LIST OF ACRONYMS

AMCOW
African Ministers Council on Water

AUC
African Union Commission

BGR
German Federal Institute for Geosciences and Natural Resources

DWS
Department of Water and Sanitation South Africa

GRAPHIC
Groundwater Resources Assessment Under the Pressure of Humanity and Climate Change

GWP-SA
The Global Water Partnerships for Southern Africa

IGRAC
International Groundwater Resources Assessment Centre

IGS
Institute for Groundwater Studies

IWMI
International Water Management Institute

L/RBOs
Lake/River Based Organisations

MAR
Managed Aquifer Recharge

MCCM
Multi-Country Cooperation Mechanism

O&M
Operation and Maintenance
September 2018 had a special meaning to us at the Southern African Development Community Groundwater Management Institute (SADC-GMI). In September 2018, we celebrated the second year of our full operationalisation as SADC’s Centre of Excellence for sustainable and equitable groundwater management in the region. It was also our inaugural conference under the theme “Adapting to Climate Change in the SADC Region through Water Security – A Focus on Groundwater”. This was the confluence where all groundwater stakeholders could share experiences and chart a progressive and inclusive path for the future. The task of giving life to SADC’s Regional Strategic Action Plan on Integrated Water Resources Development and Management Phase IV, of SADC’s strategic framework from 2016-2021, has meant that the past two years have been eventful. A lot has gone into the formidable task of giving Member States the institutional muscle necessary to develop groundwater and to measure its equitable impact on socio-economic development. SADC-GMI’s intervention has brought the necessary urgency to multi-state cooperation on transboundary groundwater basins. This has certainly lifted the burden previously involved in integrating knowledge, skills and capacity across the region. The SADC Subcommittee on Hydrology now finds a more conducive environment for implementing infrastructure funding initiatives with stakeholders through the Sub-Grant Scheme which is carried out by National Focal Groups at Member State level. National Focal Groups avail two important opportunities worth mentioning. First, they offer us a coordinated approach to capacity building at Member State level. For all SADC countries we now have a fuller appreciation of the needs involved, the stakeholders affected and the nature of the support we can provide. Second, they show development finance institutions that the blending of data, research, good governance and strong institutional capacity make for sustainable infrastructure projects worth investing in. We held our inaugural conference fully aware of the fragility that climate change brings to groundwater resources. This is cause for serious concern. But this also presents interesting challenges for groundwater stakeholders across the region. The challenges should embolden us to find creative and lasting solutions to water security in the region and this is what the conference achieved.

“The challenges should embolden us to find creative and lasting solutions to water security in the region and this is what the conference achieved.”

James Sauramba, Executive Director; SADC-GMI

Mr James Sauramba
The 1st SADC Groundwater Conference, held from September 26 to 28, 2018 at the Birchwood Hotel in Johannesburg, South Africa, brought groundwater experts and stakeholders to share information on the challenges and innovative solutions that are taking place in SADC. Groundwater has become an issue of increasing prominence and concern as climate change and rainfall variability requires increased understanding and knowledge sharing about groundwater. Held under the theme “Adapting to Climate Change in the SADC Region through Water Security – A Focus on Groundwater”, the conference was organised by The Southern African Development Community Groundwater Management Institute (SADC-GMI). The conference aimed to address the lack of awareness of, and reliable information about groundwater, inform interventions and promote cross-boundary cooperation on groundwater. The inaugural groundwater conference was held in response to the felt increasing water-related challenges in SADC countries. This is a cause for serious concern and presents interesting challenges for groundwater stakeholders across the SADC Region, where it is estimated that over 70% of the 250 million people living in the region rely on groundwater as their primary source of water. The conference provided the opportunity for the first time to representatives from Member States, experts and other stakeholders to debate and discuss not only the great dependence of human populations and ecosystems on groundwater in the region, but also the available technology and resources that aid groundwater management. With surface water facing increasing risks from climate change, millions of people and large parts of economies are becoming more fragile. Groundwater resources present a number of opportunities, as they comprise a means to cope with rainfall variability and alleviate growing water scarcity in the region. However, poor information and management of the resource can lead to pollution and depletion. Proactive groundwater management systems and accounting for climate change in groundwater resources planning coupled with early warning mechanisms to detect groundwater over-abstraction and contamination are required to secure the long-term, sustainable use and dependence on the resource and to optimally harness the potential of the resource. It is therefore imperative that conjunctive use of surface and groundwater is understood and advocated for, especially in transboundary aquifers (TBAs) of the SADC Region where significant human development is happening presently. The role of groundwater in the water, energy and food (WEF) nexus and the links to sanitation and other infrastructure issues needs to be further explored. Knowledge and capacity development at all levels are required to enhance the attention to and proper development and management of groundwater. The SADC Groundwater Conference will be held annually, with the primary objective of providing a platform for the advancement of knowledge sharing on sustainable management of groundwater at national and transboundary levels across SADC Member States. The conference was held in collaboration with the United Nations, Educational, Scientific and Cultural Organization – International Hydrogeological Programme (UNESCO-IHP), the International Groundwater Resources Assessment Centre (IGRAC), the International Water Management Institute (IWMI) and the Global Water Partnerships for Southern Africa (GWP-SA). This year’s conference was attended by 123 participants from 26 different countries, with 38 presentations, two panel discussions and one roundtable discussion taking place over the course of the three days. The Conference was widely engaged with on social media, under the hashtag #GWConference2018. This report provides a summary of the key messages arising from the event and abstracts from each of the presentations.
THE CONFERENCE IN NUMBERS

123 PARTICIPANTS
FROM 26 COUNTRIES

38 PRESENTATIONS

7 KEYNOTE SPEAKERS

2 PANEL DISCUSSIONS

1 ROUND TABLE DISCUSSIONS

NUMBER OF PARTICIPANTS

TOTAL 123

SECTORS

Private Sector 18%
Research/ Academia 22%
NGO 17%
Public Sector/ Government 43%
Grand Total 100%
PARTICIPANTS FROM 26 COUNTRIES

- South Africa: 63
- Zimbabwe: 9
- Botswana: 8
- Netherlands: 4
- Mozambique: 4
- Namibia: 4
- Zambia: 3
- Malawi: 3
- Sweden: 2
- Germany: 2
- Others: 21
- Others: 7
### DAY 1 - Wednesday 26th September 2018

#### PHOTO SESSION and TEA-BREAK

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00Hrs-11:00Hrs</td>
<td><strong>Keynote paper</strong>: Karen G. Villholth and Jude Cobbing. <em>Adapting to Climate Change in the SADC Region – A Focus on Groundwater.</em> P11</td>
</tr>
</tbody>
</table>

#### SUB-THEME 1

**PROMOTING CLIMATE CHANGE RESILIENCE THROUGH TRANSBORDARY AQUIFERS (TBAS) MANAGEMENT AND CONJUNCTIVE GROUNDWATER SURFACE WATER MANAGEMENT IN THE SADC-REGION.**

**Chair**: Phera Ramoeli, **Rapporteur**: Arnaud Sterckx

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 Hrs - 11:30Hrs</td>
<td><strong>Keynote Speaker</strong>: Dhesigen Naidoo. <em>Adapting to a changing climate to ensure water-energy-food security.</em></td>
</tr>
<tr>
<td>11:45Hrs - 12:00Hrs</td>
<td>Jonathan Lautze. <em>Implementing transboundary aquifer cooperation in Africa. Lessons learned from the Ramotswa and Stampriet Aquifers.</em> P13</td>
</tr>
<tr>
<td>12:00Hrs - 12:15Hrs</td>
<td>Tshepo Jankie and Berhanu Alemaw. <em>Implications of Climate Change for Groundwater Recharge in the Transboundary Tuli-Karoo Sub-Basin.</em> P14</td>
</tr>
<tr>
<td>12:15Hrs - 12:30Hrs</td>
<td>Anton Lukas and Eelco Lukas. <em>Evaluation of the SADC Hydrogeological Mapping Borehole Database.</em> P15</td>
</tr>
<tr>
<td>12:30Hrs - 12:45Hrs</td>
<td>Christina Fraser and Robert Kalin. <em>An Assessment of Malawi’s Transboundary Aquifers and Prioritization of Vulnerable Hotspots to Support Directed Cross Border Management.</em> P16</td>
</tr>
</tbody>
</table>

**LUNCH**

**Chair**: Cecelia Njenga, **Rapporteur**: Tales Carvalho Resende

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00Hrs - 14:30Hrs</td>
<td><strong>Keynote Speaker</strong>: Roger Parsons. <em>Groundwater – Avoiding the Single Story.</em> P18</td>
</tr>
<tr>
<td>14:30Hrs - 14:45Hrs</td>
<td>Moses Mukota, Rachel Mpe, Bochengedu Somoleke and Geert-Jan Nijsten. <em>The Ramotswa Information Management System – a tool to support governance of the Ramotswa Transboundary Aquifer.</em> P19</td>
</tr>
<tr>
<td>14:45Hrs - 15:00Hrs</td>
<td>Phuti Mabotja, Modreck Gomo, Geert-Jan, Arnaud Sterckx and Eelco Lukas. <em>Free Software as a tool to optimize groundwater data management.</em> P20</td>
</tr>
</tbody>
</table>
DAY 2 - Thursday 27th September 2018

8:45Hrs - 9:15Hrs | **Keynote Speaker: Jason Gurdak. Beneath the Surface of Climate Change: Managing Natural Climate Variability toward Sustainable Groundwater.** P28

**SUB-THEME 2** TOWARDS AN UNDERSTANDING OF THE IMPACT OF CLIMATE CHANGE ON GROUNDWATER WATER RESOURCES AND EXPLORING CLIMATE SMART GROUNDWATER INFRASTRUCTURE OPTIONS

Chair: Modreck Gomo, Rapporteur: Micah Majiwa

09:15Hrs - 09:30Hrs | Steve Kumwenda, Muthi Nhlema and Robert Kalin. *A review of climate change impact understanding on ground water recharge and baseflow in the SADC region.* P29

09:30Hrs - 09:45Hrs | Girma Y. Ebrahim, Jonathan F. Lautze and Karen G. Villholth. *Managed Aquifer Recharge (MAR) in Africa: What do we know, where should we go?* P30

09:45Hrs - 10:00Hrs | Esther Chifunyuro Mabedi, Longcang Shu, Song Wang, Qi Tiansong and Manqi Zhang. *Predicting Soil Secondary Salinization from Groundwater Evaporation using Artificial Neural Networks.* P31

10:15Hrs - 10:30Hrs | Alfred Kabo Petros, Jean-Christophe Comte, Jose Geris, Fulvio Franchi, Ame Selepeng, Thato Seth Setlokosoa and Chandrasekar Kurugundla. *Understanding the Impacts of Climate Change on Groundwater Resources: Lessons from Extreme Floods in the Upper Limpopo.* P33

11:00Hrs - 11:15Hrs | Moitela Lekula and Maciek W. Lubczynski. *Integrated hydrological model of the Central Kalahari Basin – optimal tool for assessment of sustainability of groundwatre resources.* P34


12:00Hrs - 12:15Hrs | Jean van Niekerk and Eelco Lukas. *Common inaccuracies to avoid in the field: A focus on the SADC region.* P37

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30Hrs - 12:45Hrs</td>
<td>M.R Mpe, M. Magombeyi, and L.P Maunatiala. <em>Nitrate contamination in Ramotswa Transboundary Aquifer.</em> <strong>P39</strong></td>
</tr>
<tr>
<td>12:45Hrs - 13:00Hrs</td>
<td>Zachariah Maswuma. <em>Groundwater resources assessment of the Nyl River Flood plain, South Africa, and its relation to the hydrological regime of the drought system and proposed management options.</em> <strong>P40</strong></td>
</tr>
<tr>
<td><strong>LUNCH</strong></td>
<td>Chair: Khangweleni Fortress Netili, Rapporteur: Girma Ebrahim</td>
</tr>
<tr>
<td>14:00Hrs - 14:30Hrs</td>
<td><strong>Keynote speaker: Gavin Kode. Experiences from the Western Cape Government (WCG) Water Business Continuity Plan (BCP) Programme’s use of groundwater to secure certain critical WCG facilities across the province to ensure ongoing key service delivery in the event of municipal water failure as a result of the drought and water crisis.</strong> <strong>P41</strong></td>
</tr>
<tr>
<td>14:30Hrs - 14:45Hrs</td>
<td>Theresa Mkandawire, Evance Mwathunga, Alan MacDonald, Helen Bonsor, Sembeyawo Banda, Prince Mleta and Sella Jumbo. <em>An analysis of hand pump boreholes functionality in Malawi.</em> <strong>P42</strong></td>
</tr>
<tr>
<td>14:45Hrs - 15:00Hrs</td>
<td>Albie Steyn, Robert Hansen and Eelco Lukas. <em>Geochemical investigation of an underground mine, Mpumalanga, South Africa.</em> <strong>P43</strong></td>
</tr>
<tr>
<td>15:00Hrs - 15:15Hrs</td>
<td>Emmanuel Kisendi. <em>Groundwater Resources Evaluation in central Kalahari Karoo Basin.</em> <strong>P44</strong></td>
</tr>
<tr>
<td><strong>TEA-BREAK</strong></td>
<td></td>
</tr>
<tr>
<td>15:30Hrs - 16:00Hrs</td>
<td><strong>Keynote speaker: Alan McDonald. Resilience of rural groundwater supplies to climate change.</strong> <strong>P45</strong></td>
</tr>
<tr>
<td>16:00Hrs - 16:15Hrs</td>
<td>Thokozani Mtewa, Evance Mwathunga and Wapulumuka Mulwafu. <em>They gave us breakfast and a good meal</em>: Roles, perceptions and motivations of water point area mechanics in the maintenance of borehole handpumps in Balaka district, Malawi. <strong>P46</strong></td>
</tr>
<tr>
<td>16:15Hrs - 16:30Hrs</td>
<td>Piet Kenabatho, Bertram Swartz, Kwazikwakhe Majola, Marc Leblanc, Clément Berry and Tales Carvalho Resende. <em>Promoting groundwater cooperation in Southern Africa through modelling: the Stampriet Transboundary Aquifer System case study.</em> <strong>P47</strong></td>
</tr>
<tr>
<td>16:30Hrs - 16:45Hrs</td>
<td>Modreck Gomo. <em>On the Methods to Determine Borehole Sustainable Yield.</em> <strong>P48</strong></td>
</tr>
<tr>
<td>16:45Hrs - 17:00Hrs</td>
<td>George Molaolwa. <em>Development of the Training Manual for Groundwater Resource Management and Groundwater Governance for Municipalities in South Africa.</em> <strong>P49</strong></td>
</tr>
<tr>
<td><strong>DAY 3 - Friday 28th September 2018</strong></td>
<td></td>
</tr>
<tr>
<td><strong>GALA DINNER (18:30Hrs)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>8:45Hrs - 9:15Hrs</strong></td>
<td><strong>Keynote Speakers: Callist Tindimugaya and Sean Furey. Groundwater and African National Development Strategies.</strong> <strong>P50</strong></td>
</tr>
<tr>
<td><strong>SADC-GMI Projects</strong></td>
<td>Chair: Zione Uka, Rapporteur: Brighton Munyai</td>
</tr>
</tbody>
</table>
### Posters

<table>
<thead>
<tr>
<th>Author</th>
<th>Title of Poster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lindelani Lalumbe and Elelwani Netshitanini.</td>
<td>Understanding the role of climate change and groundwater abstraction for sustainable groundwater management: Vanrhynsdorp case study. <strong>P55</strong></td>
</tr>
<tr>
<td>Petrina Litta Amoomo, Reginalda Joseph, Christoph Lohe, Bertram Swartz, Martin Quinger and Sackeus Ihemba.</td>
<td>Trend analysis of water levels of the Namibian groundwater monitoring. <strong>P55</strong></td>
</tr>
<tr>
<td>Rofhiwa Joyce Ramasala, Lore-Mari Deyesel and Modreck Gomo.</td>
<td>Assessment of laboratory leach test methods for the evaluation of environmental impact by coal and gold mine waste. <strong>P56</strong></td>
</tr>
<tr>
<td>Tobias El-Fahem and Tewodros Tena.</td>
<td>Groundwater Management Tools for Zambia - the National Hydrogeological Map and the Borehole Database. <strong>P57</strong></td>
</tr>
</tbody>
</table>
The official opening focused on the theme of the inaugural conference, “Adapting to Climate Change in the SADC Region through Water Security — A Focus on Groundwater”. It was presided over by eSwatini’s Director of Water Affairs in the Ministry of Natural Resources and Energy, Trevor Shongwe. The opening speakers were two highly-esteemed individuals in the SADC water sector: Chairperson of SADC-GMI’s board and former head of the SADC Water Division, Phera Ramoeli, and Deputy Director General of the Department of Water and Sanitation (DWS) in South Africa, Lindiwe Lusenga. Both speakers opened by recognising the significance of the 1st SADC-GMI Groundwater Conference. The speakers noted SADC-GMI’s progress thus far from an intention in 1999, its founding in 2011, to it being a subsidiary structure of SADC, to the first conference, which was to allow for the sharing of groundwater information, innovation and experiences. Mr. Ramoeli highlighted groundwater’s importance in irrigation, water and food security, especially when an overwhelming majority of the SADC Region’s population rely on groundwater as a primary source of water supply.

Phera Ramoeli
Southern African Development Community Groundwater Management Institute

“It is estimated that over 70% of the 255 million people living in the SADC Region, and more than 75% of sub-Saharan Africans rely on groundwater as their primary source of water.”

“Groundwater and not surface water constitute about 97% of fresh water resources in Africa.”

“40% of the region’s population use informal or unimproved sources of water, which are often unsafe and prone to the effects of drought. Groundwater is often the only source for the poor and those in the rural areas.”

Lindiwe Lusenga
Department of Water and Sanitation (South Africa)

“Let me first congratulate SADC, our mother body, for leading us to where we are today, it has been a long journey, starting in 1999 where they set the pace for us through the various policies and strategies, in ensuring that we remain climate resilient in the region.”

“This meeting is going to give us solutions. Let this solution not be only for us, but the whole world, and also the ordinary people.”
Presenting the keynote paper of the conference was the Principal Researcher of the International Water Management Institute (IWMI), Dr Karen G. Villholth. Dr Villholth delivered a paper entitled "Adapting to climate change in the SADC Region — a focus on groundwater." Dr Villholth emphasised the great opportunity that groundwater presents in addressing water-security challenges. Furthermore, she contended that groundwater is a strategic resource, which is drought-proof and climate resilient when managed correctly.

Dr. Karen G. Villholth
International Water Management Institute

“Groundwater can be a component of climate-change adaptation in the region.”

“Groundwater is not only a resource that we need to be concerned and worried about — to see as a problem — but also very much a big opportunity to solve some of our issues in terms of water supply, security, and resilience.”

“Every time you have a drought period, the groundwater levels go down. This is due to less recharge to the resource (rain), and more dependency on the resource during those periods.”

“Groundwater is a key resource for socio-economic development, water security and drought resilience in SADC.”
In a session chaired by Phera Ramoeli, Dhesigen Naidoo CEO of the Water Research Commission, delivered the keynote presentation of the morning session for sub-theme 1 with a paper entitled, “Adapting to a changing climate to ensure water-energy-food security”. Mr Naidoo opened his presentation by noting how neglected knowledge investment on groundwater issues is. Without knowledge and data, interventions addressing the WEF security nexus would fail.

Mr Naidoo noted that the need for informed TBA management is becoming more urgent as WEF demands are increasing in Africa and the rest of the world. Mr Naidoo cautioned that it is fundamentally important that SADC’s TBAs are managed well. He warned that the choices made now around these resources are critical for future proofing the region.

Dhesigen Naidoo

Water Research Commission (WRC), South Africa

“Groundwater as you would know is neglected. It is neglected at the level of implementation, it is also neglected at the level of knowledge investment and it’s neglected at the level of practitioner investment, and South Africa found out this the hard way through the recent drought in Cape Town, South Africa.”

“Groundwater is going to have a major part to play not only in the water strategy for the region going forward, but in the overall development strategy for the region going forward.”

“Moving into the future we should be wise and organize for renewable energy, and possibly nuclear energy, for the purposes of sustainability.”

“The relationship between water-energy-food is an intimate one. Agricultural production as well as Agri processing cannot happen without water and energy.”
Following Dhesigen Naidoo’s keynote address, six presenters contributed to day one’s sub-theme:

- Khangweleni Fortress Netili from the DWS in South Africa gave a review of how South Africa is managing its National Groundwater Monitoring Network and its implications for the country’s TBA management obligations.
- Jonathan Lautze from IMWI presented on lessons learned from the Ramotswa (shared between Botswana and South Africa) and Stampriet (shared between Botswana, Namibia and South Africa) Transboundary aquifers, which aimed to strengthen cooperation on TBAs in SADC.
- Tsepho Jankie, an independent researcher from Botswana presented on the implications of climate change in the Transboundary Tuli-Karoo Sub-Basin shared between Botswana, South Africa and Zimbabwe.
- Anthon Lukas from the University of the Free State in South Africa shared results from an evaluation of the SADC Hydrogeological Mapping Borehole Database and the implications for Member State’s future data collection.
- Christina Fraser from University of Strathclyde in Scotland spoke about a resource-light assessment methodology used in exploring Malawi’s TBAs.
- Davison Saruchera from the University of Witwatersrand in South Africa presented the findings and lessons for SADC on an assessment of the status and strength of conjunctive management of surface and groundwater in transboundary waters treaties.

Khangweleni Fortress Netili

Department of Water and Sanitation (South Africa)

“The Department of water and sanitation (DWS) has a mandate to protect, use, develop, conserve, monitor, manage and control South Africa’s water resources in an integrated manner.”

“The current groundwater monitoring network coverage for South Africa is skewed and inconsistent.”

Jonathan Lautze

International Water Management Institute

“There has been scant investigation on the practicalities of implementing TBA management in Africa.”

“There is no blueprint for TBA cooperation. Rather, these initial experiences in SADC provide tools and illustrate options for strengthening management of shared groundwater resources, which can be placed in a larger toolbox and drawn upon as needed in other systems.”

Tshepo Jankie

Independent Researcher

“The work, which this presentation is based on, is intended to assess the possible impact of future climate change scenarios on groundwater recharge in the transboundary Tuli-Karoo sub-basin of southern Africa.”

“This study is important in enhancing the knowledge and capacity of decision makers, to allow them to sustainably manage groundwater both for current and future demands.”
Anton Lukas
University of the Free State

“SADC-GMI commissioned the IGRAC to revive the SADC Hydrogeological Map that was developed in 2010 to identify all shortcomings in the dataset, including identifying errors and absentees in the data.”

“This process has the potential of improving future data collection.”

Davison Saruchera
University of Witwatersrand

“The scale of conjunctive water management treaties is not straightforward.”

“Limited growth of robust conjunctive treaties is likely due to knowledge gaps. Urgent investment in filling these knowledge gaps is needed.”

“Those who genuinely want to implement conjunctive management lack guidelines on how to do so”

Christina Fraser
University of Strathclyde

“Countries need to take responsibility for their potential transboundary impacts.”

“Zooming in on hotspots can allow countries to make directed management decisions where they are actually needed.”

Dr Roger Parsons
Parsons & Associates

“There have been severe water restrictions applied to the agricultural sector, the industrial sector and the urban environment in the city of Cape Town.”

“This had a devastating impact on the economy, and in particular the poorest of the poor.”

“Throughout this crisis, groundwater continued to play an important role, along with the more expensive desalination and less popular recycling.”

“About 13% of the volume of municipal water in the Western Cape Province is now sourced from groundwater.”

“There is plenty of evidence that groundwater levels across the Western Cape Province have not been significantly impacted by the drought.”
AFTERNOON SESSION

Continuing on sub-theme 1, the afternoon session of day one kicked off with a keynote address by natural scientist, and Parsons & Associates CEO Dr Roger Parsons who presented a paper entitled “Groundwater — Avoiding the Single Story.” The presentation takes inspiration from Chimamanda Adichie’s viral Ted talk which, like Parsons’ presentation, detailed the dangers of looking at things from only one’s own perspective, using the water crisis in Cape Town, South Africa. In this keynote address, Dr Parsons’ also emphasised the significance of creating an environment that will enable multi-country collaboration on water resources management, as well as creating funding opportunities to expand and maintain groundwater monitoring networks. One of the key takeaways from the presentation is that information on groundwater should be provided to those who need it, like information on surface water.

Dr Parsons’ presentation was followed by other presentations and a panel discussion continuing on the first day’s sub-theme of “Promoting climate change resilience through TBAs management and conjunctive groundwater surface water management in the SADC Region”. These presentations focused on the need to manage and share data as well as build skills, knowledge and cooperation within and between Member States.

The presentations were:

- Kwazikwakhe Majola from the DWS in South Africa presented on the Ramotswa Information Management System (RIMS), a system developed to compile, house and display mappable data from the Ramotswa TBA.
- Phuti Mabotja from the University of the Free State (UFS) shared insights on how free software can aide in optimising and managing groundwater.
- Piet Kenabatho from the University of Botswana (UB) shared about the journey towards improved governance of TBA’s in southern Africa, central to this being the establishment of the Stampriet Transboundary Aquifer System (STAS), and the Multi-Country Cooperation Mechanism (MCCM).
- Sakeus Ihemba from the Ministry of Agriculture, Water and Forestry in Namibia presented on a case in Namibia, looking at groundwater governance and the demand for sustainable agriculture in the Grootfontein-Tsumeb-Otavi Subterranean Water Control Area.
- Girma Y. Ebrahim from the International Water Management Institute spoke about sustainable agricultural groundwater use, with a focus on the case of the Hard Rock Catchment in Hout, Limpopo Province, South Africa.

Girma Y. Ebrahim
International Water Management Institute

“The Hout River catchment/Dendron aquifer area is one of the most agriculturally-productive regions in South Africa.”

“Hydrogeological modelling is fundamental for understanding dynamics and spatial and temporal variability in key parameters required for managing the groundwater resources sustainably, and for maintaining resilience in the context of increasing water demand and climate change.”
Sakeus Ihemba
Ministry of Agriculture, Water and Forestry (Namibia)
“The high demand for groundwater resources for agricultural purposes in the Central Area of Namibia has put the resource under tremendous pressure.”
“Groundwater use for agriculture as well as cross-basin augmentation during drought periods has increased the use of the resource to above the sustainable safe yield.”
“Climate change is posing as a new challenge to manage the resource.”

Piet Kenabatho
University of Botswana
“Understanding this precious groundwater resource and managing it sustainably is essential to achieving water security in the area and thus, improving the quality of life of neighbouring and resident communities.”
“The Multi-Country Cooperation Mechanism for the governance and management of the STAS established in August 2017 is the first example of institutionalising cooperation over a transboundary aquifer in southern Africa.”

Phuti Mabotja
University of Free State
“Data collection and management remains the key areas of concern in groundwater management. This can be improved by using software programmes.”
“Advancement of free software development is necessary to realise better groundwater management.”

Kwazikwakhe Majola
Department of Water and Sanitation (South Africa)
“The Ramotswa Information Management System contributes to the 2030 Groundwater Governance Vision as well as the SADC Revised Protocol on Shared Watercourses.”
“This information and reports are accessible to everyone.”
PANEL DISCUSSION ON TBA HOTSPOTS IN THE SADC REGION

A panel discussion facilitated by Dr Karen G. Villholth and Girma Y. Ebrahim on TBA hotspots in the SADC Region concluded the day. Panellists to the discussions were:

- Peterson Robin from South African National Parks
- Eddie Riddell from South African National Parks
- Ralf Klingbeil from the Federal Institute for Geosciences and Natural Resources in Germany

All presented findings of studies they undertook that contributed to the understanding of hotspots. Robin presented findings from a study on hydrological dynamics in Mapungubwe National Park, Riddell on TBAs and the role of large protected area management in Limpopo, while Klingbeil gave the results of a study on deep, semi-fossil aquifers in southern Africa.

Peterson Robin
South African National Parks - Scientific Services

“The key groundwater issues in the Mapungubwe National Park are related to the abstraction of water for mining activities and agricultural purposes.”

“The abstraction from these aquifers not only affects the base flow contribution to the Limpopo River during the dry season, but also applies great stress on aquifer dependent ecosystems.”

“By gaining an understanding of the processes and mechanisms associated with water in the landscape, groundwater management will be strengthened to allow the natural interaction/movement/exchange between groundwater and surface water and allow sustainable use of groundwater resources without damage to the natural functions and processes associated with the aquifers.”

Eddie Riddell
South African National Parks - Kruger National Park

“The Limpopo Basin Aquifer shared between South Africa, Mozambique and Zimbabwe is a potentially valuable water source to resource poor farmers to meet and sustain small scale irrigation demands even during dry periods when surface flow ceases.”

Ralf Klingbeil
Federal Institute for Geosciences and Natural Resources (Germany)

“Large intracontinental basins in Africa are likely to comprise still-hidden fossil or semi-fossil aquifers.”

“Such deep-lying aquifers represent a strategic resource for a fast-growing population and can support the adaptation to climate change.”
The second day of the conference was opened by a keynote address by Prof Jason Gurdak of San Francisco State University on climate variability and sustainable groundwater stores entitled “Beneath the surface of climate change: managing sustainable groundwater within the water-energy-food-climate NEXUS.” He emphasised the increasing pressure on global water, energy, and food resources brought about by climate change and economic development. These stresses amplify the need for trade-offs and incite conflicts among stakeholders.

Prof Gurdak then presented new findings from the UNESCO Groundwater Resources Assessment under the Pressure of Humanity and Climate Change (GRAPHIC) project. The GRAPHIC project was undertaken against the backdrop of the pressure on global WEF resources, as well as the global groundwater crisis. The project aims to help manage our way through this climate change and economic development crisis.

Prof Jason Gurdak

“Many African countries have an opportunity to avoid groundwater crisis, but lack proper groundwater monitoring station to support decision making”

“Groundwater management institutions could further incentivise managed aquifer recharge (MAR) projects.”

“MAR operations should take advantage of temporal patterns of precipitation and enhanced recharge during wet phases of climate oscillations.”
TOWARDS AN UNDERSTANDING OF THE IMPACTS OF CLIMATE CHANGE ON GROUNDWATER RESOURCES AND EXPLORING CLIMATE-SMART GROUNDWATER INFRASTRUCTURE OPTIONS

MORNING SESSION

Following Prof Jason Gurdak’s keynote address, the focus was on sub-theme 2 entitled “towards an understanding of the impact of climate change on groundwater resources and exploring climate-smart groundwater infrastructure options.” Twelve people presented during the morning session.

The insightful session with practical knowledge sharing included presentations from Steven Kumwenda from BASEflow in Malawi, on groundwater recharge and baseflow in the SADC region and Girma Y. Ebrahim on groundwater/aquifer recharge. The presentations explored managed aquifer recharge (MAR), as a management tool in the sustainable use of water resources in order to address the most-feared impacts of climate change, such as the alteration of the hydrological cycle. Currently, MAR is not widely practiced in Africa and is concentrated in only eight African countries.

Other presentations in the morning session were delivered by Esther Chifuniro from the State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering in Nanjing China and Manuel Magombeyi from the International Water Management Institute. Both the presentations looked at groundwater and salinity.

The rest of the presentations were by:

- Alfred Kabo Petros from the Department of Water Affairs in Botswana
- Moiteela Lekula from the University of Twente in Netherlands
- Karen G. Villholth from International Water Management Institute (IWMI)
- J.D. van Niekerk from the University of the Free State (UFS) in South Africa
- Zachariah Maswuma from the Department of Water and Sanitation (DWS) in South Africa
- Manuel Magombeyi from International Water Management Institute (IWMI)

The presentations presented methodologies in use for measuring groundwater levels and quality and assessing the sustainability of groundwater resources, as well as infrastructure options for groundwater management.
Esther Chifuniro
State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering

“19.5% of irrigated land is salt affected making saline soils one of the major threats to world food production. One of the many contributing factors to soil secondary salinization is shallow groundwater which is a common occurrence in heavily irrigated regions.”

Moiteela Lekula
University of Twente

“Groundwater resources replenishment dynamics evaluation is critical for effectively managing the resource.”

Kabo Petros
Department of Water Affairs (Botswana)

“Findings show that floods in arid and semi-arid regions in Botswana causes groundwater levels to rise. Understanding the groundwater processes that take place prior, during and after extreme flood events is crucial to the sustainable management of groundwater resources.”

Manuel Magombeyi
International Water Management Institute

“Monitoring tools for soil-water, nutrient and salts in irrigated agriculture can help one identify areas that need improved management. This allows for increased gross water productivity while also improving food security.”

J.D. van Niekerk
University of the Free State

“The success of sustainable groundwater management is influenced by data quality, identifying problems and the associated cause of each problem. The complexity of this science requires the ability to integrate a variety of specialist skills. Common inaccuracies can be addressed by accurate data collection, time management, planning and experience.”
Mr Kode spoke on how groundwater was strategically used as a solution for the water crisis in Cape Town, South Africa. His presentation noted how the province’s WBCP used groundwater to allow for certain critical facilities across the province to keep running irrespective of municipal water failure because of the drought and water crisis.

Following Mr Kode’s keynote address, Theresa Mkandawire from the University of Malawi and Albie Steyn from UFS contributed to the day’s theme with vibrant presentations. Mkandawire spoke of the functionality of hand pump boreholes in Malawi, noting that a 2016 study that surveyed 200 hand pump boreholes found that only 74% of them were functional at any one point. Steyn presented findings from her study that looked at quantifying long-term water quality of mine waste drainage through the use of geochemical modelling.

**Gavin Kode**

**Western Cape Provincial Department of Public Works (South Africa)**

“Most interventions undertaken by the Western Cape Government are permanent and have been designed to improve the resilience of the WCG to future water shocks and stresses.”

“Climate change is a reality, these negative effects are clear, with less annual rainfall against a background of higher average temperatures and greater evaporation of surface water.”

“The crisis is coupled by escalating water demand attributed to rapid urbanisation and growing populations, which indicates a significant future water supply challenge.”

“The strategy used in the Western Cape, the Water BCP Programme, which has a strong focus on groundwater, is water resilient.”

“Resilience means capacitating business to survive, adapt and grow in the face of turbulent change and complexity.”
Prof Alan McDonald
British Geological Survey

“Resilience of groundwater supplies is determined by several factors including groundwater storage, long term recharge, permeability and the infrastructure put in place to abstract groundwater. On a large scale and for the medium timeframe, there is evidence that groundwater is resilient to climate change. But it is vital that we investigate how rural communities use water during droughts and investigate recharge processes and its links to land use, abstraction, geology and climate.”

Theresa Mkandawire
University of Malawi

“Functional hand-pump boreholes in these districts is an indication that the widely used groundwater resource is accessible at any given point to those who need it. The results give a good indication of our progress on achieving universal access to safe and reliable water for all by 2030, especially in the African continent.”

“Hand-pump boreholes, other than being the most economical and simple solutions for providing a collective supply of drinking water in rural areas, they also help to eliminate the risks of people, and children in particular, falling into open wells.”

Albie Steyn
University of the Free State

“The generation of large volumes of mine wastewater by South African mines have the potential to adversely affect groundwater, which is an already scarce water resource. It is essential to predict water quality post-mining, as well as properly manage the resource.”
The afternoon of day two resumed with a keynote address by British Geological Survey’s Professor Alan McDonald, entitled “Resilience of rural groundwater supplies to climate change.” Rural groundwater supplies appear to be resilient to climate change, especially in the case of boreholes with pumps. But continued monitoring of groundwater levels, as well as measuring the functionality of water points, are critical as these influence the resilience of the resource.

The presentations from four remaining speakers of day two of the conference all agreed on the need for training in groundwater resource management and governance for municipal employees and contractors. In this session, Emmanuel Kisendi from the University of Twente who presented results from his evaluation of groundwater resources in the Central Kalahari Karoo Basin, and Piet Kenabatho from the University of Botswana presented results of an assessment of the Stampriet Transboundary Aquifer System (STAS) and spoke of the need to promote groundwater cooperation in southern Africa through modeling.

Modreck Gomo presented on the methods to determine borehole sustainable yield, while his UFS counterpart, George Molaolwa gave a presentation that looked at the need for, and development of, a training manual for groundwater resource management and groundwater governance for Municipalities in South Africa.

Emmanuel Kisendi
University of Twente
“Groundwater resources evaluation is an important aspect of water resources’ management and this is optimally done through distributed numerical models. The development of a transient model to quantify aquifer storage and specific yield should be explored.”

Piet Kenabatho
University of Botswana
“The Stampriet Transboundary Aquifer System joint governance mechanism is the first arrangement on transboundary aquifers since the Sustainable Development Goals (SDGs) were adopted in 2016. It is a breakthrough in many aspects.”

Modreck Gomo
University of the Free State
“As a few direct established methods exist that determine sustainable borehole yield. The administration of these tests ensures that groundwater experts are involved in operational phases and can save cost on unnecessary and unreliable once-off pumping tests.”
The SADC-GMI Gala Dinner was held to celebrate the 1st Annual SADC Groundwater Conference as well as to mark two years since the SADC-GMI’s launch on September 26, 2016. The Gala Dinner also allowed for a dedicated time to pause and honor the input of all stakeholders. The Gala Dinner began with James Sauramba, the Executive Director of the SADC-GMI, welcoming everyone to the event, and thanking them for making time to attend both the conference and dinner irrespective of their busy schedules. In his opening message, Sauramba voiced appreciation for the respect and gratitude shown to SADC-GMI, in spite of its only two years of operation. Following Sauramba’s short opening address, the attendees were given the opportunity for social interaction and networking, while simultaneously treated to tranquil music from a local band.

The evening also gave Sauramba the opportunity to give praise to every individual who contributed to the conference. More specifically, he gave a special thanks to the key note speakers, citing the effort they took to prepare their resounding key note speeches. To this end, Sauramba and the SADC-GMI, presented the key note speakers with gifts as tokens of appreciation.
The evening was capped by an award ceremony acknowledging the most promising young professionals presenting at the conference. According to the awards sponsors, the International Groundwater Resources Assessment Centre (IGRAC), the awards were aimed at stimulating young professionals from SADC Member States to contribute to groundwater science, development and management. The awards were given to the best oral presentations of young professionals at the conference.

Ultimately, a panel of six experts from across the SADC Region scored the presentations. The awards had three categories: the Best Presenter for Sub-theme 1 entitled “Promoting climate change resilience through transboundary aquifers (TBAs) management and conjunctive groundwater surface water management in the SADC-region”; the Best Presenter for Sub-theme 2 entitled “Towards an understanding of the impact of climate change on groundwater resources and exploring climate smart groundwater infrastructure options”; and the main award for the Best Promising Young Scientist.

The best presenter prize for sub theme 1 was handed to Christina Fraser, a PhD research student from the University of Strathclyde in Glasgow, Scotland. Fraser’s winning presentation spoke of a resource-light assessment methodology used to explore Malawi’s TBAs.

Albie Steyn, an MSc student at the University of the Free State in South Africa won two prizes — one for the Best Presenter for Sub-theme 2 and also the award for the Most Promising Young Scientist. Steyn’s presentation looked at quantifying long-term water quality of mine waste drainage through the use of geochemical modeling.

Steyn’s reward for winning the Most Promising Young Scientist award was an offer to attend the 19th WaterNet/WARFSA/GWP-SA Symposium held in Livingstone, Zambia from October 31 to November 2, 2018 under the theme “Integrated Water Resources Development and Management: Managing Water for the Future in a Changing Environment in Eastern and Southern Africa”.
The final day of the conference commenced with keynote speaker Dr Callist Tindimugaya, Head of Department for Water Resources Planning and Regulation at the Uganda’s Ministry of Water and Environment. The opening keynote address on a paper entitled “Groundwater and African National Development Strategies” looked at how groundwater can and should fit on African National Development Strategies, especially when the resource “is poised to play a key role in Africa’s transformation.”

Dr Tindimugaya noted that over two-thirds of African nations have made specific reference to groundwater within their National Growth and Poverty Reduction Strategies. Despite this, the use of groundwater has not predominately featured in public discourse. As a result, the role of groundwater is still not well appreciated in most of the African countries.

Dr Callist Tindimugaya

Department for Water Resources Planning and Regulation (Uganda)

“Almost every African nation has made specific reference to groundwater within their National Growth and Poverty Reduction Strategies, this includes all SADC countries.”

“It is therefore important to get the key players to appreciate that a strong connection exists between groundwater and Africa’s politically-owned agenda of national development, inclusive growth and poverty reduction.”

“Research links to poverty can evolve from conceptual frameworks towards the actual political commitments to use groundwater towards poverty reduction in Africa.”
The session was chaired by Zione Uka, of the Department of Water Development in Malawi. The session comprised of four presentations:

• Anita Lazurko of the International Water Management Institute (IWMI)
• Traci Reddy of Pegasys
• Arnaud Sterckx of the International Groundwater Resources Assessment Centre (IGRAC)
• Geert-Jan Nijsten of the International Groundwater Resources Assessment Centre (IGRAC)

The presentations all looked at groundwater management, including managing groundwater data and were followed by a panel discussion.

Dr Arnaud Sterckx and Geert-Jan Nijsten presented on the Capacity Building on Groundwater Data Collection and Management for SADC Member States (SADC-Groundwater DataCoM) project. Dr Sterckx spoke of the gaps in groundwater data collection and management among Member States, while Nijsten presented on the development of a SADC framework for groundwater data collection and management. All these presentations underscored the significance of properly managing groundwater and how essential it is to have the right data.

Anita Lazurko
International Water Management Institute

“Issues about water security, resilience and climate change make conjunctive management of water necessary. There’s opportunity to take major steps forward in conjunctive transboundary water management and to produce lessons learned.”

Traci Reddy
Pegasys

“The generation of large volumes of mine wastewater by South African mines have the potential to adversely affect groundwater, which is an already scarce water resource. It is essential to predict water quality post-mining, as well as properly manage the resource.”

Geert-Jan Nijsten
International Groundwater Resources Assessment Centre

“The SADC framework for groundwater data collection and management is an idea motivated by research findings which has indicated that national groundwater monitoring activities in the SADC countries lack clear objectives and technical procedures for consistent data collection.”

“The framework is primarily designed to provide guidelines for developing, and implementing effective and efficient groundwater data collection and or groundwater monitoring programmes.”

Arnaud Sterckx
International Groundwater Resources Assessment Centre

“The gaps in SADC groundwater data are impacted by insufficient budget, a lack of a coherent strategy, poor quality assurance and difficulties with data storage and sharing.”
Panel discussion: Groundwater Data Collection and Management in SADC Member States

The session was closed by a panel discussion on ‘Groundwater Data Collection and Management in SADC Member States’ organised by IGRAC. The discussion, hosted by Zione Uka, included expert panellists — Zacharia Maswuma, Frank Ngoma, Cyril Masamba, Mwanamkuu Mwanyika, and Ana Isabel Fotine Mponda. The experts discussed groundwater data collection and management in SADC.

Key topics included:

- How to think about the challenges of data scarcity and lack of access to reliable data?
- Key impediments to improving groundwater data collection and management.
- Possible ways to best address these challenges.

The panellists agreed that the challenge of poor and non-reliable data was not limited to one or a few countries, but affected SADC as a whole.

Zacharia Maswuma
Department of Water and Sanitation (South Africa)

“You cannot manage what you cannot measure, thus data is the foundation for everything with regards to groundwater management.”

“The accuracy of the data is very important as the same data informs decision makers.”

“Water monitoring networks in South Africa are mostly situated in farms, which presents a challenge to access them.”

“The water monitoring networks are at times vandalised. To prevent this, it is important to empower local citizens with skills, and other incentives so they can willingly safeguard the equipment.”

Cyril Masamba
Department of Water Affairs (Democratic Republic of the Congo)

“There is a big issue pertaining accessing data that is valid, and at times this comes at a cost.”

“There are also issues with meters that allow for studying the quantity of water used in the boreholes.”

Dumisane Mndzebele
SADC Secretariat

“The SADC water protocol’s challenge is on watercourse systems.”

“The protocol does embrace both surface and groundwater, but when it comes to specifications, the protocol does not explicitly touch on the data types of groundwater.”

“The protocol is robust when it comes to cooperation between Member States.”
ROUND TABLE DISCUSSION: KEY MESSAGES FROM THE 1ST SADC-GMI GROUNDWATER CONFERENCE FOR AFRICA WATER WEEK AND BEYOND

To sum up the conference, a roundtable discussion was held on the key takeaway messages from the conference, as well as a way forward facilitated by SADC-GMI’s Executive, James Sauramba.

Key to this messaging was the significance of groundwater, since the resource is widely used in the SADC Region. It called for African Union states to treat the resource with the seriousness it deserves, similar to how surface water is treated. The need for increased investment on groundwater was highlighted, as well as the need for knowledge sharing and data collection.

A need for more capacity building related to groundwater was also raised, as well as the opportunities for better capitalising on the economic value of groundwater.
The SADC-GMI held its 1st Groundwater Conference in Johannesburg, South Africa, from the 26th to the 28th of September 2018, under the theme “Adapting to Climate Change in the SADC Region through Water Security – A focus on Groundwater”. The conference was attended by 123 groundwater practitioners, researchers and decision-makers, deliberating on the role of groundwater in enhancing water security and resilience in SADC under the pressures of climate change and human development.

The conference notes that the 7th Africa Water Week has been held from the 29th of October to the 2nd of November 2018 in Libreville, Gabon, convened by the AMCOW in conjunction with the AUC under the theme “Toward Achieving Water Security and Safely Managed Sanitation for Africa”. We, the participants, have the following key messages to inform deliberations following Libreville:

1. Groundwater supplies in many cities and rural communities in Africa. About 75% of the African population depends on groundwater for drinking. It contributes to health through improved sanitation and hygiene. It is also used for irrigation and livestock farming and supplies industries supporting food production and economic development on the continent. In addition, groundwater supports several ecosystems that have cultural and economic value. Groundwater for productive uses fundamentally hinges on energy for pumping. Solar energy access for farmers can greatly enhance the pressure on groundwater resources and needs to be carefully developed. We call upon African States to meaningfully include groundwater in water management plans and, more generally, in socio-economic development strategies, considering the WEF nexus.

2. Groundwater is more resilient to climate change than surface water. It is poised to play an increasing role in adaptation and mitigation strategies. Population and economic growth will also increase the pressure on this resource. We call upon African states to proactively include groundwater in climate change and adaptation strategies to enhance the long-term resilience of cities and communities.

3. Given the importance of groundwater in coping with water scarcity challenges brought about by climate change, there is a need to develop regional groundwater assessment and exploration strategies, which will also identify priority transboundary aquifers for sustainable development. This is in response to the fact that, in contrast to surface water, groundwater remains invisible to policy makers because of lack of information.

4. Successful conjunctive use and management of groundwater and surface water resources at national and transboundary level should be supported by science-based evidence from research, capacity building and an enabling policy, legal and institutional framework. The vulnerability of African cities to drought has necessitated a rethink about water resilience and conjunctive use of water resources. Decision-makers in African cities are encouraged to broaden the water supply mix to include urban stormwater, treated waste water, desalinated water and groundwater.
5. The implementation of MAR schemes has been successfully implemented in several African countries and it has proved to be a sustainable solution to water management in a wide range of environmental and social contexts. We call upon AMCOW for the proactive implementation of MAR to enhance water security.

6. 72 TBAs have been identified in Africa. They underlie 40% of the continent and it is estimated that 33% of the African population live on top of TBAs. There is a need to strengthen and develop institutions to promote transboundary aquifer cooperation, focusing on tangible water problems faced by African states. Transboundary groundwater monitoring infrastructure is required along with data sharing and harmonisation protocols. Several projects have been launched in the SADC region to foster the management of TBAs (e.g. Stampriet aquifer, Ramotswa aquifer, Shire aquifer). The lessons of these pilot projects can be extrapolated and applied across the rest of the continent.

7. Experiences of TBA management in SADC show that transboundary organisations are instrumental in managing TBAs, such as L/RBOs and the SADC-GMI. We encourage L/RBOs and other transboundary organizations to support the management of TBAs.

8. Among the United Nations SDGs, SDG 6 aims at ensuring water and sanitation for all. This SDG targets that by 2030, integrated water resources management is implemented at all levels, including through transboundary cooperation (SDG 6.5.2). We call upon AMCOW to support international cooperation amongst African States to develop instruments for TBA management contributing to Indicator 6.5.2.

9. It is critical to recognize that groundwater issues arise at local, national and transboundary level. Countries need to identify appropriate scales for intervention and management, and ensure a nesting of scales and associated institutions, from local to international, in order to properly match resource investments with problems at hand and achieve successful outcomes. Also, African countries need to strengthen their capacity for groundwater management so as to enhance the success of transboundary cooperation.

10. Sanitation and waste handling is closely linked to groundwater, with poor onsite sanitation and unplanned dumpsites being culprits of serious contamination, rendering groundwater unfit for use for extended times, up to generations. Significant co-benefits arise from proper land-use planning and recycling of waste. AMCOW and African states are urged to explicitly account for groundwater impacts in land-use, sanitation and waste handling strategies.

11. Coastal aquifers present special challenges due to risk of seawater intrusion, which is already evident. Coastal cities and small island states in Africa need to carefully develop their groundwater resources, while also protecting them through MAR and augmenting water supply from secondary sources, like desalination and waste water reuse.

12. Finally, AMCOW and African states are strongly encouraged to foster learning alliances, capacity development, knowledge-sharing and networking on groundwater at the continental and international level, through the support to learning institutions, specialised centres, and international exchange programs in order to fulfill their mandate on supporting sustainable water management in Africa.
SPONSORS’ AND ORGANIZING PARTNERS
required for sustainable groundwater resource development, groundwater management and groundwater monitoring worldwide.

SADC - Groundwater Management Institute
SADC-GMI is a subsidiary structure of the SADC Secretariat. SADC-GMI's core mandate is to promote sustainable groundwater management and provides solutions to groundwater challenges in SADC through creating an enabling policy, legal and regulatory environment; capacity building; advancing research; supporting infrastructure development; and enabling dialogue and accessibility of groundwater information

UNESCO - International Hydrological Programme (IHP)
UNESCO-IHP is the only intergovernmental programme of the UN devoted to water research, water resources management, and education and capacity building. Through one of its flagship programmes, the Internationally Shared Aquifer Resources Management (ISARM), more than 70 transboundary aquifers have been identified in Africa of which 28 are shared between two or more SADC Member States. www.unesco.org

IGRAC - International Groundwater Resources Assessment Centre
IGRAC (International Groundwater Resources Assessment Centre) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide. Since 2003, IGRAC provides an independent content and process support, focusing particularly on transboundary aquifer assessment and groundwater monitoring. Read more about IGRAC mission and objectives and organisation at www.un-igrac.org
DWS - Department of Water and Sanitation

The mission of the Department of Water and Sanitation is a custodian of South Africa’s water and sanitation resources. The Department’s strategic goals are: to be an efficient, effective and development orientated sector leader; equitable and sustainable provision of raw water; provision of equitable and sustainable water services of acceptable quantity and quality; and protection of freshwater ecosystems.

IWM - International Water Management Institute

International Water Management Institute is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. IWMI works in partnership with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health.

GWPSA - Global Water Partnership Southern Africa

The Global Water Partnership Southern Africa (GWPSA) is one of the 13 regional networks of the The Global Water Partnership international network created to foster an integrated approach to water resources management (IWRM) for a water secure world. GWPSA offers practical advice for sustainably managing water resources specifically to 15 countries in the SADC region.
**GRIPP - Groundwater Solution Initiative for Policy and Practice**

The GRIPP partnership, led by the International Water Management Institute (IWMI), strengthens, expands and connects current groundwater initiatives. It supports the Global Framework for Action developed by the Groundwater Governance Project funded by GEF and implemented by the UN Food and Agriculture Organization (FAO) together with UNESCO-IHP, International Association of Hydrogeologists (IAH) and the World Bank.

---

**WRC - Water Research Commission**

The Water Research Commission (WRC) is South Africa’s premier knowledge hub. WRC provides the country with applied knowledge and water-related innovation. The strategic role of the WRC is therefore, to be continuously relevant and effective in supporting both the creation of knowledge through R&D funding and the transfer and dissemination of the created knowledge.

[www.wrc.org.za](http://www.wrc.org.za)

---

**WCS - Wellfield Geosciences Corporate**

WCS is the principal operating company of Wellfield Geosciences Group in the fields of groundwater resources evaluation, development and management. It also offers services in water quality monitoring and laboratory analysis, pollution studies, irrigation, mine dewatering, digital cartography and surveying, remote sensing, numerical modelling, and integrated water resources evaluation and development.

---

**Pegasys Institute**

Pegasys Institute is a value-based not-for-profit organisation that focuses on generating innovative ideas, advocacy, policy and strategy in the areas of natural resource use, water, climate change and infrastructure.
International Association of Hydrogeologists and the South African National Chapter (IAH-SA-NC)

The International Association of Hydrogeologists (IAH) is an international scientific and educational organization that aims to promote research and understanding of the proper management and protection of groundwater for the common good throughout the world. www.iah.org.za

Ground Water Division (GWD)

The Ground Water Division is a body of scientists, academics and technicians with direct or indirect involvement or interest in the optimal development of the country’s groundwater as a limited natural resource, and in the preservation of its quality. It is committed to upholding and promoting professionalism in the field of groundwater among its membership and strongly supports environmental consciousness. www.gwd.org.za

Institute for Groundwater Studies (IGS)

The institute conducts contract research on a water-related topics with a special interest in contributing to water management and minimisation of pollution in the mining and industrial sectors, as well as understanding the nature and behaviour of South Africa’s aquifers. The institute provides a complete service through field investigations, the developing of specialised field equipment, a well-equipped commercial and water research laboratory and a number of computer models. www.ufs.ac.za/natagri/departments-and-divisions/institute-for-groundwater-studies-(igs)-home
The Southern African Development Community Region is subjected to severe climatic variability scenarios which negatively impact on more than 70% of the region’s population, who are dependent on groundwater for their livelihood. With the challenges of climate change, pollution growth and rapidly growing water demand in the region the need to strengthen the management and development of groundwater for social and economic development cannot be overemphasized. The rationale for the establishment of the Southern African Development Community Groundwater Management Institute (SADC-GMI) was premised on the importance of groundwater in the region and the need to set up a “Centre of Excellence” for groundwater management and groundwater dependent ecosystems in the region, and to have an institution that will serve as an interlocutor with national, regional and international groundwater initiatives and institutions. The institute is hosted by the University of the Free State, Bloemfontein, South Africa on behalf of and under the strategic guidance of the SADC Secretariat, Directorate of Infrastructure’s Water Division, in Gaborone, Botswana. SADC-GMI is a project driven institute, currently implementing multiple projects in the SADC Region in partnership with key players in the water sector. The Southern African Development Community Groundwater Management Institute (SADC-GMI) is established as a section 21 not-for-profit company registered under the South African Companies Act No. 71 of 2008, as amended. The company is run by a Board of Directors composed of representatives from the SADC Member States and the University of the Free State, with an Executive Director and SADC Secretariat’s Water Division as the Chair. SADC-GMI’s core mandate is to promote sustainable groundwater management and provide solutions to groundwater challenges in the SADC Region through creating an enabling policy, legal and regulatory environment, capacity building, advancing research, supporting infrastructure development and enabling dialogue and accessibility of groundwater information.