# The eMkhomazi Water Project Phase 1

**Project Steering Committee (PSC)**
**7 June 2012**
**Main Boardroom, BKS Durban Office**

water affairs
Department: Water Affairs
REPUBLIC OF SOUTH AFRICA

BKS

## Agenda

**4. Background to the eMkhomazi Water Project**

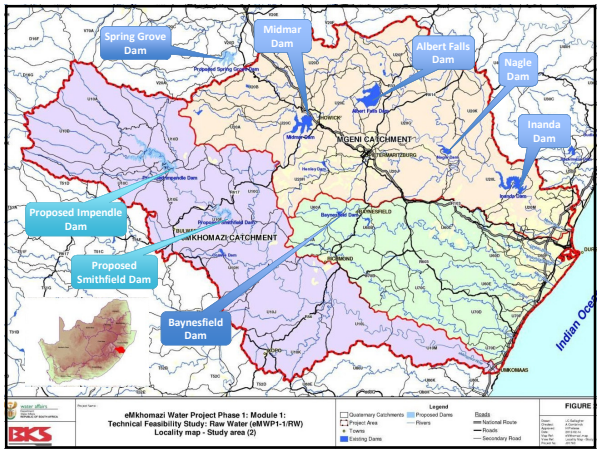
- Background to the project
- Project components
- Project cycle
- Governance of the project
- Project structure (modules of the project)

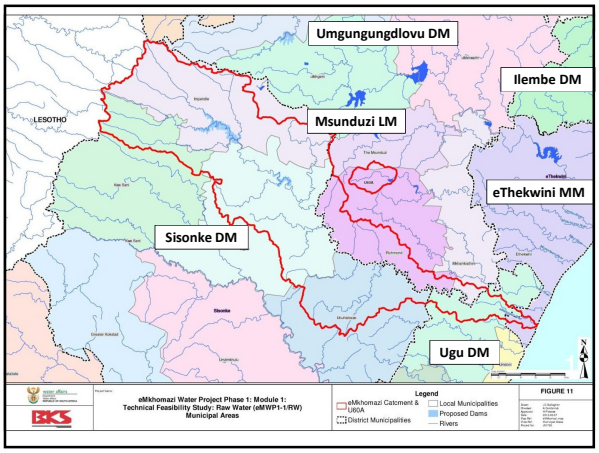


## Background to the project

- Mgeni System (*Midmar, Albert Falls, Nagle and Inanda Dams*) main source of water for eThekwini MM (Durban), Msunduzi LM (Pietermaritzburg) and surrounding areas
- Long-term water demands exceed yield of water resources of the Mgeni System (334 million m³/a) – *Midmar, Albert Falls, Nagle and Inanda dams*
- Current development
  - ✓ MMTS-2: Spring Grove Dam (60 million m³/a)
- Proposed development
  - ✓ eMkhomazi Water Project Phase 1



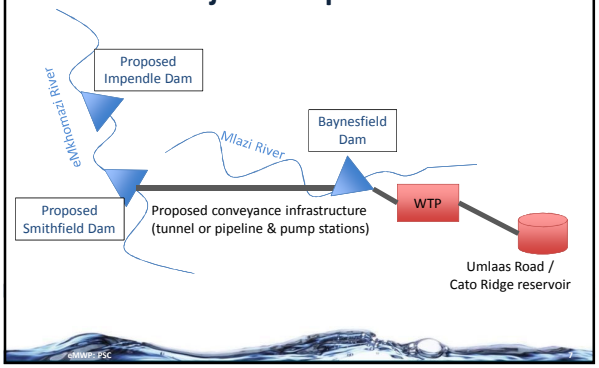


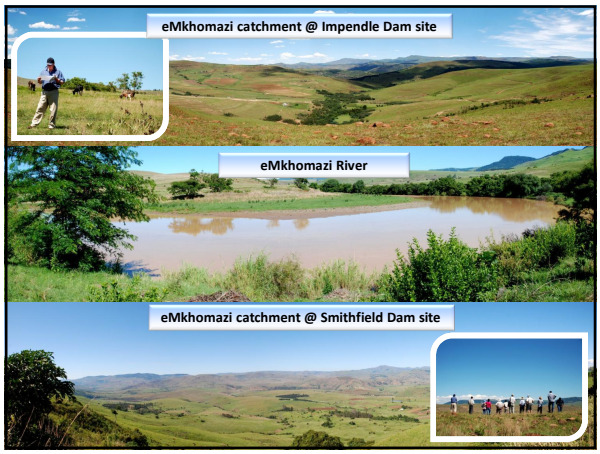




## Municipalities within the eMkhomazi catchment

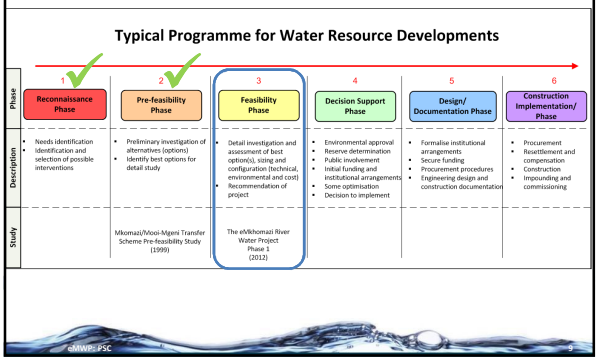
| Municipality | Water Service Authority | % Area |
|---|---|---|
| **Sisonke DM** | **Yes** | - |
| Impendle LM | No | 90% |
| Kwa Sani LM | No | 30% |
| Ingwe LM | No | 50% |
| Ubuhlebeze LM | No | 40% |
| **Umgungundlovu DM** | **Yes** | - |
| Richmond LM | No | 40% |
| Msunduzi LM | Yes | Very small – Water users within LM |
| Mkhambathini LM | No | 10% |
| **eThekwini MM** | **Yes** | **None – Water users within MM** |
| **Ugu DM** | **Yes** | - |
| Vulamehlo LM | No | 20% |

## Project components

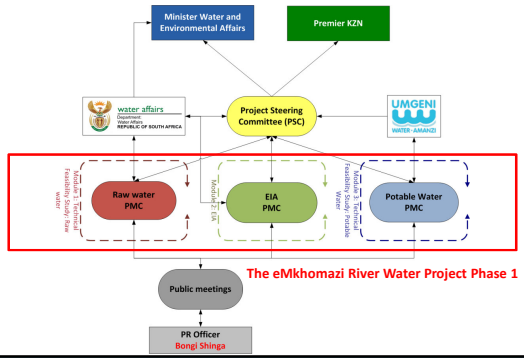



## Project cycle




## Governance of the project




## Project structure (modules of the project)

**Module 1: Technical feasibility**

***(BKS appointed: 1 December 2011 to 30 November 2014)***

**Raw** water component (DWA)

*(Impendle/Smithfield Dam, including conveyance infrastructure to balancing dam and WTP)*

**Module 2: Environmental impact assessment**

**Raw** water component (DWA)

**Potable** water component (Umgeni Water)

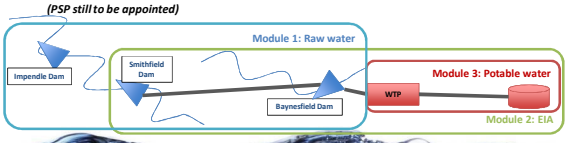
***(PSP still to be appointed)***

**Module 3: Technical feasibility**

- **Potable** water component (Umgeni Water)

*(WTP to tie-in point with eThekwini distribution system)*

***(PSP still to be appointed)***




## Agenda

7. **Presentation and discussion on study overview, progress and first findings of the *eMkhomazi Water Project Phase 1: Module 1: Technical Feasibility Study: Raw Water***

## Objective of the study

Project status: Feasibility

Undertake a feasibility study to finalise planning of proposed eMWP **at a very detailed level** so that scheme may be:

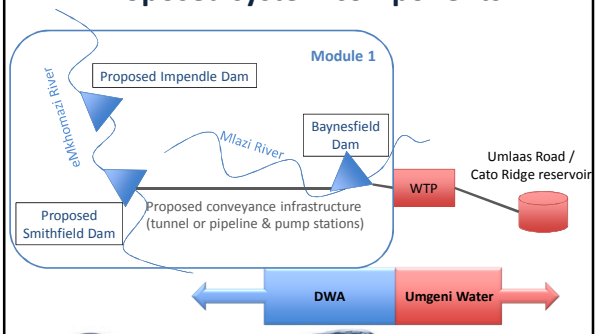
- ✓ accurately compared with other possible alternatives
- ✓ ready for implementation (detail design & construction) on completion of study

- **Project Description:**

  Develop Smithfield and Impendle dams with conveyance infrastructure transfer water to a balancing dam in the Baynesfield area. This will supply water to a Water Treatment Plant, from where it is conveyed to a tie-in point with the eThekwini distribution system



## Proposed system components






## eMWP1-1/RW study

**Focus areas:**

- **Water resources task:** eMkhomazi & Mgeni River catchments
- **Water requirements:** Water users – Mgeni System & eMkhomazi River catchment
- **Engineering investigation:** Impendle (only costing) & Smithfield dams as well as conveyance infrastructure corridor
- **Socio-economic impact assessment:** Regional, Provincial & National

| Organisation | Percentage complete |
|---|---|
| Task 1: Inception | |
| Task 2: Environmental screening | |
| Task 3: Project management | |
| Task 4: Water resources | |
| Task 5: Engineering investigation | |
| Task 6: Implementation actions | |
| Task 7: Institutional, financial and operational aspects | |
| Task 8: Socio-economic analyses | |



## Environmental Screening

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## Task 2: Environmental Screening

- **Objective:**
  - A valuable tool to investigate potential environmental implications
  - Not required by legislation
  - To inform the EIA (Module 2 – soon to be appointed)
- **Assessment area**
  - Proposed Impendle and Smithfield dams
  - Conveyance infrastructure (tunnel)
  - Balancing dam site



## Task 2: Environmental Screening

- Confirmation of the presence of species of conservational concern.
- The possible occurrence of heritage resources and graves.
- The exact number of people to be displaced.
- The environmental impacts of access roads (e.g. increased traffic, noise generation, influx of people into the area – including potentially the criminal element), and infrastructure related to the tunnel.
- Inclusion of ancillary items such as power generation alternatives. The consideration at this point is limited to the potential triggers that the greater scheme will have based on the full extent of the proposed scheme.
- Consideration of alternatives to minimise the size of the impoundments. This is a factor that will be considered in detail in the EIA process, but is again considered from at least a preliminary level in order to determine the possible enviro-legal triggers that may be encountered.

## Water resources

(Hydrology, water requirements)

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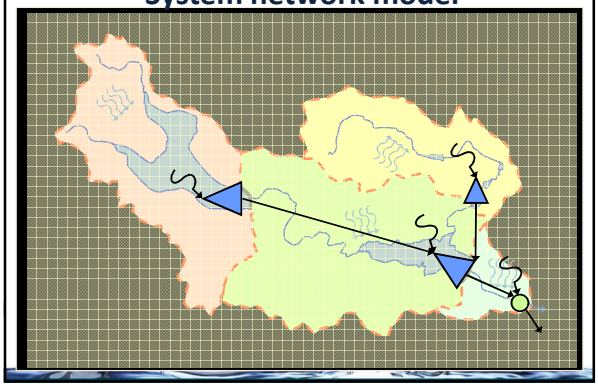
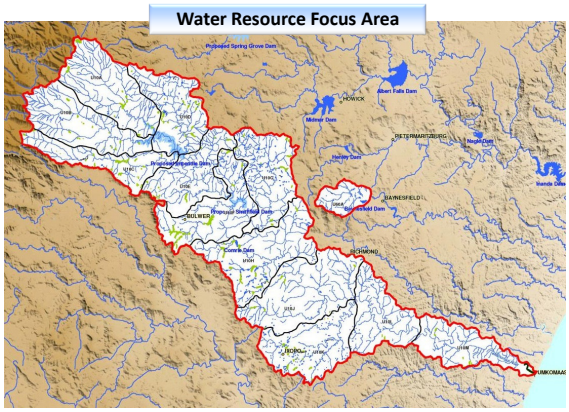
## Typical water resource system


eMWP: PSC 20

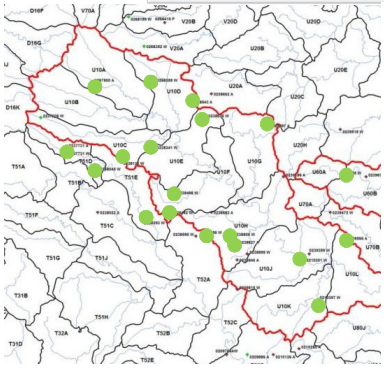
## System network model



## Water Resource Focus Area

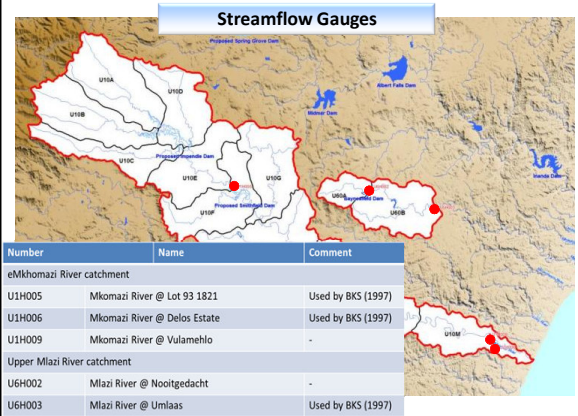


## Rainfall Stations - Used



- Rainfall data patching process completed
- A total of 58 rainfall gauges located within and in close proximity to the study area selected for patching purposes
- Generation of representative catchment rainfall data sets required for rainfall-runoff modelling currently underway
- Data quality generally acceptable, but low spatial coverage of study area

## Streamflow Gauges



| Number | Name | Comment |
|---|---|---|
| eMkhomazi River catchment | | |
| U1H005 | Mkomazi River @ Lot 93 1821 | Used by BKS (1997) |
| U1H006 | Mkomazi River @ Delos Estate | Used by BKS (1997) |
| U1H009 | Mkomazi River @ Vulamehlo | - |
| Upper Mlazi River catchment | | |
| U6H002 | Mlazi River @ Nooitgedacht | - |
| U6H003 | Mlazi River @ Umlaas | Used by BKS (1997) |

## Hydrology: Land use assessment

- Cultivated areas (km²):

| Catchment | Irrigation[1] | Commercial forestry[1] | Dry-land sugarcane[1] |
|---|---|---|---|
| eMkhomazi | 60.2 | 604.4 | 26.4 |
| Upper uMlaza | 38.9 | 94.8 | 79.0 |

*(1) EKZN-W Spot5 (2008)*

- Small dams:

| Catchment | Total number[1] | Total surface area[1] (km²) | Total storage capacity[2] (million m³) | Average depth (m) |
|---|---|---|---|---|
| eMkhomazi | 655 | 9.1 | 20.2 | 2.2 |
| Upper uMlaza | 179 | 4.3 | 14.5 | 3.3 |

*(1) CD:NGI (1:50 000 Spatial Data)*
*(2) Analysis of characteristics from DWA Dam Safety Register (2010)*

## Existing and future water requirements

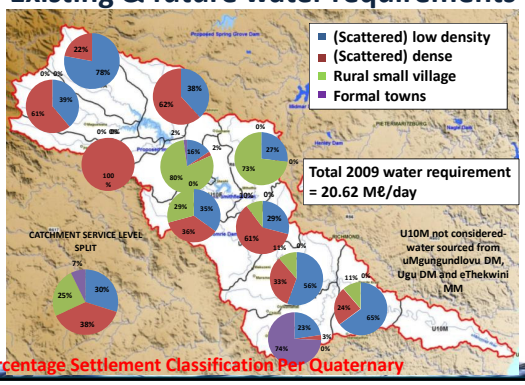
## Existing & future water requirements

### eMkhomazi catchment

- Completed house counts for the whole of the eMkhomazi catchment;
- Studied various previous reports to provide a basis for population figures and associated growth rates;
- Translated the 2009 house counts into population figures which were benchmarked against the 2001 census to provide accurate figures for 2012;
- Mapped different levels of services for the catchment and used this to quantify the current demands for domestic use;

| SETTLEMENT CLASSIFICATION | SERVICE LEVEL |
|---|---|
| (SCATTERED) LOW DENSITY | 15 l/capita/day |
| (SCATTERED) DENSE | 35 l/capita/day |
| RURAL SMALL VILLAGE < 5000 | 75 l/capita/day |
| FORMAL TOWNS | 150l/capita/day |

## Existing & future water requirements




Percentage Settlement Classification Per Quaternary

## Existing & future water requirements

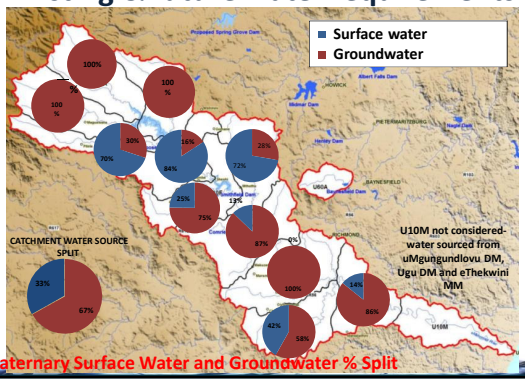
**DEMAND BASELINE**

Using the 2001 counts and a growth factor of 2.2% ,the 2009 population and household & dwelling occupancies for the area under assessment was determined.
Linear growth was considered.

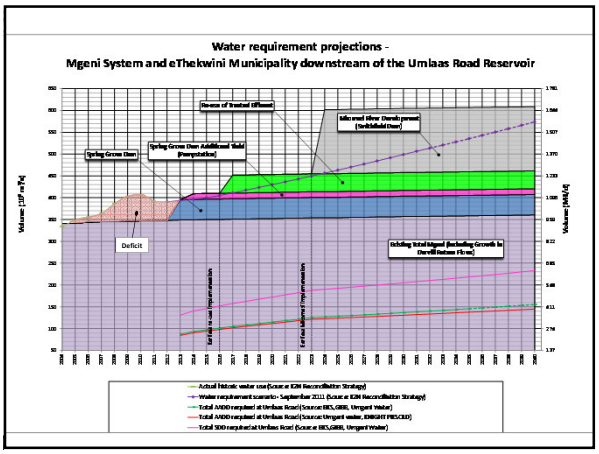
| | |
|---|---|
| Design year | 2009 |
| Design Horizon | 8 years |
| Dwelling occupancy | 3.053 |
| Household Occupancy | 6.945 |
| Growth Rate | 2.21 % |
| Exp. Growth Factor over 8 years | 1.19 |
| Linear Growth Factor over 8 years | 1.02 |
| Demand | 60 l/capita/day |
| Design Loss Factor | 25% |
| Summer Peak | 0 |

It was determined through this exercise the most likely growth scenario would be a 2.2% linear growth for the eMkhomazi Catchment area 2012 GAADD .

## Existing & future water requirements




Quaternary Surface Water and Groundwater % Split




## Engineering investigation

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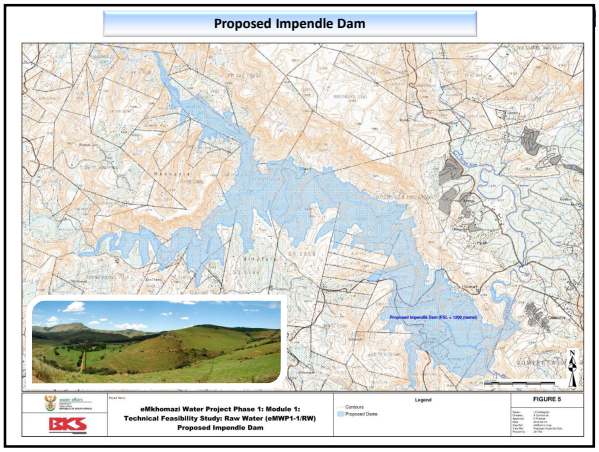
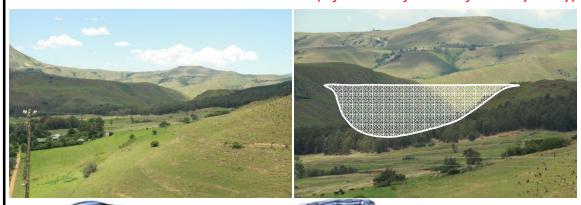


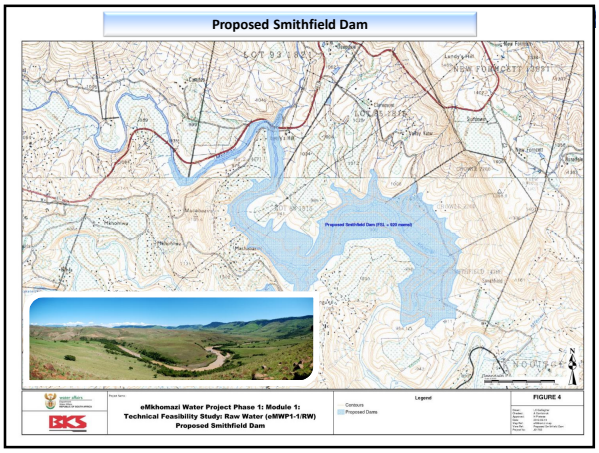

## Impendle Dam

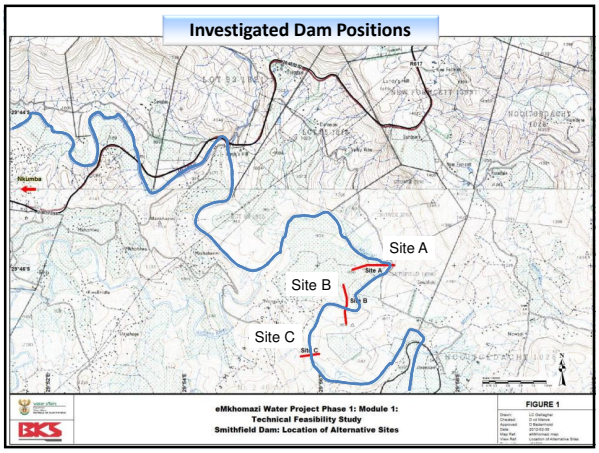
- Proposed clay core rockfill dam (prefeasibility study)
- Maximum storage = 830 million m³ (1.5 MAR)
- 92 m high
- Historic firm yield with Smithfield Dam = 388 million m³/a

*(Information from Pre-feasibility Study)*







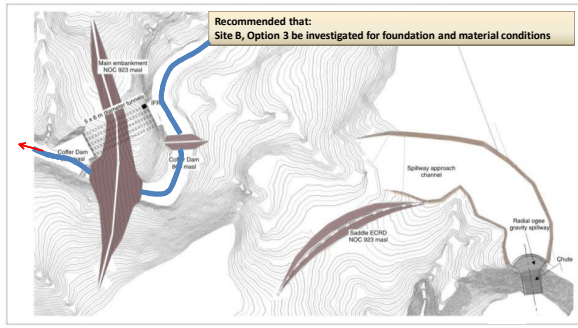
## Smithfield Dam

- 58 m high dam
- Dam wall length 1.1km
- Storage capacity = 140 million m³/a (0.19 MAR)
- Historic firm yield = 119 million m³/a

*(Information from Pre-feasibility Study)*


## Site B, Option 3

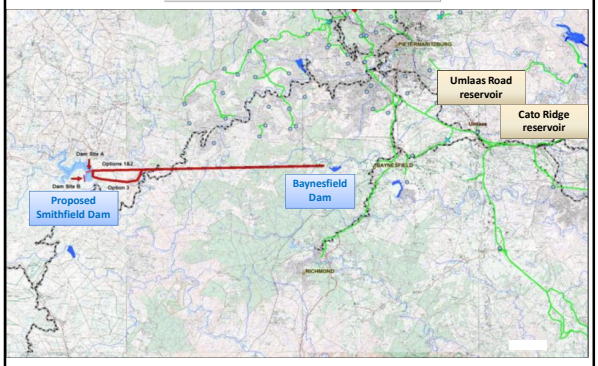
Recommended that:
Site B, Option 3 be investigated for foundation and material conditions




eMkhomzai Water Project Phase 1: Module 1: Technical Feasibility Study
Smithfield Dam: Site B: Option 3 - Dam Layout

FIGURE 7

## Investigated Transfer Routes

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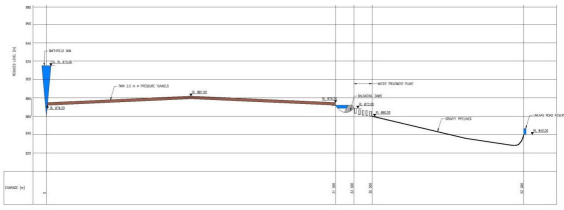
## Long section through conveyance system

Preferred:
Twin phased pressure tunnel from Smithfield position B to Baynesfield



LONGITUDINAL SECTION

To be confirmed:
1. Firm yields and storage provided;
2. Transfer capacity factor;
3. Storage state exceedance relationship;
4. Power generation at the outlet of the tunnel;
5. Necessity to line tunnels – geotechnical investigation;

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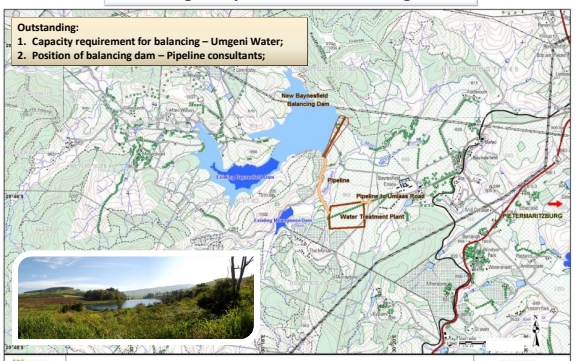
## Investigated position for balancing dam

Outstanding:
1. Capacity requirement for balancing – Umgeni Water;
2. Position of balancing dam – Pipeline consultants;




eMkhomazi Water Project Phase 1: Module 1:
Technical Feasibility Study
Balancing Dam: Layout of Option 2 Dam

FIGURE 3

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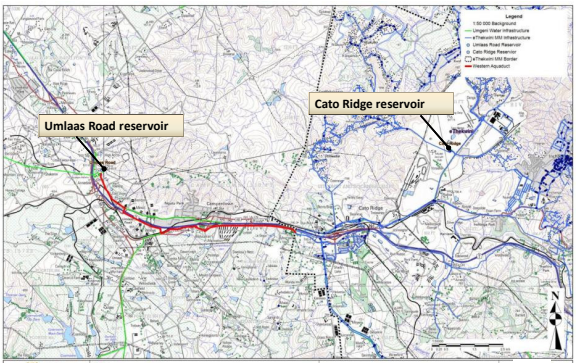
## Western Aquaduct




THE eMKHOMAZI WATER PROJECT: PHASE 1
MODULE 1: TECHNICAL FEASIBILITY STUDY

Western Aquaduct

## Project programme

| | Date |
|---|---|
| **Feasibility studies** | |
| Technical – Raw water | Dec '11 to Nov '14 |
| Environmental Impact Assessment (EIA) | Aug '12 to July '15 |
| Technical – Potable water | Aug '12 to Oct '13 |
| **Implementation** | |
| Decision Support Phase | 2015 to 2017 |
| Design/Documentation Phase | 2017 to 2019 |
| Construction/Implementation Phase | |
| Smithfield Dam and tunnel | 4 years |
| Estimated water delivery | 2023 |
| Impendle Dam (incl. decision support phase, design & construction) | 9 years |



## Project Cost

- **Feasibility Study**
  - ✓ DWA: Raw water component
    *Module 1: Technical Feasibility: R31 million*
    *Module 2: Environmental impact assessment: Estimated > R5 million*
  - ✓ Umgeni Water: Potable water component
    *Module 3: Technical Feasibility: Estimated > R4 million*
- **Implementation** *(Pre-feasibility estimate, esc. from 1998 to 2012)*
  *Design: 4% of capital: R278 million*
  Capital:
  *Phase 1 – Smithfield Dam: R4 005 million (O&M: R28 million/a)*
  *Phase 2 – Impendle Dam: R2 321 million (O&M: R23 million/a)*
  *Phase 3 - raised Impendle: R 624 million (O&M: 15 million/a)*
  *Total: R6 949 million (O&M: 67 million/a)*



## Challenges of the project

- Appointment of Environmental Assessment Practitioner for EIA (Module 2)
- Appointment of UW Technical PSP (Module 3)
- Assessment and comparison of alternative options (desalinisation, re-use)
- Obtain final Reserve figures
- Approvals of project (environmental, ministerial, etc.)
- Obtain funding



## Discussion

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## Project Management: Information Management - PIMS

- DWA required:
  - System to keep track of decisions made;
  - Electronic data base of emails, letters, reports, etc
  - Electronic linkages between DWA, Umgeni Water, PSP, also for progress reports
  - Project Webpage, to keep the public informed
  - Publish project related information

**Solution:** enterprisecloud value everywhere **DWA webpage**

## Working of the PIMS

**CRM 2011**

- Project information
- Contacts/project members
- Locality plan
- Shared calendar
- Project message board
- Action items
- Financial management:
  - ✓ Graph 1: Cash flow over time
  - ✓ Graph 2: Expenditure per task
- Time management
  - ✓ Work programme

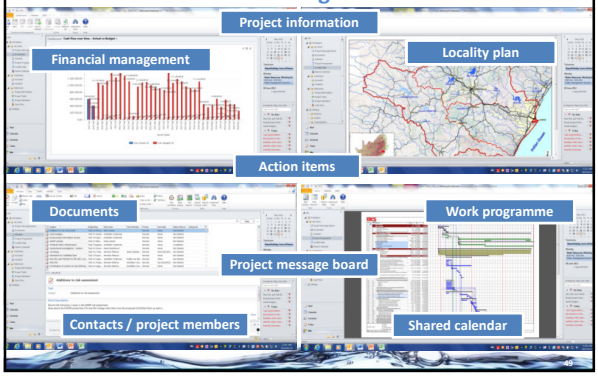
**SharePoint**

Document library for management of documents

**Microsoft Outlook**

**BKS, DWA, Umgeni Water & ACER Africa**

## Information Management - PIMS




## Information Management - Website

- Home
- Background of the study
- Overview of the study (& study area)
- Objectives of the study and study approach
- Environmental screening & EIA
- Stakeholder engagement
- Water resources
- Engineering investigation
- Project Steering Committee
- Report structure and reports
- Newsletters and announcements
- Implementation programme
- Record of Implementation Decisions
- Contacts

www.dwa.gov.za/Projects/eMkhomazi

## Thank you

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