# TERMS OF REFERENCE FOR A SOLICITED WRC-MANAGED RESEARCH PROJECT

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| **THRUST** | **Big Data Analytics and modelling; Stakeholders engagement; Policy support; Research support** |
| **PROGRAMME** | **Transboundary Water Collaboration** |
| **TITLE** | **Localizing transboundary data sets in Southern Africa: A case study approach** |

## BACKGROUND TO THE SPECIAL CALL FOR PROPOSALS AND CRITERIA

This Terms of Reference (ToR) document is part of a suite of research calls that link to an initiative called "Big Data Analytics and Transboundary Water Collaboration in Southern Africa". This initiative is funded by USAID, the South African Department of Science and Technology (DST), and the SADC Groundwater Management Institute (GMI), managed primarily by the Water Research Commission (WRC), and with technical support from the US Geological Survey (USGS) and the IBM Research Africa Lab in South Africa.

This programme includes 3 main components: 1) a series of research calls on transboundary ground and surface water with a focus on big data potential and value for improving the management of the region's water resources, the creation of scenarios for the region and the support to regional strategies and policies; 2) the creation of a Community of Practise (CoP) related to transboundary water, including the potential contributions of big data analytics to transboundary water management; 3) a series of workshops and training opportunities for individuals involved in the projects and the CoP.

The overarching goals of this programme are to:

- *Deepen* water-related big data skills and capabilities for Southern African researchers and their students through research activities, training and engaging in a CoP;
- *Enhance* current understanding of shared groundwater resources and they can contribute to management and delivery of sustainable drinking water and other productive uses;
- *Improve* transboundary ground/surface water management and collaboration.

This initiative has grown out of a series of USAID and partner-driven initiatives in the Southern African region over a number of years. The need for this program was cemented in a regional workshop that took place at the IBM Africa technology hub in Johannesburg in April 2017. At its core, this program acknowledges the importance of robust, sufficiently detailed and locally relevant data to inform local and regional decision-making in transboundary basins.

The program thus explores how enhanced big data capabilities can potentially improve the robustness of data, analysis and decision making in the context of transboundary ground and surface water decision-making.

This is part of a set of 4 separate calls for proposals to advance the goals of the programme:

Theme 1 Consolidation of data and application of big data tools to enhance national and transboundary data sets in Southern Africa that support decision-making for security of water resources;

Theme 2 Imagining solutions for extracting further value from existing datasets on surface and groundwater resources in Southern Africa;

Theme 3 Localizing transboundary data sets in Southern Africa: A case study approach;

Theme 4 Groundwater secure transboundary systems

Under this call, we seek proposals that **improve localized transboundary data sets and data use in Southern Africa through a case study approach**

## APPLICATION ELIGIBILITY

- Any organization based in the SADC region can apply to the call as project leader;
- The lead organization can partner with any institution globally to carry out the activities proposed;
- All documents requested in the application form and online process must be submitted for the proposal.

## OVERARCHING GUIDELINES FOR RESEARCH PROPOSALS

- All proposals need to have a **transboundary dimension** (i.e. Any case/application must include two or more countries in SADC);

- Preference will be given to:
    - proposals related to **groundwater systems**;
    - proposals by consortia showing clear evidence of **big data capabilities**, as well as strong **water sector technical experience**;
    - proposals that show a strong **commitment to student development**.

- The proposals should be **creative and include novel elements** in their theoretical and practical approaches, while aiming at supporting the wider goals of the programme (see above). Submissions should also specifically address how the proposed activity will:

    - Identify and/or address gaps in knowledge, management and use of ground and surface water data;
    - Advance the use of data to address transboundary issues in water management and use, especially in water supply system for drinking water;
    - Have broader impact on the sustainable management of water resources, including the sustainable management of drinking water supply systems.

Please note the following:

The consortium of organisations, which is selected for funding, will be expected to engage in activities and events related to the **Community of Practice** and should budget for attendance at the programme's **three technical workshops**.

The opportunity will be provided for one data-focussed individual within the consortium to take part in an **internship programme with the IBM Research Africa Facility in Johannesburg (Braamfontein)**, which includes comprehensive training in the latest methods in big data analytics, including classical and deep machine learning.

## RATIONALE

A recent Global Diagnostic report[1] indicates that Sub-Saharan Africa is in the pre-development stage of groundwater management while societal dependence on groundwater is dramatically increasing. It found that "the information needed for aquifer management is generally lacking". Several large-scale assessments are available but are of limited value, because they aggregate information to an extent that it becomes meaningless for operator level decision-making where water provisioning is from localised wellfields within heterogenous aquifer systems. The behaviour of localised aquifer systems rarely matches that of the catchment or of larger scale information provided in regional assessments and maps. Decision-making has to incorporate large uncertainties. These wellfields may be tapping into groundwater from aquifers that are shared across administrative and national boundaries, which are being recharged over substantial periods of time. Some efforts have been made to better understand the Stampriet transboundary aquifer (South Africa, Namibia and Botswana) and the Ramotswa transboundary aquifer (South Africa and Botswana). However, spatial and temporal data inconsistencies hamper effective assessments of both. In general, data related to transboundary aquifers in Southern Africa are not readily available to decision-makers, the public, and specialists to enable planning and management of water resources. Data driven information paired with local knowledge can be a powerful tool for effectively and collaboratively manage shared water resources.

## OBJECTIVES

### *General:*

One of the criticisms of many transboundary water initiatives is that they provide a helpful regional/macro view on issues and opportunities for regional collaboration, but that the data, and as a result the insights derived from the data, are not suitably localized to meaningfully support decisions at more local operational levels. Research under this call for proposals will focus on exploring how to make use of sparse transboundary data sets, supplemented where possible by regional and local data sets using big data analytics and computational tools, in order to make the data and insights relevant for finer scale decision-making at various operational levels, for example, in the management of municipal water systems.

### *Specific:*

- Select case study area(s) where there are active transboundary data sets in addition to reliable local data sets and identify which data elements are of high value for joint

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[1] FAO (2016). Global diagnostic on groundwater governance. Food and Agricultural Organisation.

decision-making.

- Identify and prioritize data parameters critical for local decision-making by developing a matrix for various management scenarios (exploitation, protection, forecasting).
- Match, integrate and model local data with regional data (data from official and non-official sources).
- Integrate and downscale datasets for finer scale decision making using big data tools.
- Extrapolate to similar settings (e.g., geology, climate, aquifers).
- Evaluate and test whether big data tools can model local data results at the transboundary level.
- Provide an assessment of the viability of using big data analytics to make data sets detailed enough for operational decision making.
- Identify and assess important problems/issues regarding transboundary water systems and their management.

## DELIVERABLES

1. Workshops with key stakeholders to understand the status quo, train on tools applied and follow-up on implementation, at a minimum, and reporting thereof;
2. Data requirements for localisation and extrapolation approaches report for the identified management scenarios;
3. Policy brief on modelling and data analytics tools for downscaling in a transboundary water management context;
4. Report on lessons learnt from case study(ies);
5. A comparative tool for inventory data sets;
6. Policy brief on downscaled information using data analytics for various transboundary management scenarios (including visualisation tools and dashboards);
7. Recommendation report to reduce model and or analytical uncertainties to guide future investments in data collection in transboundary contexts, including how data can help solve related problems.
8. A print-ready integrated final report, including lessons learnt.

Please, take note that deliverables are not entirely prescriptive and may change depending on the research and workplan proposed.

## TIME FRAME

18 Months

## TOTAL FUNDS AVAILABLE:

R2 055 000