Resource water quality status of the Crocodile West Catchment

MW (Lebo) Mosoa
Overview of the presentation

• Study area.

• Background: RWQOs

• Background: Determination of water quality compliance and status.

• Water quality compliance & current status.

• Recommendations & way forwards

• Current Water quality initiative: Harties Metsi a me project
Background: 
Determination of Water Quality Compliance and Status 
(Resource Water Quality Objectives)

According to the National Water Act (Act 36 of 1998)

- Minister is required to use the classification system established in Part 1 to determine the class and resource quality objectives of all or part of water resources considered to be significant.

- **RQOs: clear goals relating to the quality of the relevant water resources**

- **RWQOs: It is the water quality component of the RQOs outlining water user needs with respect to WQ as well as their needs with respect to the disposal of water containing waste to the resource**
Background: Determination of Water Quality Compliance and Status

• The following water users (SAWQG, 1996) were considered in determining the fitness for use: BHN, domestic, agricultural, industrial, and ecological requirements.

• The variables of concern and importance in the catchment:
  – Electrical Conductivity / TDS- indicator of salinisation
  – Chlorides
  – Sulphates- indicator of mining impacts
  – Phosphates & Nitrates- indicator of nutrient levels
  – Ammonia- indicator of toxicity
  – pH- indicator for mining impacts
Water Quality Compliance to RWQOs
Map Description

This water quality data has been collated from data available on the Water Management System (WMS). A process of monitoring point selection was undertaken in order to select appropriate water quality sites per secondary drainage region.

The water quality data per monitoring point was compared to the water quality objectives derived for WMA 3 [Crocodile (West) and Marko]. The water quality compliance to objectives was derived using data for the period 1 January 2004 to 31 December 2008 (5 years). The water quality trend was derived using data for the same period.

Water Quality Compliancy Chart

See compliancy table for compliancy limits

NH4-N
(mg/l)
Ammonia
Compliant
Non-Compliant

Cl
(mg/l)
Chloride
Compliant
Non-Compliant

PO4-P
(mg/l)
Orthophosphate
Compliant
Non-Compliant

EC
(mS/cm)
Electro.
compliance
Compliant
Non-Compliant

SO4
(mg/l)
Sulphate
Compliant
Non-Compliant

pH
(pH units)
Compliant
Non-Compliant

Water Quality Trend

😊 Water quality deteriorating (Concentration levels are increasing)
😊 Water quality improving (Concentration levels are decreasing)
viol Water quality stable (Concentration levels are stable)
مجتمع Blank Hexagon: No historical data available to show trend
Crocodile West Catchment Compliance Map

Upper Crocodile West catchment
Current Water Quality Status
Water Quality Status (cont...)

- Water quality is a driver of the status of the water resources in the catchment.

- Main water quality concerns are related to:
  - Nutrient status
  - Salinity impacts
  - Microbial contamination

  Due to waste water discharges & flow regulation
## Water Quality Status (cont...)

<table>
<thead>
<tr>
<th>Catchment Area</th>
<th>Driver of Water Quality status</th>
<th>Water Quality status</th>
<th>Variables of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Crocodile River</td>
<td>Urbanisation &amp; waste Water discharges</td>
<td>Poor WQ</td>
<td>High levels of nutrients &amp; salt concentration</td>
</tr>
<tr>
<td>Magalies</td>
<td>Land based activities</td>
<td>localised impacts</td>
<td>None identified</td>
</tr>
<tr>
<td>Elands</td>
<td>mining activities &amp; erosion</td>
<td>middle and lower reaches have fair WQ</td>
<td>high sediment load</td>
</tr>
<tr>
<td>Hex River</td>
<td>intensive irrigation activities</td>
<td>poor</td>
<td>elevated concentration of salts, nutrients &amp; toxicants</td>
</tr>
</tbody>
</table>
### Water Quality Status (cont...)

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<tr>
<td>Apies/ Pienaars (lower catchment)</td>
<td>Discharges from industries &amp; WWTW</td>
<td>Poor</td>
<td>nutrients &amp; salinisation</td>
</tr>
<tr>
<td>Apies/ Pienaars (upper catchment)</td>
<td>Urban return flows, WWTW &amp; land based activities</td>
<td>Poor &amp; deteriorating further</td>
<td>high pH</td>
</tr>
<tr>
<td>Lower crocodile</td>
<td>Urbanisation, industrial diffuse sources &amp; high agricultural return flows</td>
<td>Deteriorating WQ</td>
<td>salts &amp; nutrients • toxicants (in the middle reaches of the river)</td>
</tr>
</tbody>
</table>
Recommendations & way forward

Poor WQ has serious environmental impacts & can limit potential for water re-use.

• Salinity impacts needs to be managed.

• Eutrophication due to increased nutrient concentrations needs to receive attention.

• Detailed & comprehensive RWQOs needs to be set for major rivers and impoundments. To reconcile the need to protect and the need to use the water resource.

• Management options should be investigated towards achieving those RWQOs.

• Appropriate remedial measures needs to be taken to lessen the impacts in affected streams and impoundments.
Current Water Quality Initiative in DWA

Harties, Metsi a me “My water”

HARTBEESPORT DAM
INTEGRATED BIOLOGICAL REMEDIATION PROGRAMME

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Acknowledge the involvement of Rand Water in the project
Republic of South Africa

- Crocodile West Marico Catchment
- Hartbeespoort Dam
- Bojanala District Municipality
- Madibeng Local Municipality
Problem statement

• The Hartbeespoort Dam was identified as being in a **hypertrophic state**
  – which means there are excessive nutrients like phosphate and nitrogen in the dam due to a combination of factors
Some of the WQ drivers and symptoms at Hartbeespoort dam

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urbanisation:</td>
<td>Depleted riparian variation &amp; in-stream habitat</td>
</tr>
<tr>
<td>• 700+ Mega Liters of purified sewage p/d</td>
<td>• Shrinking wetlands</td>
</tr>
<tr>
<td>• 280+ tons of phosphate p/a</td>
<td>• Toxic microcystis algal blooms</td>
</tr>
<tr>
<td>• Exotic fish - Mainly bottom dwelling fish (Carp, Barbel, Canary Kurper)</td>
<td>• Exotic water plants (Hyacinths)</td>
</tr>
<tr>
<td></td>
<td>• Distorted food web and fish population</td>
</tr>
<tr>
<td></td>
<td>• Depleted diversity in catchment and dam</td>
</tr>
</tbody>
</table>
**CROCODILE RIVER**
Average inflow (Volume) = 170 mil m³
Average PO4 concentration = 0.12 mg/l
Modelled load PO4 = 166 000 kg/a (80 - 300 x10³)
Point discharges = 620 Ml x 365 days x 1.0 mg/l
= 226 300 kg/a
Direct discharges =440 Ml/d x 365 days x 1.0 mg/l
= 160 600 kg/a

**MAGALIES RIVER**
Volume = 18 mil m³
Concentration total P = 0.0582 mg/l
Load total P = 1047 kg/a

**HARTEBEESPOORT DAM**
Volume = 205 mil m³
Concentration total P = 0.122 mg/l
Load total P = 25 010 kg

**HARTEBEESPOORT DAM TOTAL PHOSPHATE MASS BALANCE**

**USAGE FROM DAM**
Volume = 176 mil m³
Concentration total P = 0.17 mg/l
Load total P = 29 920 kg/a

**IN HARTEBEESPOORT DAM: Full level**
Volume = 205 mil m³
Concentration total P = 0.122 mg/l
Load total P = 25 010 kg

**HARTEBEESPOORT DAM SEDIMENTS**
Volume = (i) 194,6 mil m³ TP or
= (ii) 2062 ha x 20 cm
Total P = (i) 1230 mg/kg or bio-avail. PO4= (ii) 0.44 mg/kg
(580 ?)
Load P = (i) 1,79 X108 kg or
Bio-avail. = (ii) 881 kg
(1 195 653 kg)

**INCOMING SEDIMENTS**
Main Objectives of the programme

• Implement IWRM principles in Catchment to enhance Growth, Development and Work Creation.

• Determine, Optimise & Manage Physical and Biological conditions in the dam to ensure reduction in algae (blue-green) and biomass.

• The remediation programme is focusing on projects with short term results and will be implementing them in parallel with longer term challenges.
Project Goals

• The establishment of symptomatic treatment, restorative action and creation of biological self-cleaning balanced ecosystem in the dam basin.

• Restoring and protecting the natural filters (wetlands and riverbanks) in the immediate catchment of the Hartbeespoort Dam.

• The regulation of water use in greater Hartbeespoort Dam catchment.
  – Including the development of a Resource Management Plan (RMP) for the dam that may become the blueprint for similar plans for other impoundments. (The RMP project was launched in September 2007)
Thank you