Scope

- Hartbeespoort Dam 1 of 9 Hypertrophy in RSA
- 7 of 9 in Crocodile Marico Catchments
What is a hypertrophic dam?

Dam water *excessively* enriched by

- **phosphate** and
- **nitrogen** nutrients,

where algal growth is limited by

- Solar **Radiation** and
- Water **Temperature**

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**Hartbeespoort Dam 2016 hectares**
### Hartbeespoort Dam: Infrastructure

- **Catchment Area:** 4,112 km²
- **Mean Annual Rainfall:** 670 mm
- **Mean Annual Evaporation:** 1,690 (S) / 1,246 (D)
- **Surface Area:** 2,034 ha
- **Mean Annual Run-off:** 163 million m³
- **Full Supply Capacity:** 195 million m³
- **Firm Yield (1990):** 158 million m³
- **Urban runoff/return flows:** 103 million m³
- **Wall height:** 59 m
- **Crest length:** 101 m

### Building of the Hartbeespoort Irrigation Scheme

- Construction started in 1916 after the First World War and completed early 1923
- Canals – 5 years later
- **Material used in dam wall:** 68,000 m³ concrete
- **Spillway:** 10 Crest gates
- **Spillway capacity:** 2,322 m³/s
- Dam was **raised in 1970** through the installation of the crest gates
Hartbeespoort Dam: Infrastructure

- History:
  - Planned as early as 1902
  - Formation of Union of South Africa in 1910 delayed work
  - First World War (1914) further delayed construction
  - Compensation for land took from 1914 to 1918
  - Great Flu epidemic (1918) and strikes in 1922
  - Work started in 1921, completed 1923
  - Served to provide employment and poverty relief to unemployed
  - Max of 1835 men employed on dam

Layout of the canal system and drainage canals

- Left Bank Main Canal (West) 56 km long
- Right Bank Canal (East) 48 km
  - North Canal – extension 24 km
- Drainage canals 52 km
- Branch canals in total 532 km

Outlet Structures upgraded 2005 R 10 mil +
What does Hartbeespoort Dam look like?

Impacts and Challenges

- Health Risk
- Environmental
- SMELL
- Recreational
- Water Purification
- Property Development
- Downstream water use - Water Loss
Problem Statement

- 600 Mega Liters of purified sewage p/d
- 166 tons of phosphate p/a.

Hartbeespoort dam: Significant PO4 point discharges

1 = KELVIN POWER
2 = KYNOCH CHLOORKOP
3 = HARTBEESFONTEIN SW
4 = OLEFANTSFONTEIN SW
5 = CENTURION SW
6 = NORTHERN SW
7 = DRIFONTEIN SW
8 = RANDFONTEIN SW
9 = PERCY STEWARD SW
10 = RIETFONTEIN SW
Sewage pipeline from urban metropolitan to Northern Sewage Works

Northern Sewage Works - waste water treatment plant
Impact - discharge continuous high flow into Jukskei River by Northern Sewage Works

Artificial Wetlands – aeration plays an important role
Problem Statement

- 600 Ml of purified sewage p/d
- 166 tons of phosphate p/a.
- Depleted riparian variation
- Shrinking wet lands
- Impacts from Desertification / Social Drought
Natural Wetlands

Past & present impacts on rivers and natural wetlands due to:

Non-controlled activities e.g.
- Urbanization, Agriculture, Industrial & Mining
  - Hard surface e.g: Infrastructure & roads
  - Increased runoff
  - Reduction in recharge
  - Continuous high flow from return flows
Natural Wetlands

The result:
- Increased storm-water, waste-water discharge & surcharge flows – destruction e.g. Erosion.
- Riparian vegetation destruction.
- Loss of habitat - destruction of biodiversity.
- Sedimentation.
- Degradation of land

Impact - agricultural use – Clayville wetland

Flood-plain used to grow maize
Impact - agricultural use – Clayville wetland

Impact - erosion & part of the gabions which have been washed away due to high flows – Clayville wetland
Prior impact - natural flood areas showing mostly natural riparian vegetation

Impact – riparian vegetation destruction - Dainfern Golf Estate
Impact - riparian vegetation destruction - Heronbridge College

Impact - Sand mining - Jukskei River
Impact - urban metropolitan

Problem Statement

• 600 Mega Liters of purified sewage p/d
• 166 tons of phosphate p/a.
• Depleted riparian variation
• Shrinking wet lands
• Impacts from Desertification / Social Drought
• Toxic microcystis algal blooms
• Exotic water plants (Hyacinths)
• Exotic fish (Carp)
• Distorted food web and fish population
Excessive algal blooms, hyacinth & toxicity
RESULTS & DISCUSSION

SPECIES COMPOSITION

Oreochromis mossambicus (Mozambique Tilapia)
Chelila flaviventris (Canary Kurper)
Tilapia sparrmanii (Banded Tilapia)
Pseudocrenilabrus philander (Southern Mouthbrooder)
Micropterus salmoides (Largemouth Bass)
Cyprinus carpio (Carp)
Barbus unitaeniatus (Longbeard Barb)
Clarias gariepinus (Sharptooth Catfish)
Barbus mattozi (Papermouth)
Barbus trimaculatus (Threespot Barb)
Labeobarbus marequensis (Largescale Yellowfish)
Labeobarbus polylepis (Smallscale Yellowfish)
Barbus paludinosus (Straightfin Barb)

RESTRICTURING THE FISH COMUNITY
THE PROGRAMME...

HARTBEESPOORT DAM
INTEGRATED BIOLOGICAL REMEDIATION PROJECT

Who Lives / should live in Hartbeespoort Dam?

Phytoplankton
Zooplankton
Fish
The Plan

- Overarching Projects
  - Inter Governmental Steering Committee
  - Project Coordinating Committee
    - Change control
    - Management
    - Monitoring and Auditing
  - Research and Development
  - Fund Raising
  - Communication and Awareness
    - Communication Centre
    - Information Management
Dam Basin

- Manage Recreational Activities

Biomass Management
- Control and Remove Algal
Dam Basin

- Biomass Management
  - Control and Remove Algal
  - Control Floating wetlands
Dam Basin

- Biomass Management
  - Control and Remove Algal
  - Control Floating wetlands
  - Shoreline vegetation

- Control Hyacinths
Dam Basin

- Sediment Removal

Crocodile River – sedimentation, urbanization, riparian vegetation destruction & toxic algae
**Dam Basin**

- Fishery Management and Monitoring
  - Commercial Fishery
  - Food web (Zooplankton)

**Downstream**

- Aqua Culture Hub
- Water Use Efficiency
Upstream

- Pre-Impoundment, Litter Trap, Dredging and river water treatment
- Upstream wetlands, Riparian vegetation and in stream habitat
- Phosphate reduction
- Silt and erosion Management
- Storm water management

Implemented Activities - Feb 2008

Business plan development

Algal Harvesting
  - Floating booms
  - Pump stations
  - Raft
  - Floating Islands

Hyacinths Harvesting
Dam Basin - access for The Plan

HARTBEESPOORT DAM REMEDIATION PROGRAMME - LAND REQUIREMENTS

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Meerhof Public Access
Area 2 Algae & sed.
treatment
Area 3 Litter trap

Oberon
Public access

12 ha
39 ha
Thank You

www.dwaf.gov.za/harties