Water and Sanitation Sector Leadership Group Meeting

CSIR Water Initiatives Aligned to SDGs

13 September 2018

Dr. Harrison Pienaar

our future through science

Table of Contents

- **Effective Implementation of Sustainable Development Goals (SDG 6)**
  - **Major challenges and RDI opportunities linked to SDG 6**
  - **CSIR Water Initiatives in response to SDG 6**




CSIR
our future through science

Effective Implementation of SDG 6

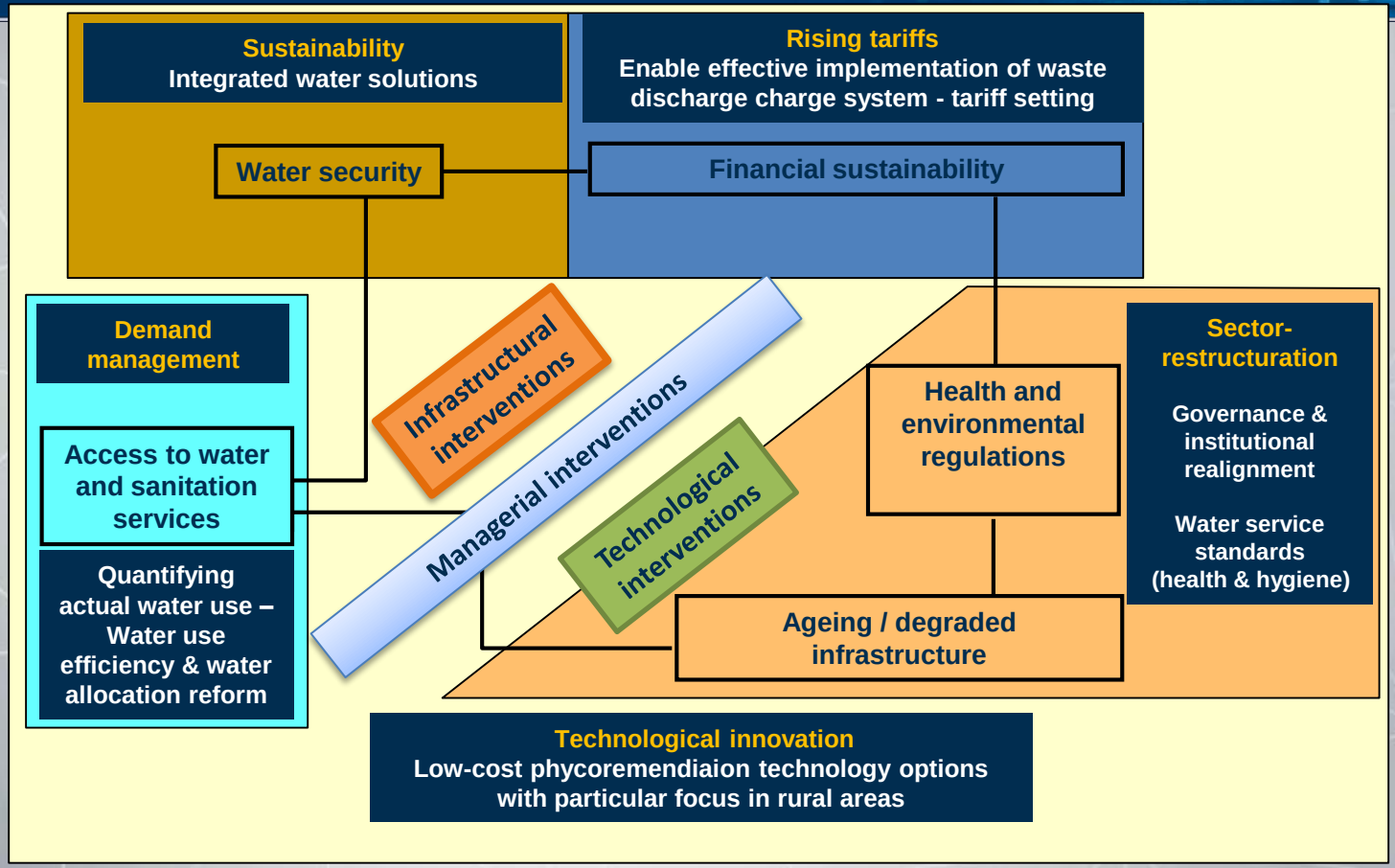
- **Ensure availability and sustainable management of water and sanitation to all**

  - Ensure – for **current** and **future** generations.
  - Implies short, medium and long-term implications to be addressed – **simultaneously**.
  - Major **challenges** and **opportunities** in responding to these.
  - Require **rapid, intermediate** and **comprehensive** interventions.
  - Applies to **SDG 6.1- 6.6**
    - Access, efficient use and sustainability
    - Improving water quality and ecosystems restoration
    - IWRM and international best practise





Major Challenges and RDI Opportunities



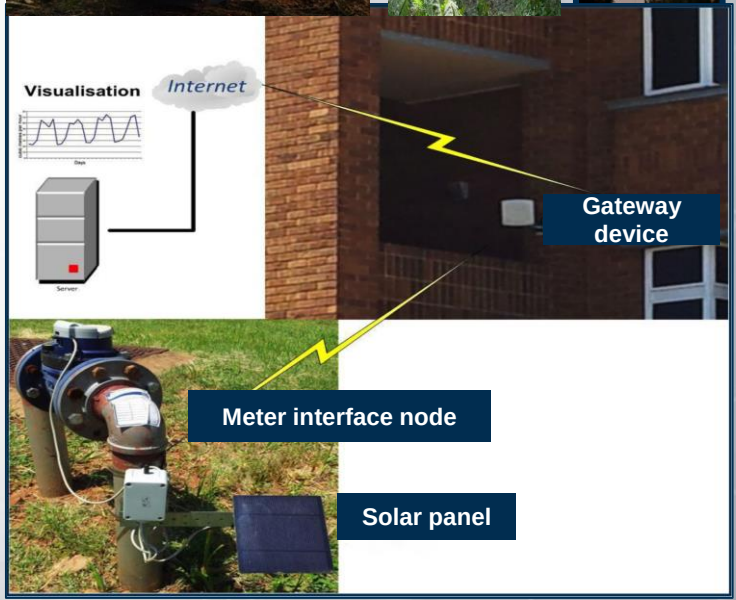
SDG 6.3 Improve Water Quality by Reducing Pollution

Pollution detection and treatment

- Low-cost rapid pathogen detection technology
- Near-real-time water quality monitoring system
- Polymer-based adsorbents for removal of toxic pollutants from water – application in acid mine drainage treatment, EDCs, and emerging contaminants (nano-scale)
- Multi-scale modelling, analysis and advanced computation (water/energy linkages)
- Low-cost passive waste treatment technology - facilitate effective and efficient removal of nutrients and pathogens in WWTWs effluent in rural areas in particular
- Desalination of inland contaminated water streams for maximum recovery of water
- Ecological infrastructure and its role in water resource management

SDG 6.4 Substantially Increase Water-Use Efficiency

- WaterGrid-Sense - for applications promoting smart water use (water loss control at municipal level)
- Agricultural biological control agents - ability to improve soil health and crop growth rate - reduce water utilisation in agriculture
- Water Use Measurements – analysing water user behaviours for more accurate monitoring and planning of water allocations to promote water use efficiency and enhance productive water uses (water use audits – validation and verification)



Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

Validation and verification of lawful water use in South Africa: An overview of the process in the KwaZulu-Natal Province

E. Kapangaziwiri*, J. Mwenge Kahinda, S. Dzikiti, A. Ramoelo, M. Cho, R. Mathieu, M. Naidoo, A. Seetal, H. Pienaar

CSIR, Natural Resources and Environment, PO Box 395, Pretoria 0001, South Africa

SDG 6.5: Implement IWRM at all Levels

❖ Quantification of catchment processes impacting on water

- Understanding hydrological impacts of land-use changes through measurements & modelling.
- Agricultural, forest & alien invasive plant water-use.
- Catchment/WMA-scale water resources assessments & management.
- Use of Earth Observation data / Remote Sensing for spatial ET estimation & IWRM.
- Water use verification & validation.

- Water use efficiency - water productivity - water footprints/stewardship – national water use index.
- Geohydrological & geochemical assessments (GW/SW interaction).
- Reserve determinations, managed Aquifer recharge, geochemical monitoring.
- Supplementing water supplies – GW for irrigation.
- Rainwater Harvesting - rural water supply.

HORTGRO SUPPORTING THE HORTICULTURAL INDUSTRY

WATER RESEARCH COMMISSION

University of Pretoria

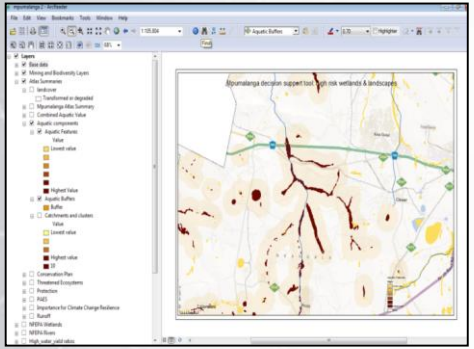
UNIVERSITY of the WESTERN CAPE

WWF

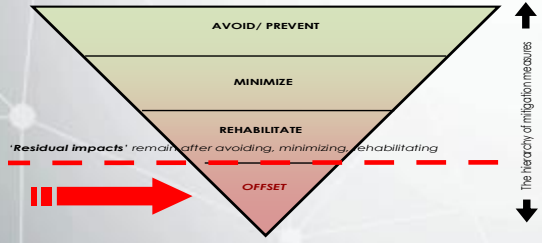
water & sanitation
Department: Water and Sanitation
REPUBLIC OF SOUTH AFRICA

SDG 6.6 Protect and Restore Water-related Ecosystems

❖ Ecological infrastructure and its role in water resource management



- The value of wetlands - valuable services to society that compliments traditional hard/built infrastructure is becoming increasingly important.
- Applied research – improve understanding & management of wetlands.
- Wetland Classification and Risk Assessment Index (WCRAI) - management of natural freshwater wetland ecosystems.
- Eskom initiative - in response to need for improving management of wetlands.
- Research work expanded - development of a High Risk Wetlands Atlas.



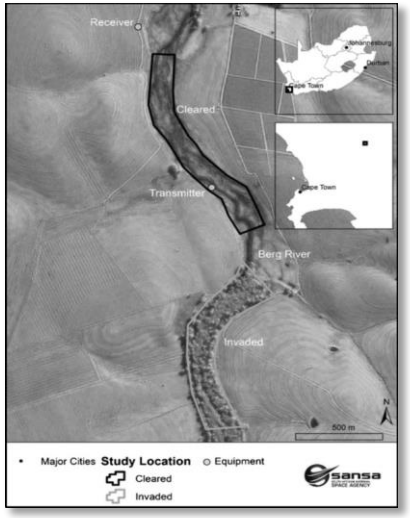
Some Project Examples…

❖ Responding to droughts and floods

- Water Bank / Managed Aquifer Recharge and Storage (MARS)
- Longstanding work with City of Cape Town in the Atlantic Water Supply Scheme
- Highly effective storage mechanism in that it reduces evapotranspiration

Quantifying potential water savings from clearing invasive alien

❖ Bergriver Catchment



- Rainfall over 1-year study period = 407mm
- Water use by large E. camaldulensis trees = 100 L/tree/day (winter) 260 L/tree/day (summer).
- (47 000 L/tree/year)
- Stand level Euc transpiration (≅833 mm/y)
- Potential for significant augmentation of streamflow through clearing of *E. camaldulensis*
- Actual volumes of water released will depend on differences in the water use characteristics of invaded stands relative to mature native replacement stands.

Desalination of inland water streams: maximum recovery of water

- Reducing brine to fresh water and dry salt at acceptable cost and energy consumption:
  - Release more fresh water
  - Treat contaminated water streams, including AMD
- Determine energy and economic feasibility of large-scale AMD treatment at Eskom power stations

- Develop modelling tools to allow realistic calculation of:
  - Energy demand, salt concentration, pressure, temperature and heat transfer surface areas for both MED and heat pumps in different configurations
  - Electricity generation impact on power stations of steam bled to drive MED and heat pumps

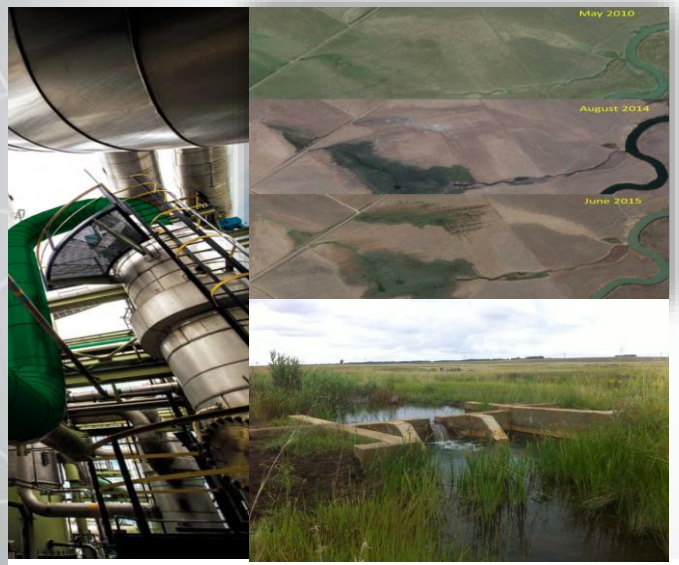
Eskom/CSIR

Water, Waste & Environmental Centre

Water	Fly Ash
Waste	Environment

Valuing Natural Resources

❖ Wetland rehabilitation (OMNIA Wetlands – Zaalklapspruit)



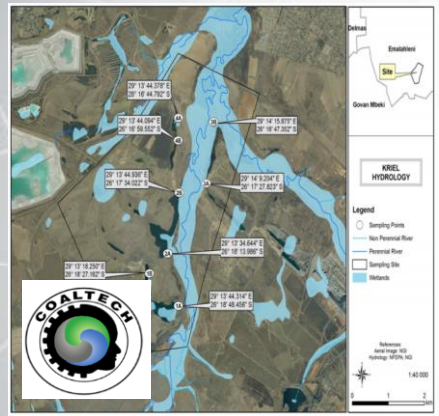
- Determine the status quo of the downstream environment in relation to their integrated water use licence
- Evaluate the potential use of constructed wetlands for effluent management

- Based on estimates of study, the asset value of Zaalklapspruit Wetland - between $42M - $65M, of which water purification & waste assimilation service contributes $11M - $48 M.
- By rehabilitating Zaalklapspruit Wetland at a cost of $145K – able to produce between $11M - $48M on the natural asset balance sheet of SA.

CSIR our future through science
SANBI Biodiversity for Life
COALTECH
WATER RESEARCH COMMISSION
PRIME AFRICA CONSULTANTS

Rehabilitation in Mining Areas

❖ Treatment of AMD and wetland rehabilitation

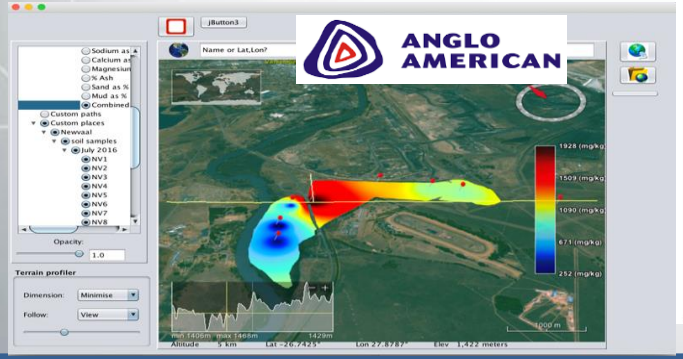


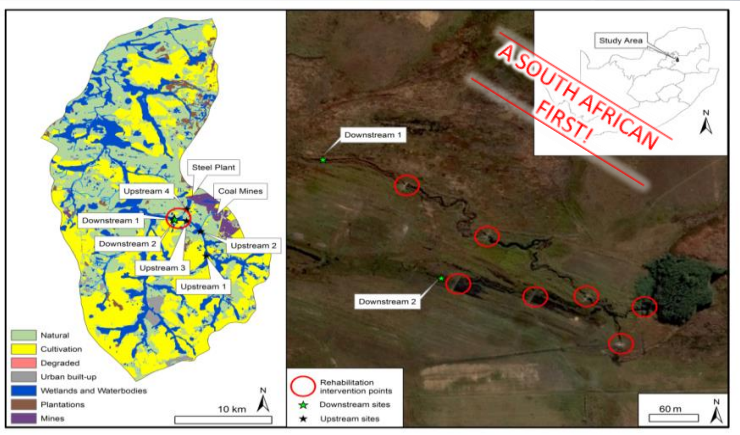
The outcome of the research aims to:

i) Inform water use license decisions regarding the monitoring and management of wetlands.

ii) Inform decisions regarding the management and treatment of acid mine drainage (AMD) as well as the potential of rehabilitating the wetlands.

iii) Enhancing goods and services that wetlands provide.





Transboundary Water Cooperation

Simulating interaction of multiparty co-investment and cooperation options

Results: SIMCCOTM developed as tool that supports interactive & cooperative gaming through role play, options ID & evaluation.
Use: Supports interactive gaming to simulate cooperative engagement between participants from the military and civil society to ID & discuss options to improve mission sustainability.
Future: Potential to upscale & replicate in different countries and with wide range of stakeholder groups.

Policy to inform flood and drought-induced migration

Scope: Advancing our understanding of the linkages between climate-induced migration and Southern Africa's preparedness to respond to internal and cross-border displacements due to environmental disasters.
Use: Strengthening regional and national policy to inform the impact of environmental migration in SA, and how to integrate it systematically into adaptation planning processes.
Future: Becoming the Southern African knowledge hub on climate-induced human mobility, growing international network.

CITY OF TSHWANE
IGNITING EXCELLENCE

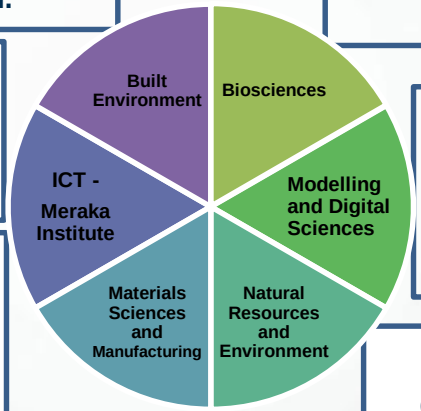
WATER RESEARCH COMMISSION

Integrated approach to address water & sanitation problems

Infrastructure interventions support
Waste water treatment technologies – membrane distillation.
Smart buildings – water use efficiencies and optimisation.

Effluent treatment technologies.

Wireless sensor networks - reticulation management .
Dynamic hydraulic model for water pressure management.



Advanced modelling – water demand and supply; Leakage detection; Water quality.

Rapid pathogen detection technology
Water & waste water purification – novel adsorbent technologies (to treat AMD and their industrial focus)
Near real-time monitoring systems

Emerging contaminants
Governance and planning support
Industrial water and waste water treatment

Way forward

- **The CSIR to further develop and strengthen its integrated water research capability**
  - **Developing a uniform vision and value proposition to address national water supply, use and reuse issues**

Thank you

our future through science