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

2030 NDP

CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2):

STRATEGY STEERING COMMITTEE

MEETING #2

Presented by:
JJ VAN WYK
Date: 13 March 2019

WATER IS LIFE, SANITATION IS DIGNITY

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PRESENTATION CONTENT

- 9.7.1. IMPLEMENTATION OF THE AMD LTS
- 9.7.2. DILUTION ASSESSMENT
- 9.7.3. WATER QUALITY MANAGEMENT STRATEGY TOR

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9.7.1. IMPLEMENTATION OF THE LONG-TERM SOLUTION (LTS) TO ADDRESS THE ACID MINE DRAINAGE (AMD)

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SHORT HISTORY: FEASIBILITY STUDY

- **September 2010:** In recognition of the challenges associated with AMD in the Witwatersrand, an **Inter Ministerial Committee** (IMC) **was formed**;
- **February 2011:** **Cabinet approved specific recommendations made by the Team of Experts** (ToE) for managing AMD in the Witwatersrand, **including the need for a Feasibility Study**;
- **April 2011:** The **Minister** of Water and Environmental Affairs **directed** the Trans-Caledon Tunnel Authority (TCTA) to implement **Short-Term Interventions** (STIs); and
- **January 2012:** The **contract** for the ***"Feasibility Study (FS) for a Long-Term Solution (LTS)*** *to address the Acid Mine Drainage (AMD) associated with the East, Central and West Rand underground mining basins"* **was awarded** to a multi-disciplinary Professional Service Provider (PSP) team to the amount of ±R 25 Million;
- **April 2013:** The **recommendations of the FS were approved** by the Departmental Functional Management Committee (FMC);
- **July 2013:** The **Feasibility Study was completed** (18 months later).

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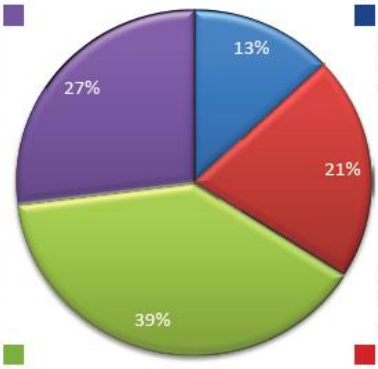
RELATIVE SALT LOADS REPORTING TO THE VAAL BARRAGE (2009)

Load received from up-stream (emanating from within the Vaal Dam Catchment) including all point and diffuse sources of pollution



Underground mine water contributions (emanating from within the Vaal Barrage Catchment)

Average daily TDS loads:
(Oct 2017 to Oct 2018)

Central Basin:	**203 ton/day**
Eastern Basin:	**159 ton/day**
Total:	**362 ton/day**

Diffuse contributions (emanating from within the Vaal Barrage Catchment) including the effects of atmospheric fallout, urban run-off, slimes dams etc.

Sewage & industrial return-flow contributions (emanating from within the Vaal Barrage Catchment)

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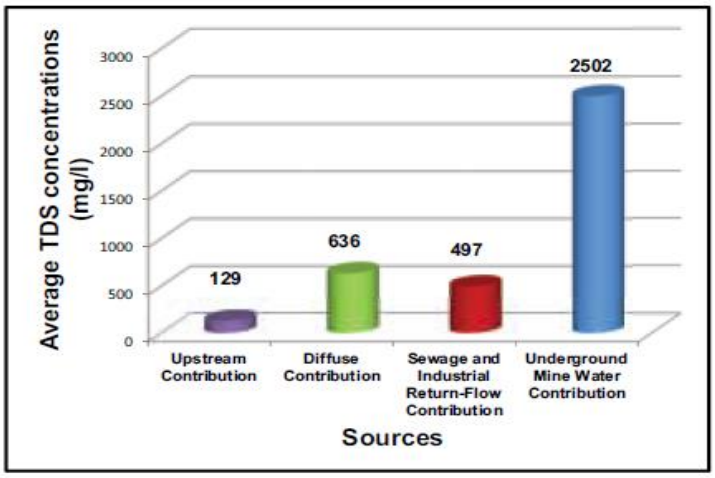
MOST CONCENTRATED SALT STREAM (2009)



Average daily TDS concentrations of partially treated AMD:
(Oct 2017 to Oct 2018)

Central Basin:	**4 019 mg/ℓ**
Eastern Basin:	**2 300 mg/ℓ**

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CAPEX & OPEX ESTIMATES: REFERENCE PROJECT

Description	Basin		
	Western	Central	Eastern
	R million		
CAPITAL COSTS (CAPEX) – STI	553	436	721
Grand Total for CAPEX	1 710		

Description	Basin		
	Western	Central	Eastern
	R million		
CAPITAL COSTS (CAPEX) – LTS	1 410	2 280	2 970
Grand Total for CAPEX	6 660		
Average Annual O&M and Lifecycle Costs (OPEX) – STI and LTS	230	330	430
Grand Total for OPEX per annum	990		

Base Date: March 2012 **Excluded:** Pipelines to possible remote industrial users; Acquisition of servitudes; Movable furniture and equipment; and Professional Fees.



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SUMMARY

- Surface and groundwater will continue to find its way into the underground workings of the East, Central and West Rand underground mine workings;
- The rate of ingress of such water into the underground mine workings can be reduced, but cannot be halted all together;
- AMD will continue to be produced when surface and groundwater come into contact with pyritic surfaces in the presence of oxygen;
- In order to protect environmental and socio-economic interests, from rising AMD levels in the mine voids, and to prevent uncontrolled decant to surface, continuous pumping of underground mine drainage is a pre-requisite; and
- The elevated TDS concentrations in and below Vaal Barrage remains to be of concern.

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NEXT STEPS

- The STI's for all three underground mining basins must continue;
- Ingress control interventions must be implemented as a high priority;
- Governance and management cooperation with DMR, and others, must continue, and improve, where necessary;
- Raising of the ECLs, with close monitoring, should be investigated;
- Monitoring, including water level monitoring (void) and WQ monitoring (for planning and modelling purposes), must be continued and expanded, where necessary;
- New and innovative treatment solutions should be piloted and developed;
- Re-establishment of the ToE to advise on the way forward;
- The updating of the Vaal IWQMS (2009) must be prioritised and the implementation thereof resourced.

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9.7.2. DILUTION ASSESSMENT

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SCOPE

- **Purpose:**
  - To compare the Vaal Barrage Dilution Model results to recent observations.
- **Rational:**
  - Virtually no dilution releases were required from Vaal Dam since the AMD discharges commenced in 2014 (Central Basin) and 2016 (Eastern Basin);
  - This was unexpected, particularly during low rainfall/ runoff periods; and
  - It was, thus, decided to undertake the assignment to determine if the model simulations exhibit similar behaviour.

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BACKGROUND

- The IVRS WRPM hydrology and salinity modules were recalibrated during the Vaal River System Analysis Update Study (2001) for the period up to 1995;
- The IVRS WRPM hydrology was further extended by ORASECOM in 2007, up to 2004;
- The model was subsequently applied in:
  - The development of the IVRS WQMS (DWAF, 2009); and
  - Various water resource risk analyses undertaken, as part of the IVRS Reconciliation Strategy and its maintenance.

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ASSESSMENT FINDINGS

- **Simulated dilution releases are higher than those observed since May 2016, *i.e.* the simulated salinity load is most likely too high;**
- **The mine dewatering discharge and treated waste water are point sources which can be modelled reasonably accurately;**
- **The model over estimation is likely due to the diffuse salinity load from the catchment wash-off (particularly for the highly developed catchments);**
- **Many changes in the catchment activities could have occurred that could influence the diffuse salinity load since the last calibration (1995); and**
- **The diffuse salinity load should be reassessed and the salt wash-off modules recalibrated.**

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RECOMMENDATIONS

- **Comprehensive recalibration of the salinity model for the Vaal Barrage Catchment is recommended, which would include:**
  - A full assessment of the **Vaal Barrage Catchment hydrology**, including recalibrating of the rainfall-runoff model;
  - Collection and collation of all available **hydrological** and **salinity related water quality time series data**;
  - Preparation and patching of the **hydrological and water quality data,** using best practise techniques;
  - Configuration and calibration of the **water quality modules in WQT**, focussing on salt wash-off parameters; and
  - Incorporate revised water quality modules into IVRS and **perform scenario analysis** to determine the implication on the dilution releases and other system components.
- **Recalibration will likely not negate the need for the LTS (desalination), but could result in changes to the extent and the possibility of phased infrastructure implementation.**

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9.7.3. WATER QUALITY MANAGEMENT STRATEGY TOR

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Something needs to be done!

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SELECTED KEY WATER QUALITY PLANNING ISSUES OF CONCERN (1)

	What should be done?	What has been done?
1.	**ISP, 2004:** Identified the need for **linked WQMSs** to be developed and implemented for the Vaal River and Orange River basins, respectively.	**Partially addressed.**
2.	**ISP, 2004:** Identified the need for **effective monitoring networks** and **information management systems**, as a prerequisite for the effective operation of the IVRS.	**Not adequately resourced.**
3.	**ISP, 2004:** Identified the need for the integration of WR management, planning and the **allocation of** water quantity and **water quality**.	**Not addressed.**
4.	**WDCS, 2000 – 2012:** Under development…	**WDCS not yet piloted.**
5.	**IWQMS, 2009:** Identified the need for the expansion of current **WQ monitoring programmes** to address planning and management needs.	**Not adequately resourced. (moving backwards)**
6.	**IWQMS, 2009:** Identified the need to **pilot a flow manipulation investigation** as part of a eutrophication management strategy.	**Not addressed.**
7.	**IWQMS, 2009:** Identified the need for the implementation of a **strategy to address microbial pollution** in the Vaal River.	**Not addressed.**
8.	**IWQMS, 2009:** Identified the need for the development and implement a **WQM Plan to address salinization caused by mining**, coal burning activities and wash-off from agricultural land in Upper Vaal.	**Not addressed.**

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SELECTED KEY WATER QUALITY PLANNING ISSUES OF CONCERN (2)

	What should be done?	What have been done?
9.	**IWQMS, 2009:** Identified the need for a **Strategy Steering Committee** is to be established to oversee the further development and implementation of WQM Plans and Strategies for the Vaal River Basin.	**Not addressed.**
10.	**NWRS, 2013:** Required the **reuse** of the Gauteng mine water return-flows to address high salinity levels in the Middle and Lower Vaal River.	**FS completed in 2013.**
11.	**Classification, 2016:** Produced WR Management Classes and RQOs that should be **accommodated in WQP** for the Vaal River Basin.	**Partially considered.**
12.	**IWQM Policy, 2016:** Found that **emerging pollutants** (*e.g.* nanoparticles, EDCs, POPs and antibiotics) exist, that due to the relative low levels of knowledge, may have adverse effects that are currently uncertain.	**Not (comprehensively) addressed.**
13.	**NW&S MP, 2019:** States that all water resources must be **fit-for-use by 2030**.	**To be addressed.**
14.	**SDGs, 2015 – 2030 (Country Target 6.3):** By 2030, **improve WQ 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**.	**To be addressed.**

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Something needs to be done!

Good planning is the first step in any effective management cycle…

… even more so, when managing natural resources, such as water!

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❶ STUDY GOAL, ❷ STUDY AREA AND ❸ PLANNING HORIZON

❶ **The over-arching goal of the study contract is to-**

- develop harmonized and an integrated **water quality management strategy and thematic plans for implementation**, that would **improve water quality**, where necessary, and **secure continued fitness-for-use** of water resources within the study area, in support of ecologically sustainable economic growth and social development in South Africa.

❷ **The Study Area is located within the Orange River Basin and consists of the Vaal River System and its linkages to other river systems.**

The relevance of the linkages referred to, specifically include, but is not necessarily limited to,

- *the influence of the transfer schemes located in the Senqu River Basin in Lesotho,*
- *the impacts on the fitness-for-use requirements of the Lower Orange River, and*
- *the linked river systems in the Upper Vaal area that supply Eskom and Sasol and that may be impacted upon by coal mining.*

❸ **The planning horizon extends up to 2050, narrowing the focus of assessment, planning, and strategy and plan establishment accordingly.**

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HIGH-LEVEL TOR: DEVELOPMENT OF WQM PLANS FOR THE IVRS

STUDY START AND PLANNING INCEPTION:

Component 1: Study inception;
Component 2: Review of existing literature, and water resource data and information;

PLANNING ASSESSMENT:

Component 3: Planning catchment assessment;
Component 4: Vaal River flow modification and dilution releases assessment;
Component 5: Integrated modelling;
Component 6: Establishment of water quality load balances and management objectives;
Component 7: Determination and integration of Water Quality Planning Limits (WQPLs);

STRATEGIZING, THEMATIC PLAN DEVELOPMENT AND IMPLEMENTATION:

Component 8: Water quality reconciliation, foresight, scenarios evaluation and management options analysis;
Component 9: Integrated water quality management strategy, with linkages to the Orange River;
Component 10: Salinity Management Plan for the Grootdraai Dam Catchment;
Component 11: Salinity Management Plan for the Middle Vaal River;
Component 12: Nutrient Management Plan for the Middle Vaal River;
Component 13: Recommendations in respect of monitoring;
Component 14: Implementation;

STUDY SUPPORT AND CONCLUSION

Component 15: Consultation, communication and capacity building;
Component 16: Study management and administration support; and
Component 17: Study closure.

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CONCLUSION
NATIONAL WATER AND SANITATION MASTER PLAN
VOLUME 2: PLAN TO ACTION Version 4.2
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31 October 2018
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