BULK SCALE INDUSTRIAL EFFLUENT REUSE POTENTIAL IN SOUTH AFRICA - ATLAS

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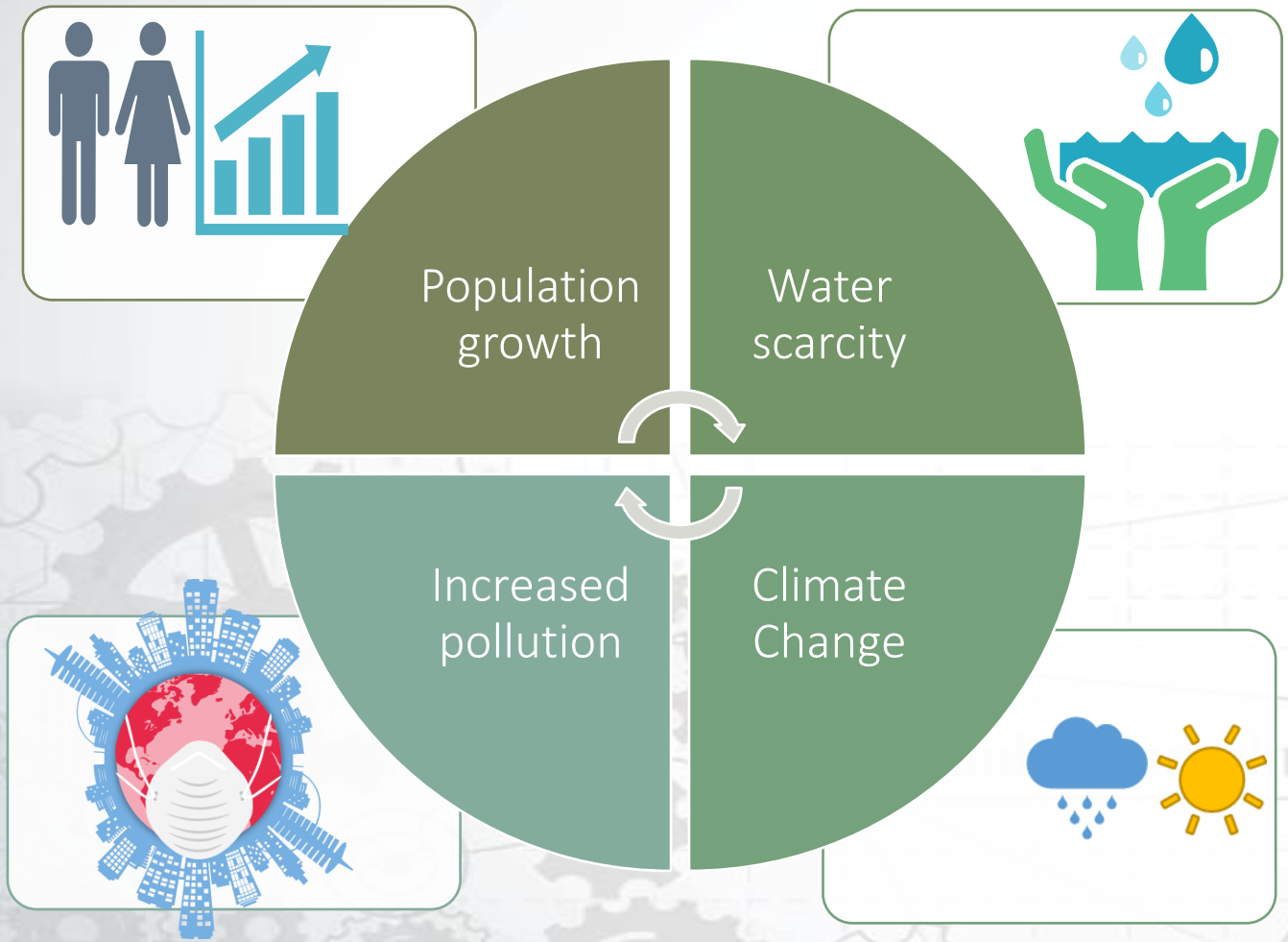
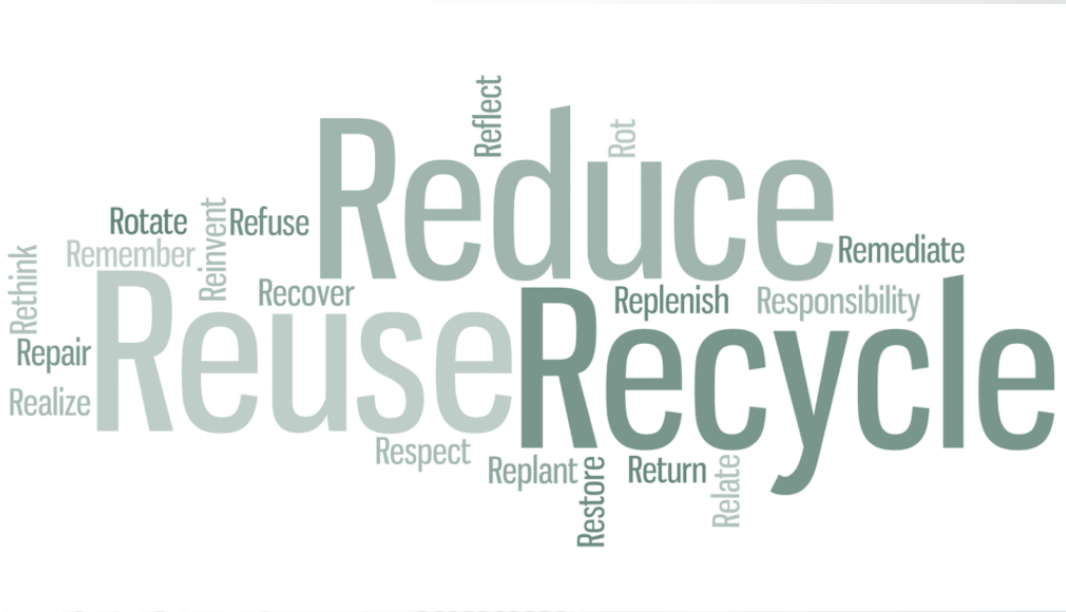
Water Institute of Southern Africa

CSIR
Touching lives through innovation

Introduction

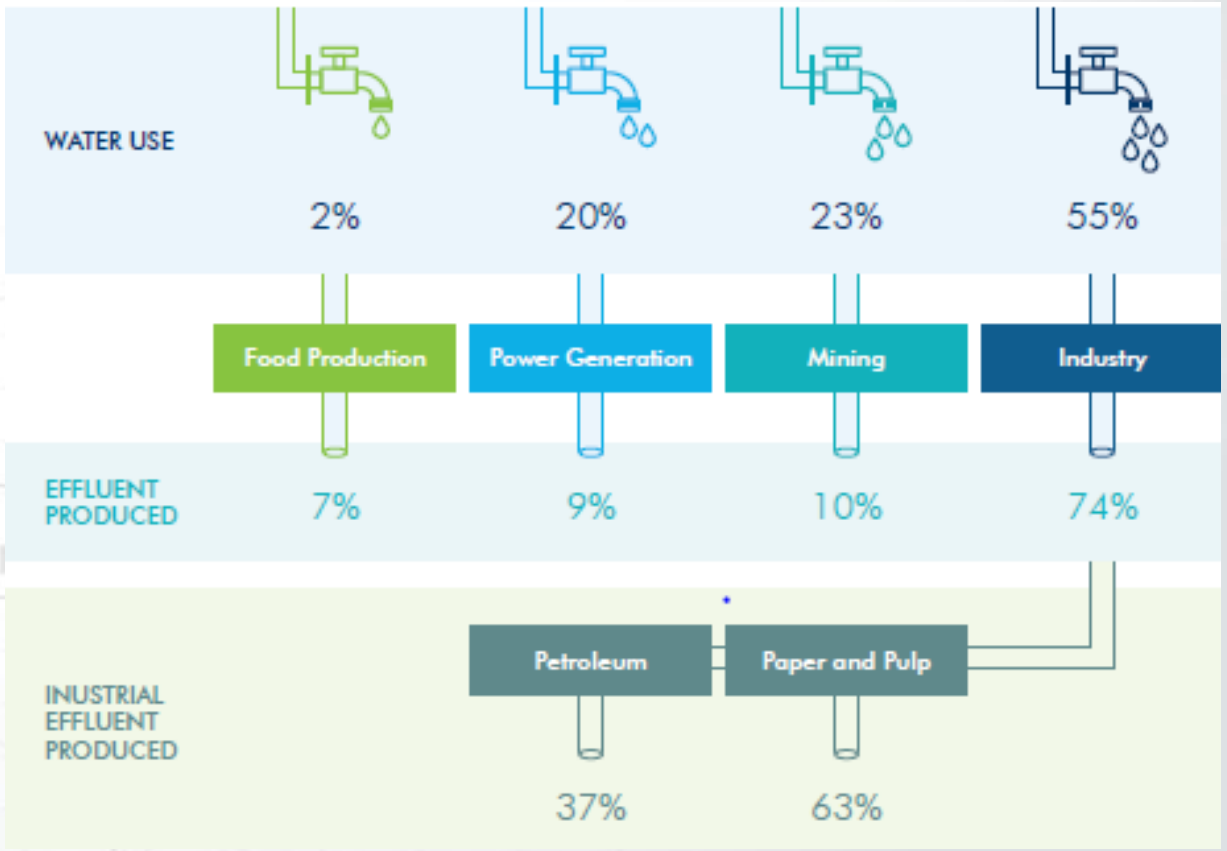




Rationale

17%
anticipated
water deficit

14%
wastewater
reused



Rationale

Water reuse objectives (US EPA, 2019)

Water Security

Sustainable access to an adequate quantity or acceptable quality water

Water Sustainability

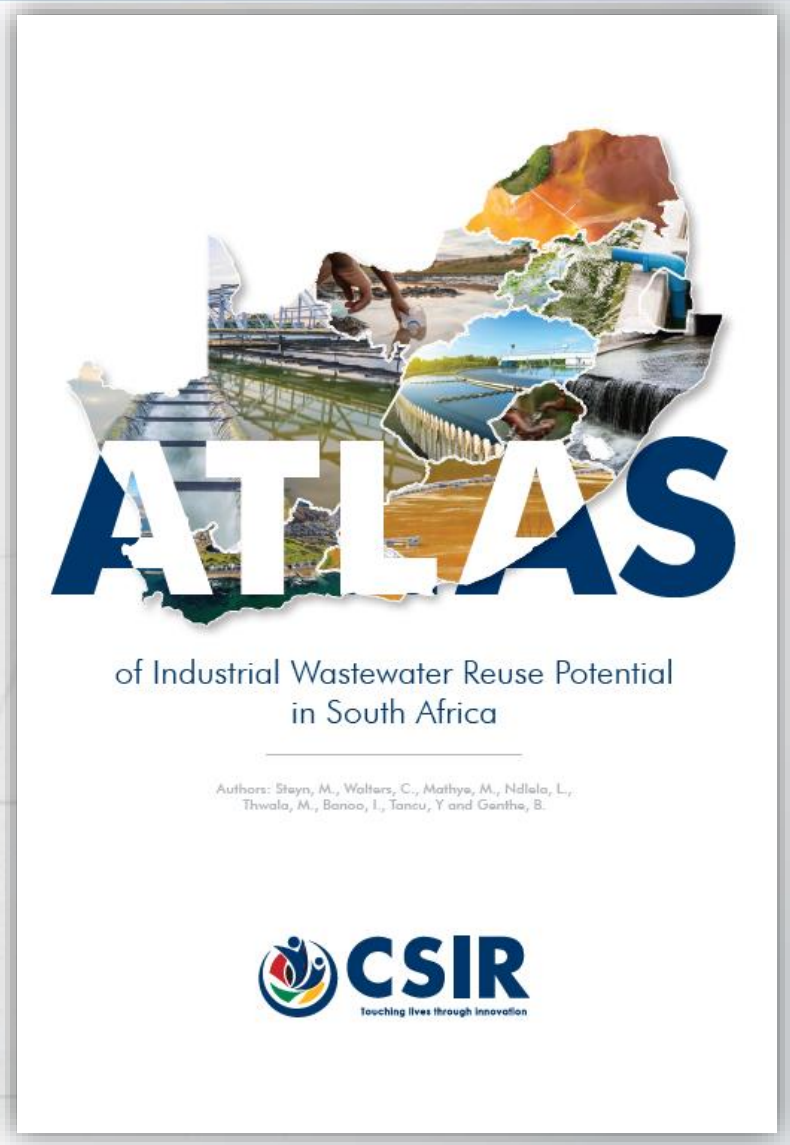
Clean water for humans and ecosystems

Water Resilience

Ability to adapt or withstand the effects of rapid hydrologic change or a natural disaster

Output: National Atlas of industrial wastewater reuse potential

Objective 1	Define water reuse for purposes of the atlas and discuss the drivers of industrial reuse in South Africa
Objective 2	Summarise the regulations and legislation underpinning industrial water reuse in the country
Objective 3	Provide examples of a few existing industrial reuse projects/activities currently taking place in South Africa
Objective 4	Describe “fitness for use” and the typical wastewater effluent quality for different industries
Objective 5	Identify some of the current barriers to industrial effluent reuse
Objective 6	Identify some of the current barriers to industrial effluent reuse



Drivers for Industrial Water Use

Industrial and population growth

South Africa's population is growing exponentially, and together with urbanisation, there is an increased need for power generation.

Freshwater costs

The cost of clean, fresh water is continually increasing, and is impacting all provinces of South Africa.

Regulatory requirements

Water use and discharge in South Africa needs to be registered and users need to obtain a water use license. Discharge regulations are in place that include volume and quality restrictions.

Social responsibility

Industry and the public have a social responsibility to protect the environment. Negative publicity around industry's water use will have an impact on a company's sales/growth.

Discharge costs

Sewer and wastewater costs have increased at a higher rate than freshwater costs.

Water scarcity

South Africa is a water scarce country, and many regions are susceptible to drought. Additionally, some industrial plants have limited access to clean/ fresh water.

Wastewater processing limitations

On-site industrial wastewater treatment capacities have not increased proportionally with production. Industry strive to meet higher flows with limited operational resources.

Sustainability efforts

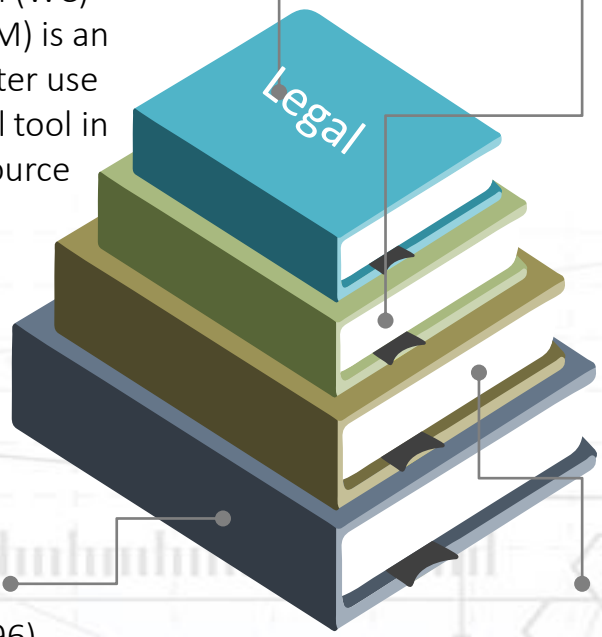
Industry strive towards sustainability by implementing economically sound programs and procedures to minimize a plant's negative environmental impact while conserving energy and natural resources.

Legislative framework

South Africa has extensive and comprehensive laws and guidelines regarding water use, reuse applications and effluent discharge.

Water Services Act

In line with the NWA and the WSA, (Act 108 of 1997) water conservation (WC) and demand management (WDM) is an important step in promoting water use efficiency and viewed as a useful tool in achieving Integrated Water Resource Management (IWRM)



NEMA

Reuse of effluent in the country requires environmental authorization in terms of the National Environmental Management Act (Act 107 of 1998)

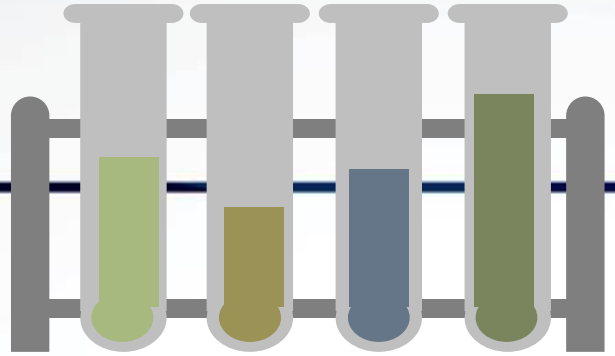
Constitution of RSA

The Constitution, (Act 108 of 1996) guarantees every person in the country the right of access to water and the right to an environment that is not harmful to their health or wellbeing now and in the future. .

National Water Act

The main legislation that governs water use and the discharge thereof in South Africa is the National Water Act (Act 36 of 1998).

Fitness for use



Alkalinity	Iron	Silica
Chemical Oxygen Demand	Manganese	Total Dissolved solids
Sulphate	pH	Suspended solids
Total Hardness	Chloride	

Category 1

Processes that require a high quality water with relatively tight to stringent specifications of limits for most or all the relevant water quality constituents. Standard or specialised technology is essential to provide water conforming to the required quality specifications Consequently, costs of inhouse treatment to provide such water are a major consideration in the economy of the process.

Category 2

Processes that require water of a quality intermediate between the high quality required for Category 1 processes and domestic water quality (Category 3 processes). Specifications for some water quality constituents are somewhat tighter or more stringent than required for domestic water quality. Standard technology is usually sufficient to reach the required water quality criteria. Cost for such additional water treatment begins to be significant in the economy of the process.

Category 3

Processes for which domestic water quality is the baseline minimum standard. Water of this quality may be used in the process without further treatment, or minimum treatment using low to standard technology may be necessary to reach the specifications laid down for a desired water quality. Costs of further inhouse treatment are not significant in the economy of the process.

Category 4

Processes that within certain limitations can use water of more or less any quality for their purposes without creating any problems. No additional treatment is usually required and there is therefore no further cost.

Paper and Pulp Industry

- Coloured compounds and absorbable organic halogens (AOX);
- Chlorinated lignosulphonic acids, chlorinated resin acids, chlorinated phenols and chlorinated hydrocarbons – about 500 different chlorinated organic compounds identified

Iron and Steel

- Pollutants characterized by BOD, COD, suspended solids (SS), toxicity and colour.
- Cooling water containing ammonia and cyanide. Gasification products – benzene, naphthalene, anthracene, cyanide, ammonia, phenols, cresols and polycyclic aromatic hydrocarbons

Food industry

- Variable BOD and pH depending on vegetable, fruit or meat and season.
- Meat – strong organics, antibiotics, growth hormones, pesticides and insecticides

Mining

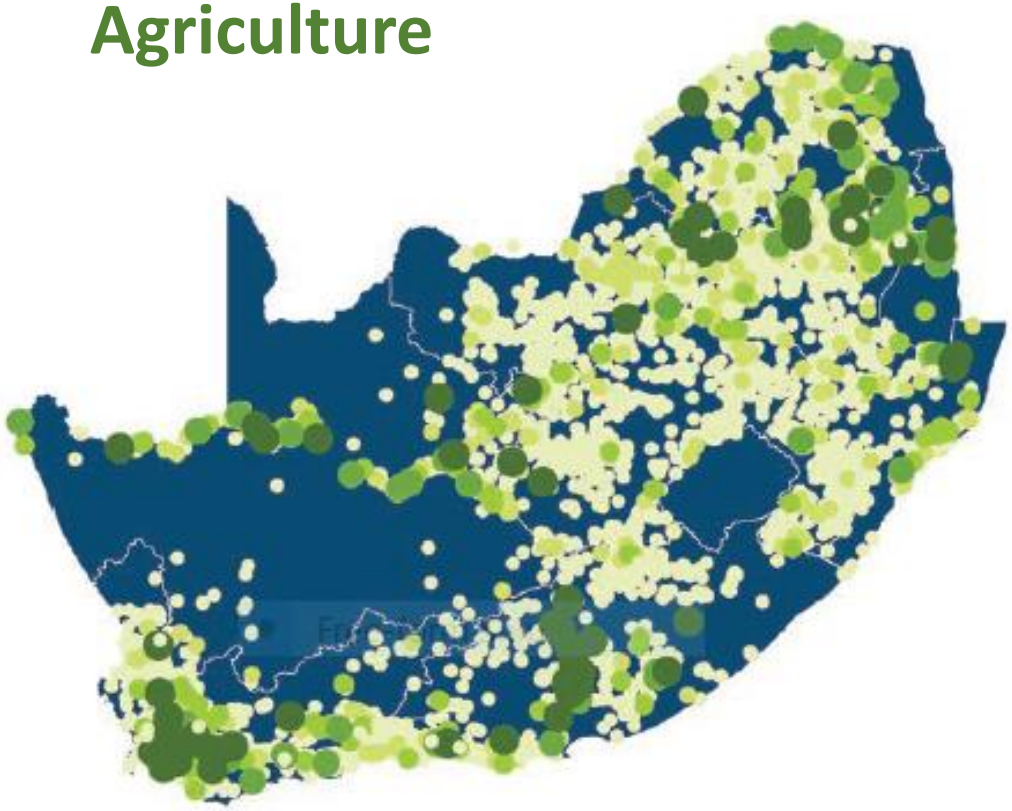
- Surfactants
- Oils and hydraulic oils
- Undesirable minerals, i.e. arsenic

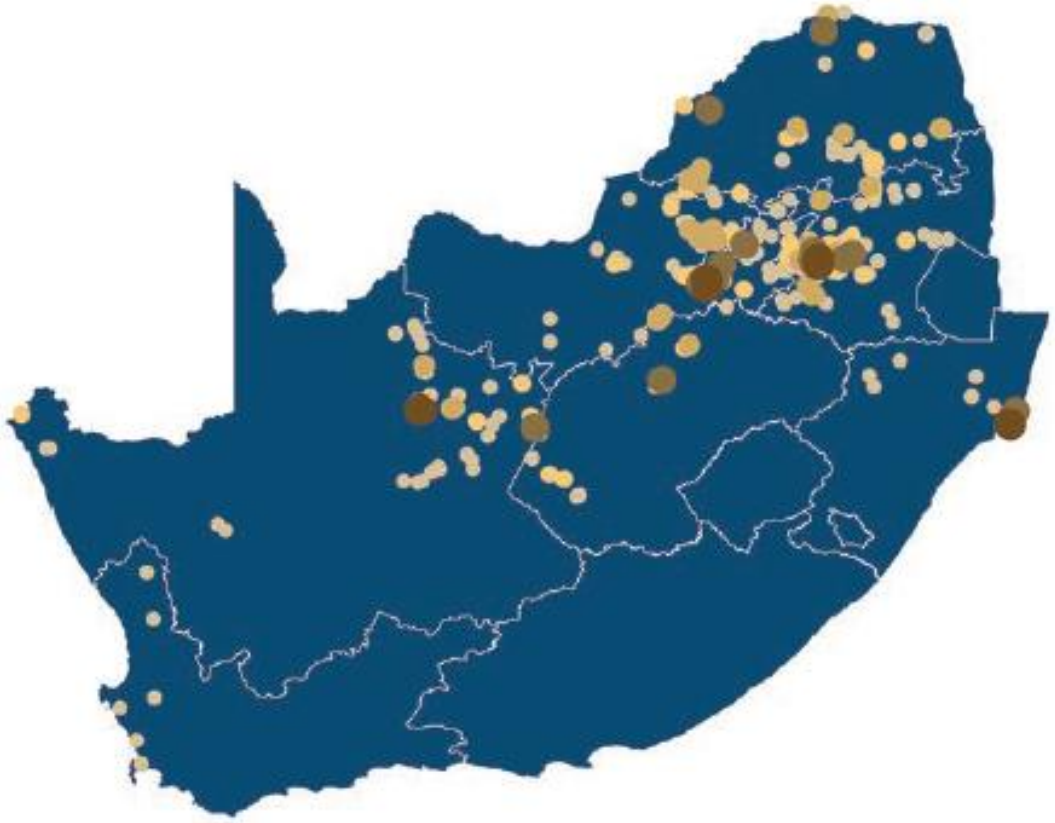
Brewing

- BOD, COD, SS, nitrogen, phosphorus - variable by individual processes
- • pH variable due to acid and alkaline cleaning agents
- • High temperature.

Bulk water use per sector

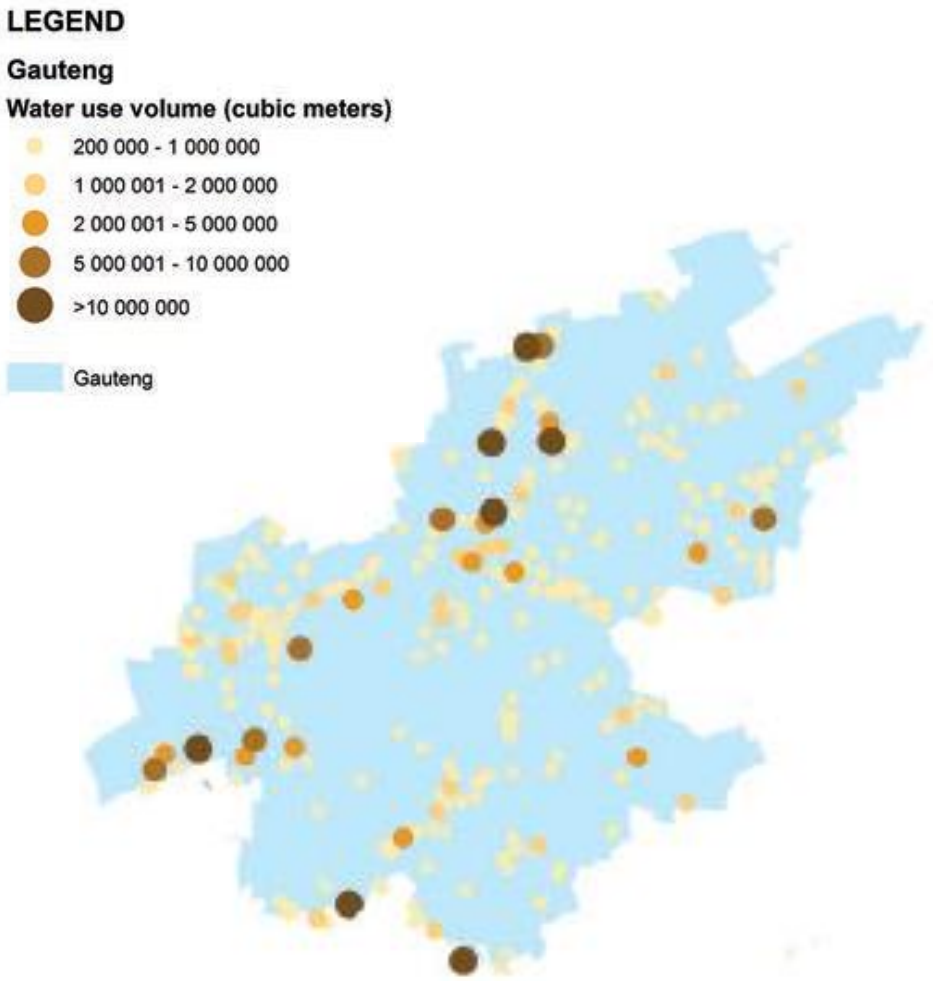
Agriculture

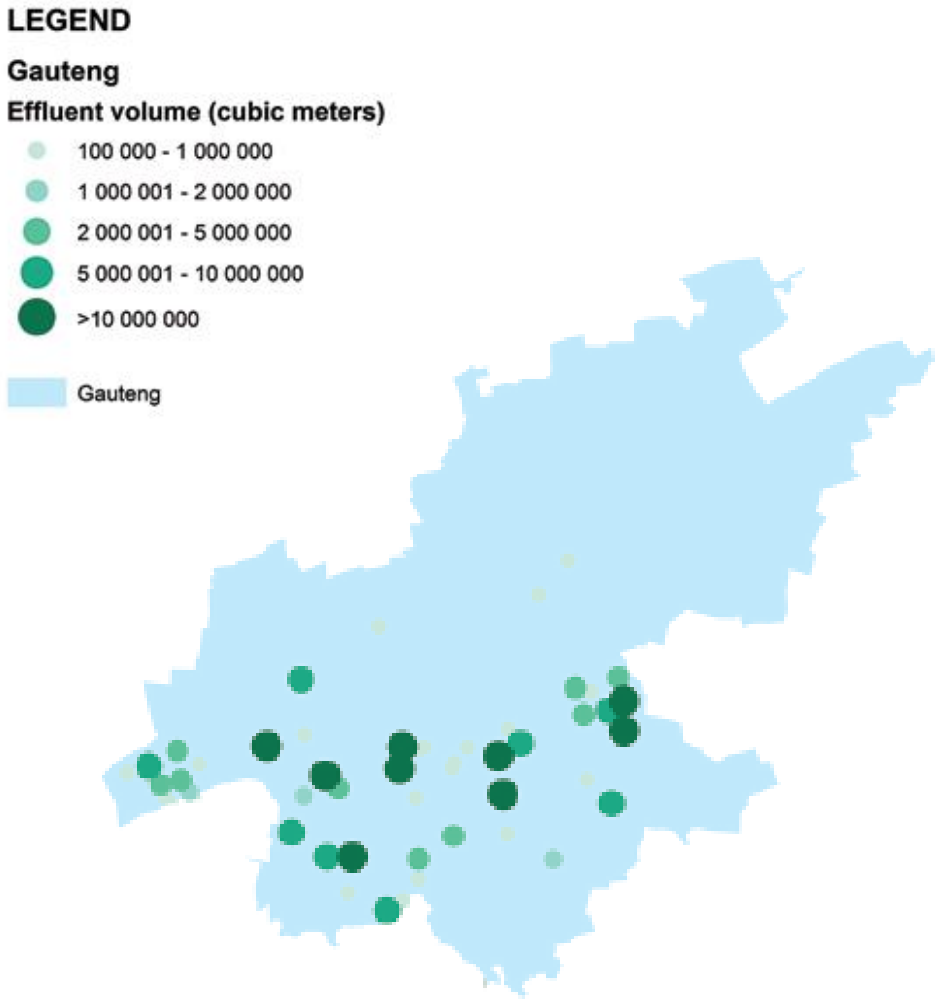




Mining

Bulk water use vs Bulk Effluent production





Barriers to Industrial Water Reuse in RSA

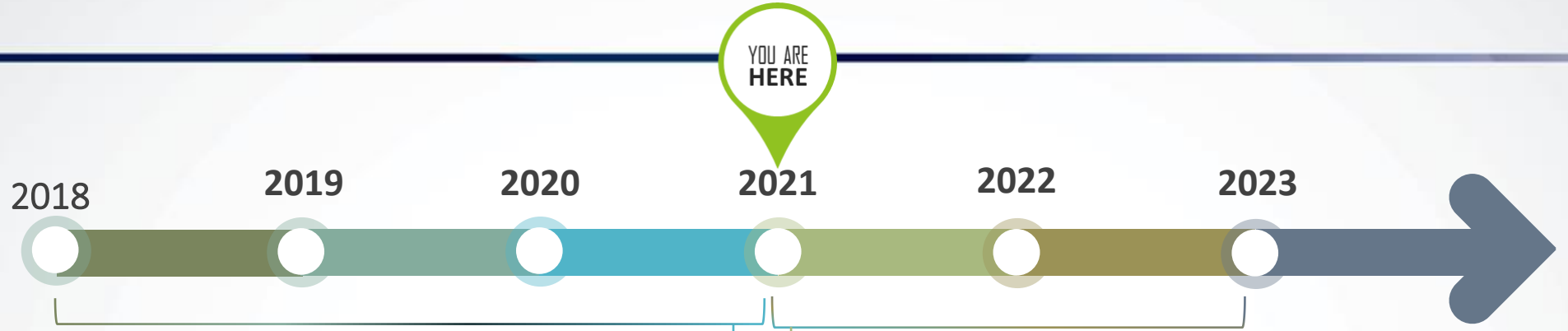
Large Capital Costs

Low freshwater abstraction tariffs

Legislative Requirements

Negative Public Perception

Overview: Bulk Water Reuse Program



PG Project: A Decision Support Tool for the prioritisation of bulk scale water reuse opportunities in South Africa and development of a risk-based decision support tool and approach to assess fitness for reuse

1. National Atlas of Industrial Wastewater Reuse Potential in South Africa
2. Risk-Informed Decision Support System (DSS) (Excel version) for Wastewater Reuse Potential as a draft CSIR technology demonstrator
3. Formulation of industry partnerships, specifically waster services providers in the form of metropolitan municipalities.

Government of Flanders Funding Concept Note

EoI: Mpumalanga Provincial Research Agenda 2020/24

PG Project: Piloting a risk informed Decision Support System (DSS) for the prioritisation of bulk scale industrial wastewater reuse opportunities in South Africa

1. Piloting and refinement of DSS
2. Development of web-based and mobile app of DSS
3. Internal and external validation of DSS and launch of DSS

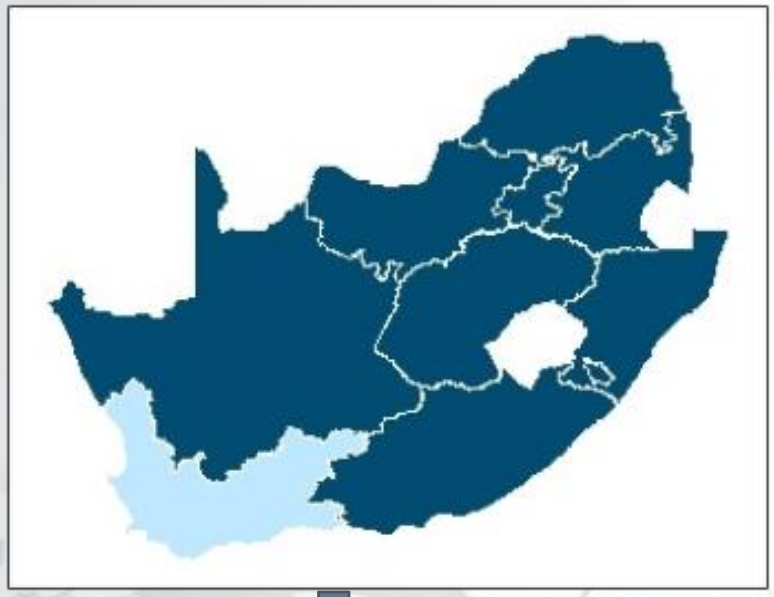
WRC Project: Development and piloting a risk-based decision support tool for the prioritization of bulk scale water reuse in metropolitan municipalities

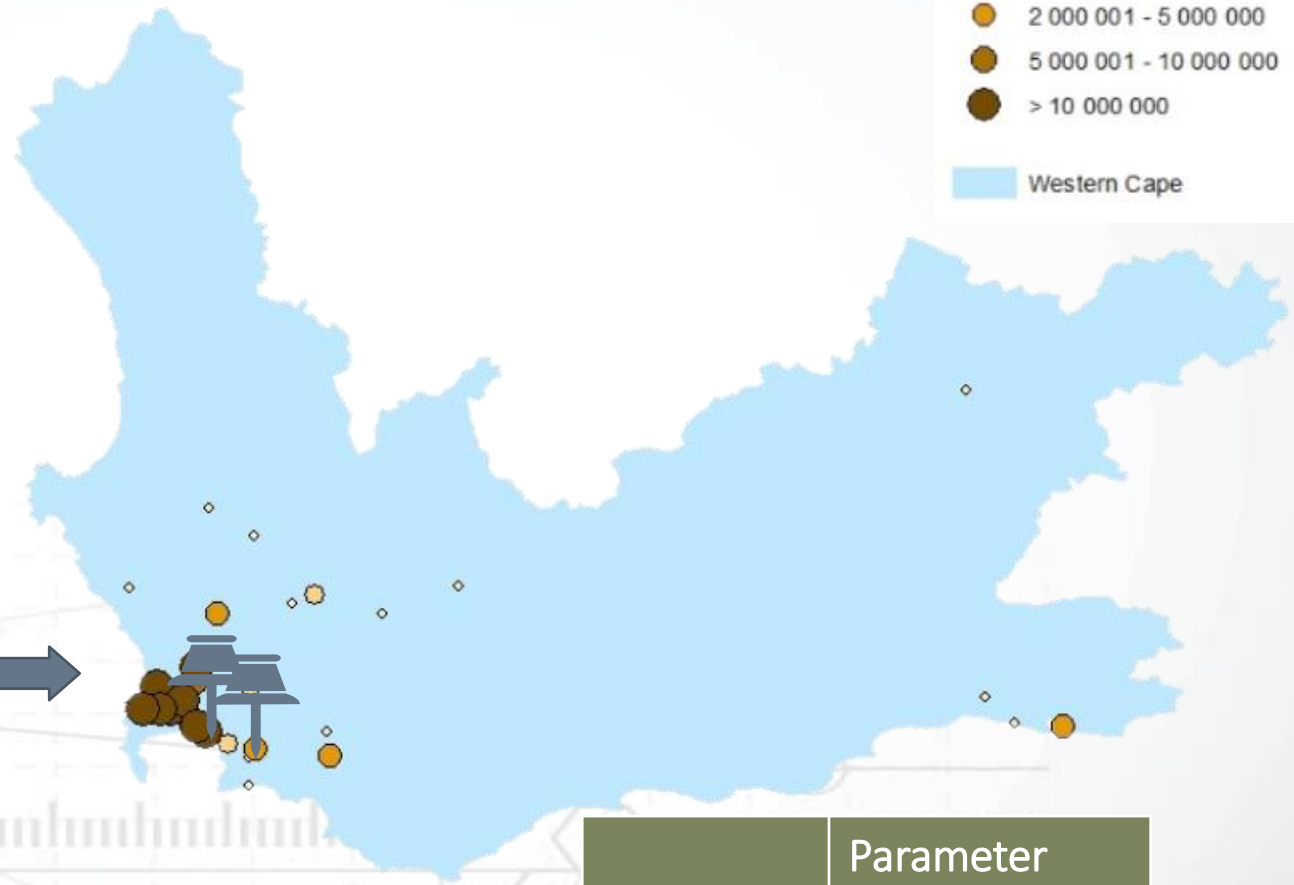
1. Multi-species toxicity bio-assays to assess fitness for use of water / wastewater
2. Final DSS for wastewater reuse potential and possible trade-offs

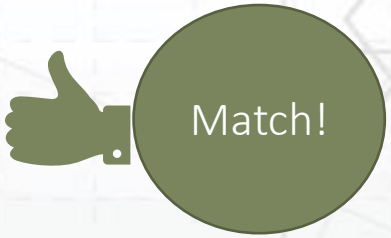
CSIR/GIZ Collaborative Agreement

1. Project 1: Collaboration with Ekurhuleni Metropolitan Municipality
2. Project 2: Collaboration on Strategic Water Partnerships Network activities related to the Integrated Vaal River System

DSS Development Example







	Parameter
✓	Water volume
✓	Distance (km)
✓	Water Quality

Way forward

- User-friendly system
- Water consumption and effluent data needed; fitness for use
- Interested to partner with metro’s and industry to improve DSS


4.0
INDUSTRY
Thank You