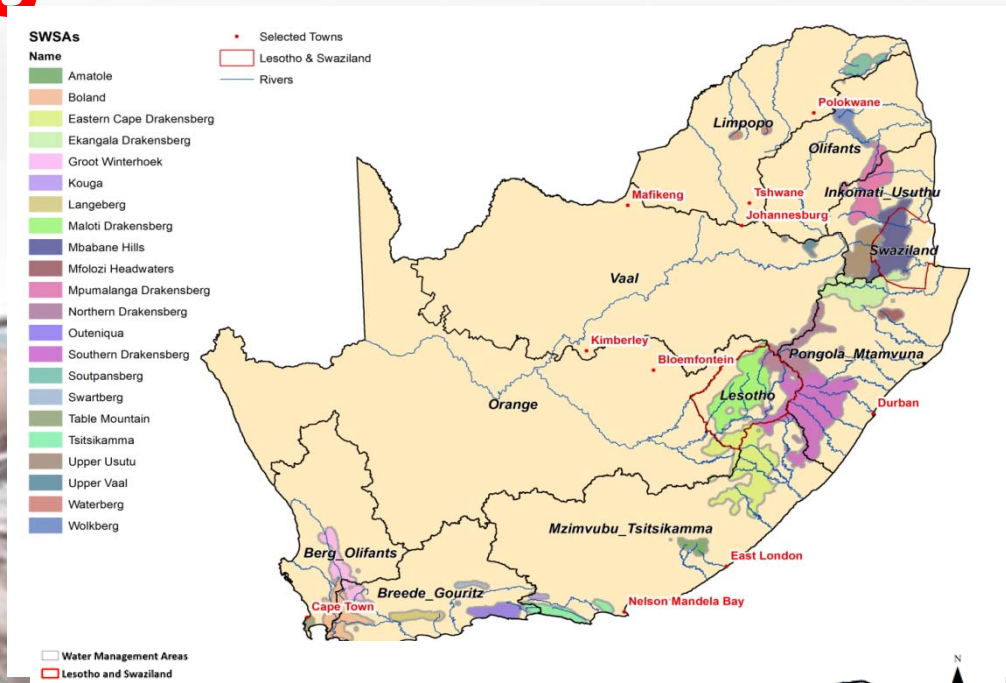
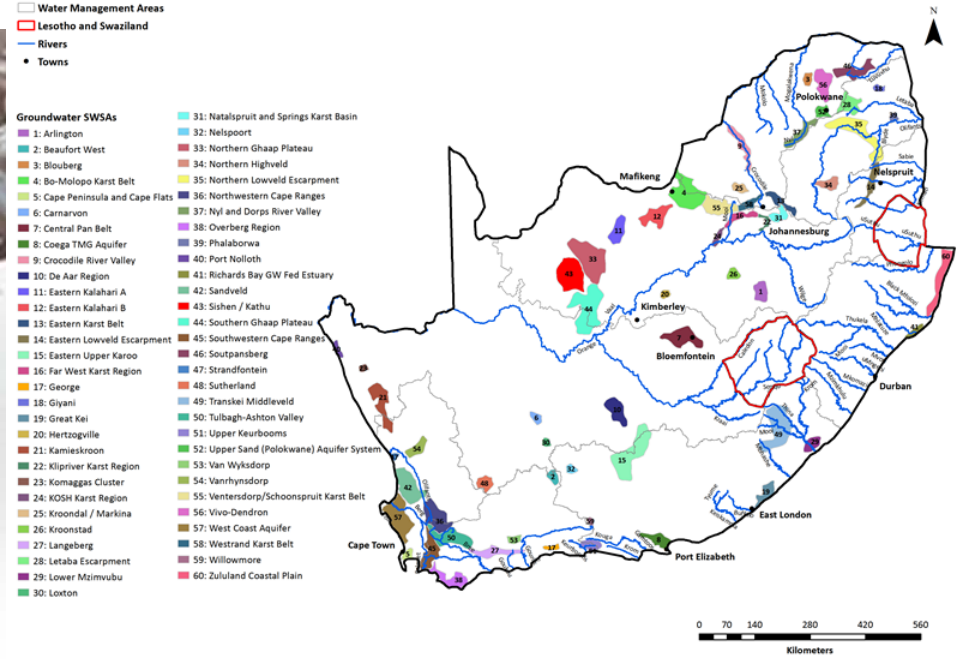
Theme: Ecological Infrastructure

- Water Source areas – Surface (Current & refined) and Ground water.
- Potential for full development & judicious management from governance through to technological and innovative solutions







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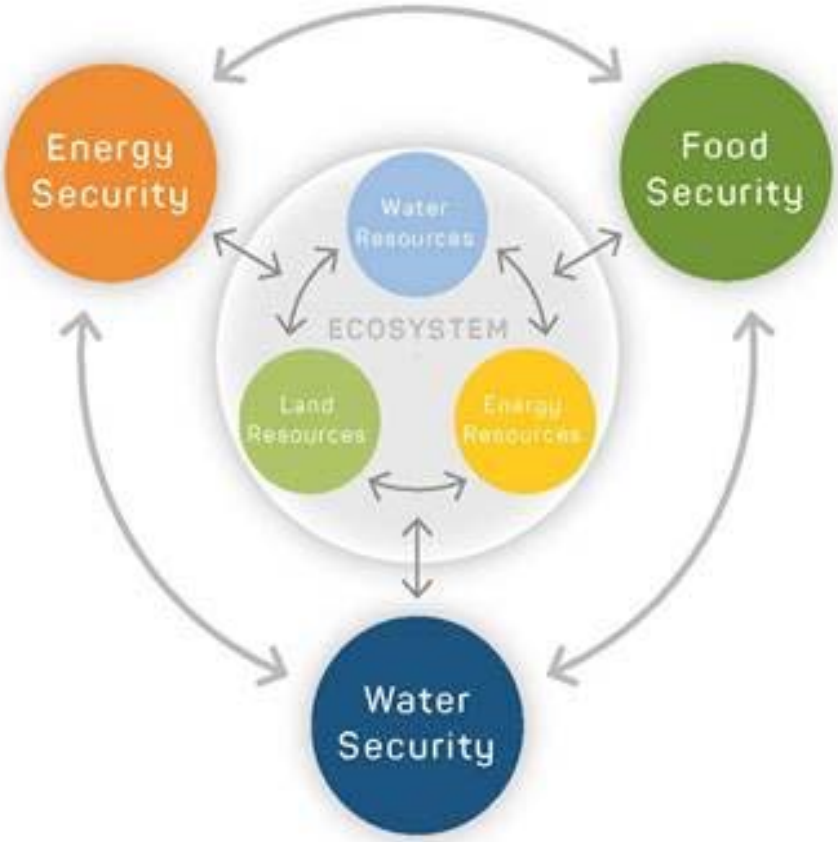
Theme: Water Nexus

- Deliberate attention to the NEXUS approach to water security:
  - ESKOM (DPE)
  - DoE
  - DAFF
  - DWS – RW, etc)
  - DEA – Climate Change
- Water has to be central to all the planning in the country and must be elevated to the highest level of planning in the country – hence key principle in terms of water security)



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Theme: Water Research Monitoring & Information

- Meaningful information is critical in respect of
  - timeliness,
  - right people and
  - right decisions
- In context of post 20th Century systems (SA's capability for water monitoring & info. has deteriorated or lost & needs urgent attention);
- Research uptake and capability to not only coordinate
- To support and ensure strategic regular assessments nationally
- Institutional arrangement to position and support beyond the sector

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High Level Interventions

Consider Developmental Planning:

- ✓ that takes into account scarcity, basic services and potential for economic growth holistically
- ✓ in which spatial planning is deconstructed and reconfigured to unlock new growth potential
- ✓ That ensures 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;
  - Roles played by other sectors in a nexus context towards TOTAL WHOLISTIC SOLUTIONS

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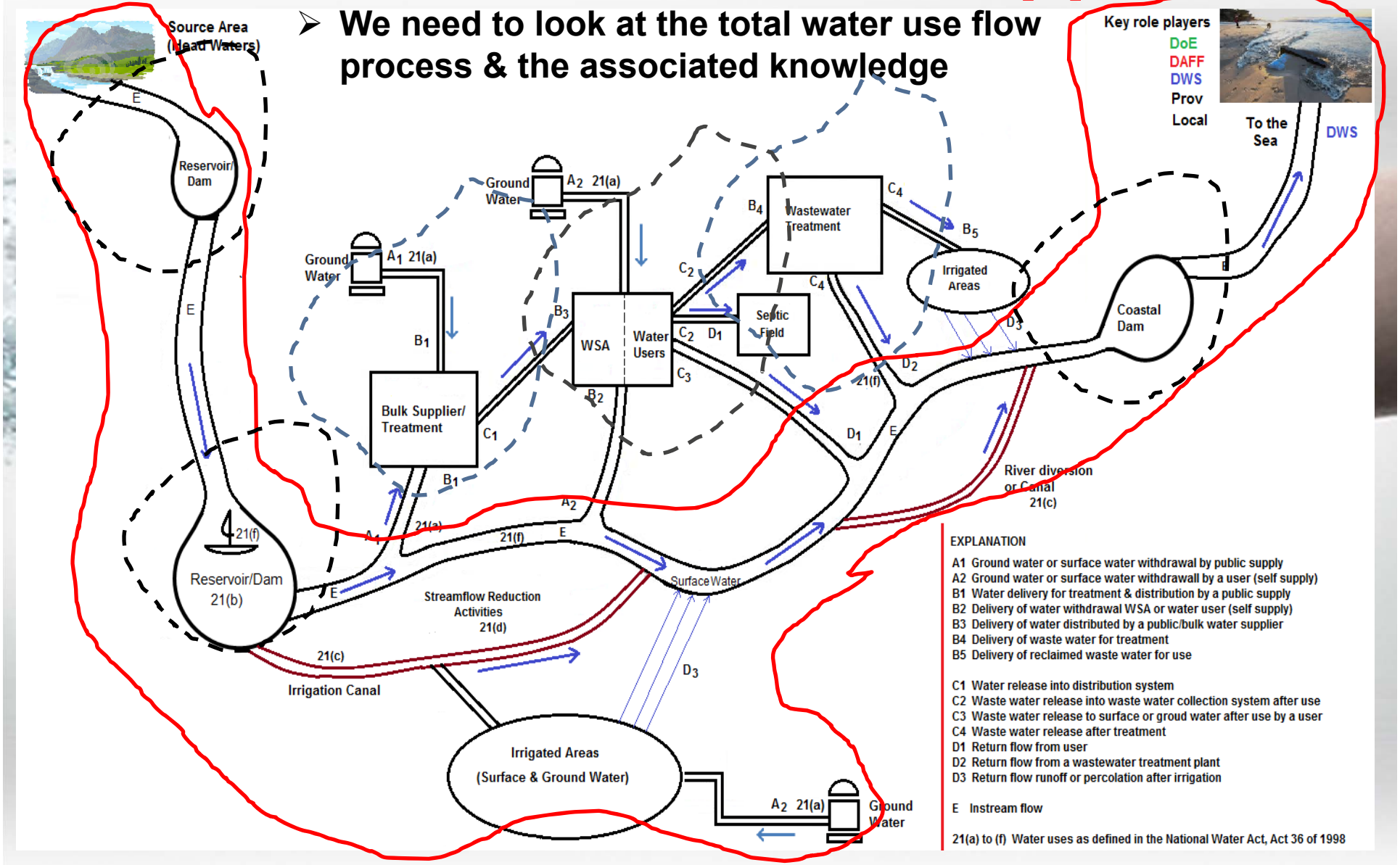
Total Water Value Chain Approach

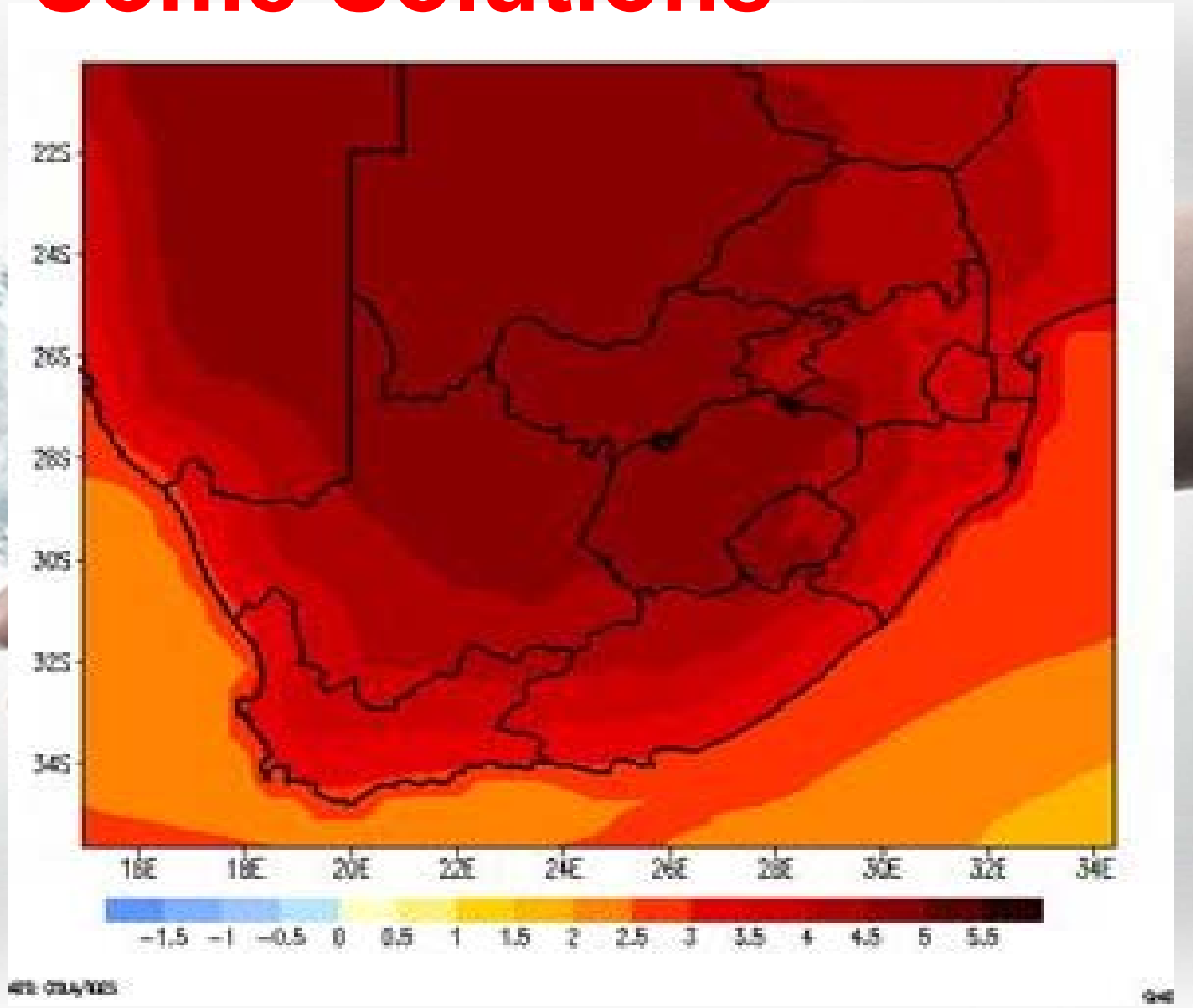
- We need to look at the total water use flow process & the associated knowledge



Some Solutions

For example what role can the energy sector play in respect of technological advances for solar and other energy forms?

What about change in water demand through technological advances ?



Some Solutions - Shared Water Courses

- Planning for water security
  - ✓ must take a regional dimension that looks at strategic and tactical aspects on trade policy, in particular within SADC
  - ✓ with options of transboundary transfers
- For example it may be prudent to position farming in a neighbouring state with significantly lower water and sanitation costs and in line with current SACU arrangements, manufacturing and industrial processing can still occur in South Africa.

Key basins for South Africa:

- **Congo, Zambezi, Limpopo, Inkomati, Orange-Senqu**
- **Potential for regional econ. dev. with hydropower**

Concluding Remarks (1)

In order to enable water security from a national perspective, we must

- Ensure that water plays a central role in socio-economic development ➔ Developmental planning
- Consider full water value chain taking into account interdependencies like food, energy, environment, health, etc.;
- Ensure that all institutional responsibilities and obligations are carried out and properly support by sound research, development and innovation;

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Concluding Remarks (2)

To enable water security… we must

- Design & implement financing models for water taking into account urgent dev. pressure points & scale the projects to yield results and impact efficiently & effectively in the shortest possible time taking into cognisance long-term impact;
- Find and create symbiotic and ecosystems that include private sector, research and development role players in practical and pragmatic manner
- Craft and execute total solutions that are multidimensional with water as central to all planning

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Concluding Remarks (3)

- "…water security is less about obtaining water, and more about fostering human capabilities as they relate to water...
- We thus ask:
  - What are the social, cultural, and political relationships with water resources and flows that advance a life that fosters human dignity? And,
  - how are those relationships secured to facilitate the freedom to achieve wellbeing, fulfilling social arrangements, and human flourishing?

Jepson et al, 2017

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Concluding Remarks (4)

Cont. from previous slide

- … water security, then, 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 development of human capabilities and wellbeing in their full breadth and scope"

Jepson et al, 2017

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