TERMS OF REFERENCE FOR A SOLICITED WRC-MANAGED RESEARCH PROJECT

THRUST	**Big Data Analytics; Building regional scenarios; Policy support; Research support**
PROGRAMME	**Big Data and Transboundary Water Collaboration**
TITLE	**Groundwater secure transboundary systems.**

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 **promote groundwater-secure transboundary systems.**

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

There is a growing recognition that local groundwater resources play an increasingly strategic role in driving economic growth and development in Africa. This is particularly true for the most vulnerable and most neglected rural communities. In many parts of Southern Africa, groundwater allocation and protection has become an important issue, and competition for the resource is increasing. Groundwater has the potential to play a strategic role in providing water for drinking and sanitation, supporting agricultural irrigation schemes and industrial uses, reducing poverty and disease, and maintaining important aquatic and terrestrial ecosystems[1]. Awareness of the need to conserve groundwater-dependent stream flows and aquatic ecosystems is also increasing[2]. Frequently missing at the local level is some form of regulation and organisation of the local users of a shared groundwater resource, which is generally seen as essential for the sustainable use of the resource. In addition, there is a need to unlock more water resources and manage existing supplies efficiently, in order to stimulate local economies and job growth.

Regional socio-economic development in the SADC region is also centred around the effective conjunctive management of transboundary water resources systems as testified by the ongoing establishment and strengthening of River Basin Organisations (RBOs) in 14 River systems across the SADC region as well as the integration of the management of the estimated 30 Transboundary Aquifers into the RBOs.

Local level water management must also be integrated with local and regional spatial and environmental planning. This will ensure that shared groundwater resources are protected from pollution, over-exploitation and other negative impacts associated with global change. Climate projections indicate that impacts of global warming would increase the intensity, area coverage, and frequency of droughts over Southern Africa. In addition, groundwater schemes are inherently more complex to manage than traditional surface resources and, often, have a lower capital expenditure cost compared to dams, but a higher long-term operational cost.

Groundwater security is thus dependent on the availability of long-term funding and capacity for operation and maintenance, and the long-term monitoring of often scattered wellfields.

[1] Knüppe K (2011). The challenges facing sustainable and adaptive groundwater management in South Africa. Water SA, 37, 1, 67-79.

[2] Foster S et al (2012). Managed groundwater development for water-supply security in Sub-Saharan Africa: Investment priorities. Water SA Vol. 38 No. 3 International Conference on Groundwater Special Edition 2012. http://dx.doi.org/10.4314/wsa.v38i3.1

With the additional hazards posed by the change in climate and weather patterns, it becomes increasingly more difficult to ensure sustainable supplies and afford overall water security.

OBJECTIVES

General:

The purpose of this call for proposals is to broaden water supply coverage in Southern Africa in general, and to enhance localised groundwater supply security in particular through augmentation, maintainable abstraction, and protection to ensure water security for a variety of uses. Develop a sustainable water supply strategy of conjunctive use where surface water is used when available and groundwater is held in reserve.

Specific:

- Produce water budgets and changes in storage for selected transboundary areas where sufficient data is available. Assess groundwater availability for a selected area.
- Identify and map suitable areas for Managed Aquifer Recharge (MAR) taking into account climate, soil, geology, topography and available water sources and courses.
- Develop aquifer vulnerability maps to guide land use planning.
- Recommend remediation techniques and approaches for a variety of naturally and man-made contaminants and pollutants.
- Identify efficient and multiple uses of groundwater resources to ensure sustainability, equity and redress; including a socio-economic analysis.
- Develop groundwater resource protection strategies through the development and strengthening of groundwater governance provisions (technical, institutional, legal) as well as awareness and participation building at all levels.

DELIVERABLES

1. Case study selection report.
2. Maps and reports for MAR, aquifer vulnerability, changes in storage (for selected periods).
3. Inventory of main polluting activities, strategies to protect source water systems and possible remediation technologies and approaches.
4. Report on multiple use services of groundwater resources for water, food and economic security.
5. Report on localised governance provisions, awareness and training needs and approaches.
6. Detailed description and analysis of the economics of any new business models.
7. Print-ready final report, with lessons learnt.

Please, take note that the deliverables are illustrative and may be tailored to suit the research workplan proposed.

TIME FRAME

18 months

TOTAL FUNDS AVAILABLE

R1 300 000