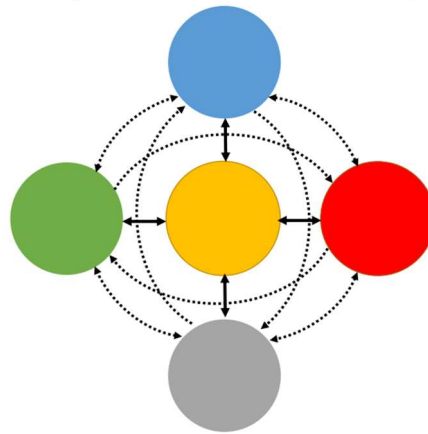


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# CoSMOS - Community-based Sustainable Water Management and Observation System (FKZ: 01DG21060)



## Description of the Initial Activities and Outcomes of the Project Pre-information on PART II OF THE FINAL PROJECT REPORT (“EINGEHENDE DARSTELLUNG”)

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Witten, May 2023





**Acronym and Project name:**

CoSMOS

- Community-based Sustainable Water Management and Observation System

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# CoSMOS

## Community-based Sustainable Water Management and Observation System

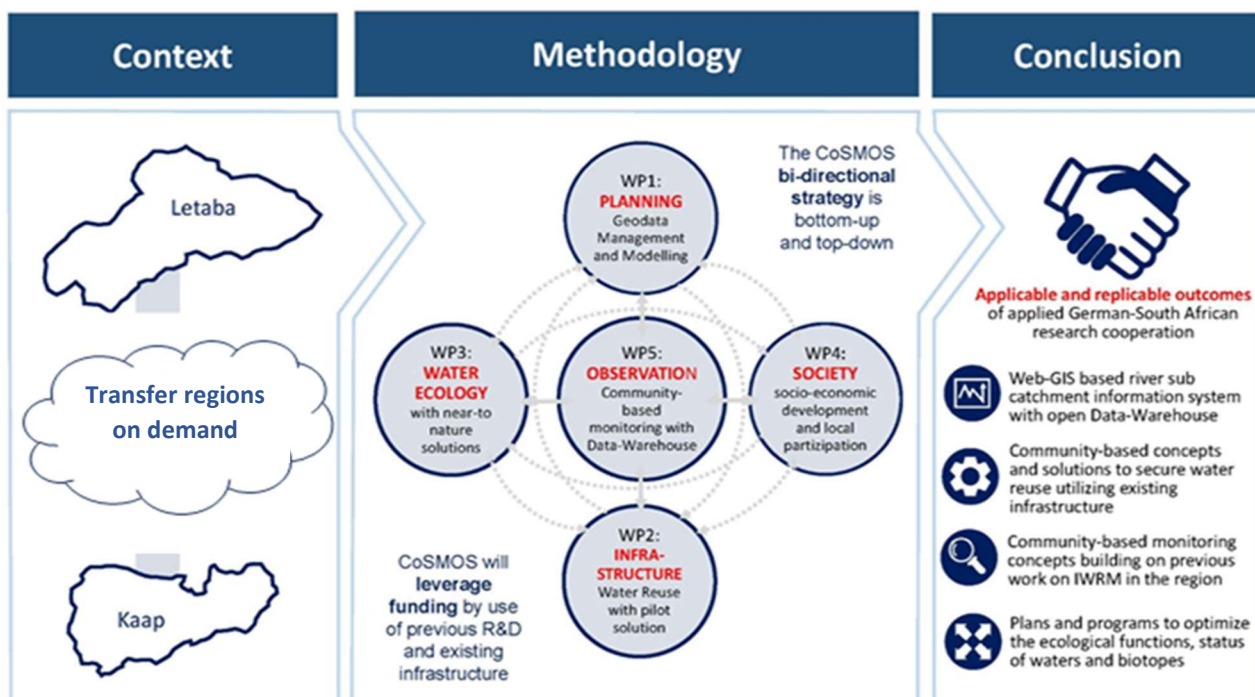
### Description of the Initial Activities and Outcomes of “the Project”

PRE-INFORMATION ON THE FINAL PROJECT REPORT (PART II “EINGEHENDE DARSTELLUNG”)

#### 1 SUMMARY

The *objective of CoSMOS “the Project* is to design and implement a **Community-Based Sustainable Water Management and Observation System** for the mitigation of water quality problems, droughts and floods affecting water security. Community-based social and citizen science approaches are characterised by a bottom-up water management and governance strategy to bridge implementation gaps with regional and local water management institutions. The Project will develop a concept with best practice examples in collaboration with relevant stakeholders on the governmental, administrative and executive levels addressing the WEF-nexus (**w**ater, **e**nergy, **f**ood). Building on previous research outcomes with valuable data and tools (some of which are implemented in South Africa, already), the Project with five work packages focuses on a combination of Regional Planning with Observation & Monitoring applying Intelligent Geodata Management & Modelling to generate appropriate information for regulation and operation of water systems and facilities.

Based on this, a sustainable *Water Reuse Concept* shall be developed to tackle local supply deficits with a novel solution to produce irrigation water from municipal wastewater. As an optional reuse extension, small quantities of potable water can be produced from irrigation water at farm buildings with a novel plant-concept piloted in the Mekong Delta 2022 to be adapted for Africa. To mitigate the problems with electricity supply (heavy “load shedding” since 2023), a digital module for smart energy production, storage and utilization shall be designed for the water reuse plants. The CoSMOS concept will strengthen Public Participation and Local Economic Development within the Water Society, flanked by concrete measures to improve the ecosystem status through Ecological Optimisation and implementing Semi-natural as well as Lean-tech Solutions (here: low-cost constructions, combined with high-tech process control).



**Figure 1: Visualized structure and brief explanations of CoSMOS, “the Project”**



## 2 INTRODUCTION

South Africa is a country suffering from increasing water scarcity and additionally struggling to keep up with a growing population. Consequently, the country needs water security for economic development in the face of climate change. South Africa is facing severe challenges - both resource-related (water stress, deteriorating water quality...) and governance-related challenges (mismanagement, collapsing infrastructure...). This is manifested for example by the deterioration of water and wastewater infrastructure due to poor facility operations and maintenance (O&M) and the lack of a comprehensive water quality monitoring network. The need to bridge between the regional and local levels, i.e. to create a *bi-directional approach between water planning on river catchment level and local measures to improve water infrastructure* was the first idea to develop the Project. The second idea was that *observation and monitoring is the precondition for enforcement of water law and standards* are inevitable to achieve the desired quality of water resources and water facility performance. The third idea was that *it is the community-based water society and beneficiaries (the "users") which must be actively involved as drivers of local water management* to overcome the challenges mentioned above. All these and other ideas are incorporated into the Project planning.

## 3 INITIAL OBJECTIVES AND TARGETS

The *overall objective of CoSMOS*, "the Project", was to develop, test and apply a community-based sustainable water monitoring and management system in target areas of South Africa together with German (DE) and South African (RSA) partners as part of the BMBF funding measure "Water Security in Africa - WASA, Initial Phase Southern Africa". During the fifteen months of the Initial Project, the current state of research was surveyed, local needs and practice-oriented requirements of water management were collected, criteria and scenarios for the demonstration were defined and an implementation concept for the subsequent Main Project was developed. Local practice partners and advisory institutional partners were involved from the very beginning to evaluate the practicality of the CoSMOS water management system and to develop transfer and financing options for long-term utilisation at an early stage.

The CoSMOS Initial Project is based on a pandemic-resilient co-working concept with online meetings, optional on-site activities and events in close cooperation between GER and RSA participants. Field studies, data collection, workshops and networking have either been shifted to online activities or contracted out to experts in RSA. In the first step, the main actors and the institutions in charge of implementing the Project results were to be identified by a group of GER and RSA project partners. The need for a river basin-wide water resources management concept as well as the current state of research in the field of community-based water facility management was to be analysed by the Project coordination in a background study at the beginning of the Initial Project.

## 4 PARTNERS AND SUPPORTERS OF THE PROJECT

In order to form a consortium of GER and RSA partners for the subsequent 1<sup>st</sup> Main Project, joint co-working meetings have been held in the hybrid format, focusing on the topics of the proposal. In hybrid workshops, the current state of the art was discussed and reconciled with stakeholders from administration, research and the private sector in order to specify the key points of the main phase of the Project. An implementation concept for the Main Project was developed, including a schedule with options for financial or in-kind contributions from the GER and RSA partners as well as from the Project beneficiaries (relevant users of Project outcomes) and other supporters. All this was done accompanied by detailed communication, consultation and reconciliation with the partners already engaged in the Project.

The Project partners are listed in **Table 1**. Four companies (incl. 1 water operator) have approached the Project team later after they heard about CoSMOS from presentations in RSA, in DE. Even though the intention was to limit the number of partners in favour of lean coordination, it was agreed to admit these 4 companies as autonomous replication partners which do not need to be fully coordinated under the Project (unlike the 9 GER and 9 RSA partners with obligations for Project deliveries). The list includes universities, a water catchment agency, water users, water operators, water industries and SMEs. As consultation partners, NGO and GO have declared to support the Project and advise the team. Lols have been signed by all listed institutions except GER applicants (who will sign grant notices) and the GOs (who must maintain neutrality). The Embassies and WASA-agencies (WRC and PTKA) have been consulted in Pretoria and Berlin; their recommendations are incorporated in the Project planning.

**Table 1: List of CoSMOS partners and supporting institutions**

No.	Classification	Acronyms and names of partner and supporting institution	Project representative	Country
1	Academia	<b>OWL</b> University of Applied Sciences and Arts	Prof. Dr. Christian Jolk	GER
2	Academia	<b>RUB</b> Ruhr-University of Bochum	Prof. Dr. Harro Stolpe	GER
3	Academia	<b>UW/H</b> Witten/Herdecke University	Prof. Dr. K.-U. Rudolph	GER
4	Water industry	<b>MaSy</b> Martin Systems GmbH @ wilo	Eng. Jose Ordonez	GER
5	SME	<b>DGE</b> DIE GEWÄSSER-EXPERTEN!	Dipl.-Geogr. Ingo Nienhaus	GER
6	Water operator	<b>Eva</b> Erftverband aquatec GmbH	Prof. Heinrich Schäfer	GER
7	SME	<b>IBC</b> Ingenieurtechnische Beratung Christoffels	Dr. Ekkehard Christoffels	GER
8	SME	<b>chromgruen</b> Planungs- und Beratungs GmbH & Co KG	Dr. Andreas Müller	GER
9	IT company	<b>Disy</b> Informationssysteme GmbH	Dr. Andreas Abecker	GER
10	Academia	<b>UJ</b> University of Johannesburg	Dr. George Tsibani	RSA
11	Academia	<b>UM</b> University of Mpumalanga	Prof. Gordon O'Bryan	RSA
12	Academia	<b>UPTA</b> University of Pretoria	Dr. Marius Classen	RSA
13	Water user	<b>KRVMIB</b> Kaap River Valley Major Irrigation Board	Eng. Marè Le Roux	RSA
14	Water user	<b>LWUA</b> Letaba Water Users Association	Mr Jaques Kruger	RSA
15	Water mgt. agency	<b>IUCMA</b> Inkomati-Usuthu Catchment Management Agency	Mr LC Mohalaba, CEO	RSA
16	Water industry	<b>NW</b> Nafasi Water (Pty) Ltd	Dr. Palesa Diale	RSA
17	Water user	<b>SANParks</b> (Kruger Park)	Mr Oscar Mthimkhulu	RSA
18	SME	<b>Emnam</b> Environmental Engineering & Consulting Pty Ltd.	Mr Thabo D. Mholala	RSA
19	Water operator	<b>UMGENI</b> Water SOE	Ms Ntombifuthi Vilakazi	RSA
20	ICT company	<b>SENTECH</b> SOC	Mr Dumisa Ngwenya	RSA
i	NGO	<b>JM</b> Knowledge Manager at Charities Aid Foundation	Mrs Judith Mtsewu	RSA
ii	GO	<b>DWS</b> Department: Water and Sanitation	Mr Peter Viljoen	RSA
iii	GO	<b>GIZ</b> Deutsche Gesellschaft f. Intern. Zusammenarbeit	Mrs Faith Lawrence	RSA
iv	Embassy	Embassy of South African in Berlin	Willi van der Westerhuizen	RSA
v	Embassy	Embassy of Germany in Pretoria	Dr Susanne Kieffer	GER

**Fig. 2** shows the participants of the latest CoSMOS Workshop in Berlin on 30,31 Jan 2023, hosted by the BDE, German Association of the Water and Circular Industry. The representatives of the Embassies were Mrs Dr. Susanne Kieffer on the Monitor, Mr Willi van der Westerhuizen (red arrow). It was the first time for both Embassies to meet at a research event. In total, there were about 30 virtual participants attending the workshop not on the monitor or visible in the photo.



**Figure 2: Photo of the CoSMOS workshop participants in Berlin 31 Jan 2023**



## 5 SELECTED PROJECT COMMUNICATION ACTIVITIES AND PUBLICATIONS

Project communication is necessary to acquire information and opinions from institutions, experts and stakeholders in order to verify whether the need assessment and Project planning fits in the working environment of the Project and whether the Project outcomes have a reasonable chance to contribute to better water security in a later stage of implementation.

### 5.1 Most important actions to communicate and reconcile the Main Project preparation

- Kick-off meeting of the German partners on 16.12.2021 (online)
- Initial meeting of the German and South African partners on 21.02.2022 (online)
- Pre-coordination of the work packages with RUB on 16.03.2022 in Witten
- Coordination meeting IEEM, RUB/TH OWL on 25.03.2022 in Witten
- Exploratory talks with an industrial company and an international financing institution in Frankfurt on 23.03.2022
- Exchange of information with the German Embassy in Pretoria on 30.03.2022 (online)
- 17 telephone meetings to clarify content-related questions and the further work process with the RSA and GER partners
- Telephone calls and telex communication with the South African institutions WRC and GIZ
- Communication by telex with GIZ in South Africa
- Project meeting of consortium partners, 11.05.2022
- Small group meeting TH-OWL, DGE, IEEM 25.05.2022
- Project meeting at the RUB, 09.06.2022
- South Africa trip July 2022
  - 04.07.2022, Water Research Commission (morning); Dr. Kiefer, German Embassy Pretoria (afternoon)
  - 05.07.2022, DWS, later visits to DWS library (group 1) and RSA water companies (group 2)
    - Late afternoon: GIZ RSA (Faith Lawrence); evening University of Pretoria (Dr. Marius Claasen)
  - 06.07.2022, University of Mpumalanga (Dr. Gordon O'Brian), IUCMA, Jacque Kruger with site visit of water-management relevant locations
  - 07.07.2022, Kaap Valley Irrigation Board (Maré Le Roux);  
inspection of Wastewater treatment plants, pond, reservoir and agricultural irrigation facilities
    - Evening: University of Johannesburg (Dr. Tsibani)
  - 08.07.2022, UJ University of Johannesburg (Prof. Michael Rudolph) with aquaponic and lab visit
  - Small group meeting 20.07.2022 with CoSMOS partners
  - Meeting Ms. Dr. S.Kiefer, German Embassy Pretoria 02.08.2022 to present and discuss the Project
  - Project meeting consortium partners, wrap-up and preparation of meetings 08.08.2022
  - Meeting Prof. Karl Rudolph and Prof. Michal Rudolph, 15.08.2022 (to discuss Project ideas, workplan and budget)
- Presentation of the CoSMOS Project at WISA conference 28.09.2022 (Justin Wiggett)
- Presentation of the Project at the WASA, Water Security in Africa , virtual conference - Stakeholder Information Event, 10.10.2022 (Prof. Karl Rudolph)
- Integrative CoSMOS workshop and small group discussions with South African experts/locals, 17-18.10.2022
- Visit to the South African Embassy in Berlin, at the occasion of the Annual Conference of the German-South African Alliance of SME (Mittelstandsallianz Afrika BVMW) 13.10.2022 ,hosted by the Ambassador of RSA in Berlin
- Project presentation at the WRC/UJ/SAIEE Symposium "Water Security Driven by IR 2.0", 27.10.2023 (Prof. K. Rudolph)
- South Africa trip in November 2022:
  - 28.11.2022 Meeting IUCMA
  - 29.11.2022 Meeting KRMIB/Mare Le Roux
  - 30.11.2022 Mr. Josef Phasha Tzaneen Dam (before noon) and Dr Jacque Kruger (LWUA) after noon
  - 02.12.2022 Mr Mamohloding and WRC team in the morning, meet Mr. P. Viljoen and DWS team after noon)
- Project meeting of CoSMOS consortium partners, 16.12.2023
- Project meeting of CoSMOS consortium partners, 09.01.2023
- Integrative Final Workshop of the InitialP "CoSMOS" in Berlin, 30-31.01.2023 (see figure 2)
- Meeting the Ambassador at the South African Embassy in Berlin 01.02.2023, with UMGENI Water, IEEM (Prof. Rudolph) and Johannesburg University (Dr. Tsibani) as the CoSMOS representatives
- Project meeting of consortium partners, 09.03.2023
- Meeting Sentech, UMGENI, UJ, DGE, TH-OWL and IEEM, 17.03.2023
- Meeting with Freestate, UMGENI, SENTECH and UJ, 12.04.2023



## 5.2 Most important presentations to verify preliminary ideas of the Main Project

### Public conferences, events

J. Wiggett (2022) CoSMOS Development of a Community based Sustainable Water Management and Observation System,  
WISA Conference 2022, 28 Sep 2022

K.-U. Rudolph (2022) CoSMOS Development of a Community based Sustainable Water Management and Observation System,  
WASA Stakeholder Information Event, 10 Oct 2022

K.-U. Rudolph (2022) CoSMOS Development of a Community based Sustainable Water Management and Observation System,  
Water symposium "Water Security Driven by IR 4.0"  
WRC, University of Johannesburg, EAIC, 27 Oct 2022

### Final Workshop of the Initial Project "CoSMOS", Berlin 30, 31 January 2023

E. Riddell (2023)  
Overview of SANParks: Kruger National Park Engagement with Local Water Resources Management

C. Jolk (2023)  
CoSMOS Community Based Sustainable Water Management and Observation Systems, Overview of the Project

C. Jolk (2023)  
Project Coordination / Water Planning / Data Management

J. Wiggett (2023)  
Systematic Regional Water Management Planning Support System on the River Sub-basin Level

F. Vilakazi (2023)  
Umgeni Water Community Based Water Resource Management Activities for Water Security and Sustainable Water Supply

K.-U. Rudolph (2023)  
Water Infrastructure

M. Le Roux (2023)  
KaaP River Valley: Major Irrigation Board, Water reuse

C. Greger, I. Nienhaus, E. Christoffels, H. Dahmen (2023)  
WP 3 : Water Ecosystems

J. Mtsewu (2023)  
The rationale for a community-based approach

G. Tsibani (2023)  
WP4 : Water Society

I. Nienhaus standing in for A. Müller (2023)  
Work Package 5.1: Water Observation: Pre-condition for Data Transparency and good Governance,

A. Abecker, M. Zemmann (2023)  
CoSMOS Data Warehouse: WP 5.2



## 6 NEED ASSESSMENT AS BASIS OF DEMAND-DRIVEN PROJECT DEVELOPMENT

Following the intention to develop CoSMOS as a *demand driven project*, the Project structure and content have been determined and further improved stage-wise in the course of the Project. The R&D-Need Assessment and definition of project structure and activities began with a reflection on previous research outcomes. It continued with project-oriented field studies in Africa and the consultation of important institutions, experts and stakeholders. Most important were interviews with catchment management experts, water users and plant operators. The results are explained below.

**Community-based approach:** The WRC has a citizen science programme, initiated in 2002, to allow schools and members of the public to participate in water resource quality monitoring. “*Citizen science* has involved thousands of lay volunteers ‘collecting, commenting, transcribing Citizen science and analysing data’, usually working with professional scientists (quoted from J.Goldin The Water Wheel March/April 2023, page 24, “Building confidence, hope and dignity in communities through citizen science”, From GER see “Citizen Science – Wenn Bürgerinnen und Bürger zu Forschenden werden”, DBUaktuell 03/2023). The Project has its focuses not on monitoring only, but on water planning and on the execution of local water management (in RSA and GER executed under municipal utilities, not under national bodies). Therefore, the keyword “community-based” is preferred to express that participation is not limited to higher levels above the communities. In that sense, the *need is to develop community-based solutions, with regional water planning, local water management and monitoring/observation*.

**The WEF nexus:** Intensive research and innovation with MOSA partners followed by IEEM, DBSA and WISA workshop at the DBSA in 2014, the agroecology framework led to the adoption of water, energy and food nexus in Southern African Development Communities (SADC) in 2018 spearheaded by the Department of Water and Sanitation (DWS). The latest shortcomings of public electricity supply with load shedding in RSA led to the conclusion that the challenges of energy management and decarbonisation are interlinked with water management on the global as well as the local level. The governments of RSA as well as of GER have signed binding commitments accompanied by bilateral programmes to support these topics like the MoU from the BMBF 21.2.2023). Meetings in 2022 with WRC as with DWS and the WASA call for the 1<sup>st</sup> phase of main project applications led to the conclusion that there is an R&D need for *improved solutions considering the WEF-nexus (the nexus between water, energy and food)*.

**Regional, local water management:** Under the BMBF-funded program “GRoW” local water management was addressed as a “bottleneck of success”. On the regional level, Integrated Water Resources Management (IWRM) deals with good management of water resources (river basins, aquifers, lakes, dams, wetlands...). On the local level, the obligation is to make water infrastructure, water services work efficiently. The “Sponge City” principle to mitigate urban flooding is just one example which cannot work without regional AND local counteraction. The “bi-directional approach” with interactive management of regional and local activities was discussed during all meetings (WRC, DWS, Embassies...) and presented to the public with positive results, numerous comments and helpful recommendations to add or improve details. *The R&D-need is to further develop regional water planning systems interlinked with the development of effective and efficient local water infrastructure*.

**Water Users:** As mentioned above, one statement from the previous water research project iWaGSS was that it is the community-based local people who make water services perform successfully or fail. Water users as beneficiaries of success and the ones who suffer in case of failure are, by their own interest, the natural drivers to make water services work. Important statements underline this: “The end-users need to be actively involved” (quoted from WRC from the project “Operationalizing Community-Driven Multiple-Use Water Services in South Africa”, 2019). *There is a need to actively involve water users as project partners whenever the water infrastructure and local water management are relevant issues*.





**Water ecology:** To consider aspects of water ecology is an essential part of regional and local water management and a legal obligation in Africa as it is in Europe. In many meetings where the Project was presented and discussed, this has never been questioned by anybody, neither from the regional nor from the local level, neither from academics nor from practitioners. However, it was recommended to prioritize the development of applicable, affordable solutions rather than focus the research on the status quo and limit the work on analysing the environmental damage and water risks. Developing solutions is possible under the Project because the CoSMOS partners can build on previous R&D projects with data and experiences in the RSA target regions. *Especially for the ecological aspects of water research, the need is to develop applicable and affordable solutions for the improvement of the status and function of the aquatic ecosystems in the target town and regions.*

**Water Society:** A lack of access to water and sanitation has many negative impacts, as emphasized by DWS, the custodian of RSA water resources. The DWS is mandated to promote effective and efficient water management to ensure sustainable economic and social development of communities. The “Water and Society” view refers, inter alia, to the allocation of rights (rights to water and appropriate use of technology, and decision-making rights informed by empirical evidence) and resources (water itself, but also O&M and investment funds for bankable, properly packaged projects). The 2nd World Water Forum in Hague 2000, the Bonn Freshwater Conference 2001 and the Johannesburg Summit on Sustainable Development 2002 highlighted ‘community-based water and sanitation supply programme’, ‘water governance’ and ‘urban resilience’. IWRM was characterized by active community participation, governance and monitoring. The academic fields of sociology, socio- and political-economics and other non-technical, non-natural field of science are inevitable for successful water management on the regional as well as on the local level (just as this is the case with water ecology). Upon strong recommendation not only from WRC and DWS but also from academia and business *the need is to have a special work package to research and find appropriate, sustainable solutions for the Water Society.*

**ICT, digitization** are of enormous importance, not only in the water sector. The response to the geodata-oriented planning, digitization of water reuse facilities and the Data Warehouse as presented before water experts and GO during the Initial Project were verified to meet the R&D needs in RSA. Recently, impact training has been carried out in RSA on the use of drone-georeferenced aerial images processed into Digital Surface Models, Digital Terrain Models, and Digital Elevation Modes. Acoustic Doppler Current Profilers to calculate river cross-sections below the water surface, Meta-data as part of Big Data Analytics for monitoring and evaluation are aimed to advance commercialisation and local beneficiation of Water Users data for robust optimization, stochastic optimization, reliability analysis, sensitivity analysis and scenario planning. GER and RSA research think tanks are expected to use appropriate technologies as a commercial principle. *The need is to prioritise the digital observation water planning and water infrastructure with RSA and GER institutions which can contribute to the transformation towards extended digital data management and data storage.*

## 7 PROJECT STRUCTURE AND CONTENT

Under the project objectives described above, and following the Initial Project communication between all partners, supporters and external experts, decision-makers and stakeholders, the structure and content of the 1<sup>st</sup> phase Main Project (as visualized in figure 1, page 1) has been elaborated as follows:

### WP 0 Project Coordination (OWL)

The ‘Project Coordination’ work package covers communication, reporting and public relations within the Project. This WP coordinates communication between GER and RSA partners in the sub-projects and combines the results of the work packages into an overall Project deliverable.





b) Utilizing the insights derived from the baseline system analysis, a Water Balancing and Allocation Tool will be developed. This tool will take estimations of climatic factors, groundwater and surface water availability and delivery, irrigation and drinking water demand, ecological water demand as well as undocumented water extractions, into account. The goals of this exercise will be to offer insights into the historical and existing water management and improve water security in the target areas. These insights can take the strengths and weaknesses of existing allocation strategies into account, identify opportunities and threats to adequate water delivery (WP2) and just allocation within the Water Society (WP4).

A water balancing and allocation tool will be developed, based on a thorough review of existing local laws, guidelines, and literature, as well as hydrological and hydrogeological information.

c) Management Scenarios will be developed for future water resources allocation strategies and serve as a modified input for the water balancing and allocation tool, to show the impact of certain land use management measures regarding, specifically, the target regions' adaptation to climate change. This approach of scenario modelling will be carried out in collaboration with the Letaba Water Users Association (LWUA) in the Groot Letaba sub-catchment as well as the Inkomati-Usuthu Catchment Management Agency (IUCMA) for the Kaap River sub-catchment. UMGENI and SENTECH will replicate the CoSMOS solutions within their service areas. The needs and content for such an approach were explicitly agreed on between the CoSMOS team and these South African partners during the CoSMOS Initial Phase, indicating a needs-based R&D approach in both project regions.

d) Lastly, a Results Handover Step is envisioned, where the WP1 team will work closely with WP0 and WP5 to further develop the improved IWRM support system into a digital tool that can be implemented in the future planning of African water institutions, as well as ensuring transferability to other WASA regions with similar boundary conditions.

### **WP 1.2 Water Planning and Data Management**

Intelligent Geodata Management and Modelling are crucial for successful water resources governance and management. Data management provides a basis to initiate interventions and actions, understand trends, predict future development and plan appropriately. In 2021 the DWS identified a "lack of data and information resulting from weak monitoring systems, information systems that are outdated or not maintained [...] therefore, improved and modernised information systems must be developed".

The goal of WP1.2 is to combine data from different devices and sources into one user-friendly platform in order to achieve the required data quality for the planning and management tasks. Intelligent fusion of data from multiple sources (citizen sensing, UAV-based mapping, and satellite-based remote sensing), low-cost technologies (wildlife cameras, smartphones, raspberry pi sensors or semi-quantitative test strips) and community-based citizen science activities into one model by combining complementary strengths of different data-acquisition modes requires certain AI-tools and big data analytics. Thus, allowing everyone (researchers, rangers, farmers, students, tourists, etc.) to collect simple environmental data and participate in a free-access monitoring system, including analytics and visualisation dashboards for relevant user groups and purposes.

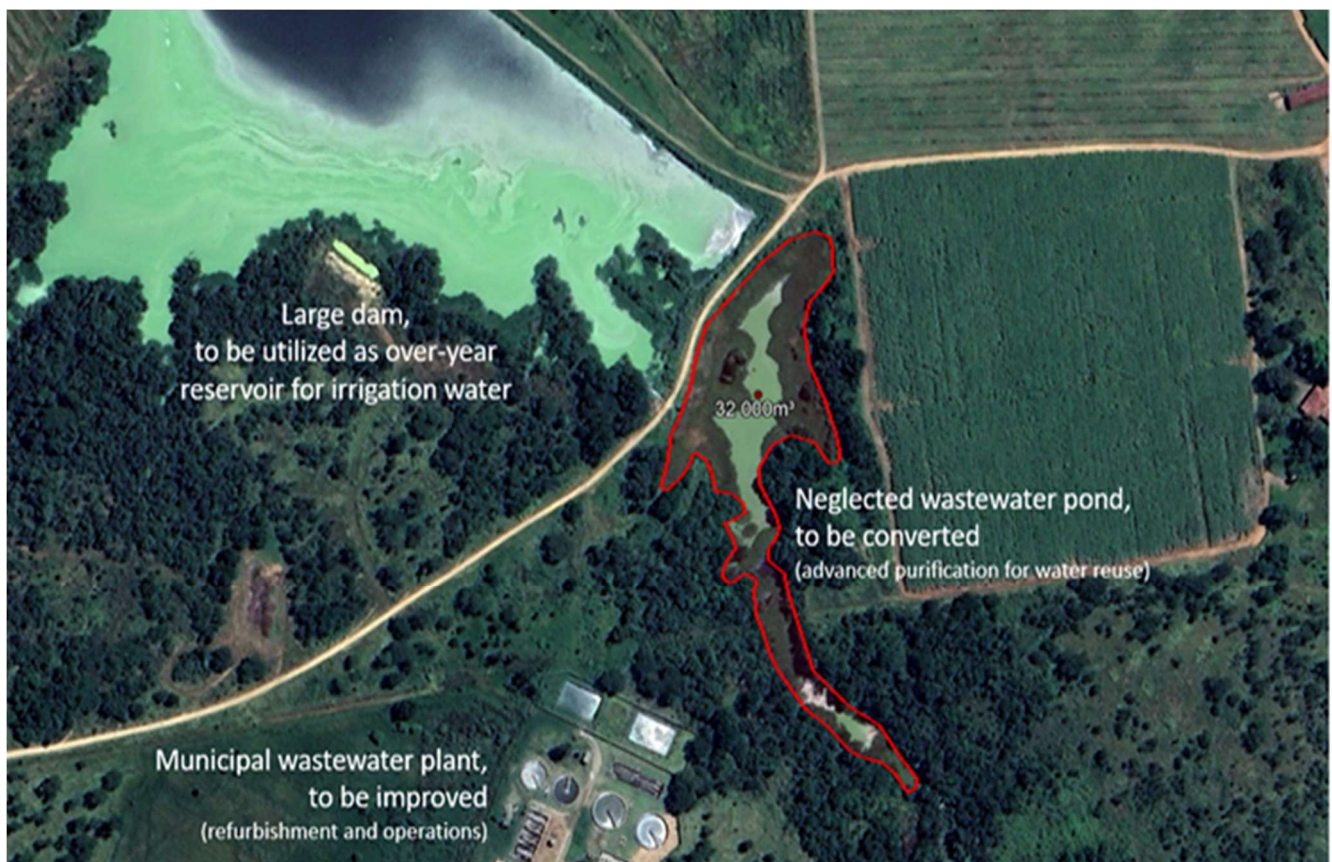
Work package 1.2 collects the (geo)information, generated from other work packages, harmonises the data, and integrates it into a developed platform, in coordination with work package 5.2, to make the data available to different user groups. The data shall be made available in coordination with SASSCAL's Open Access Data Centre. This will be of advantage for the dissemination of CoSMOS research outcomes and create new links between SASSCAL and African water utilities, the water industry.



## WP 2 Water Infrastructure (UW/H)

WP2 shall demonstrate a sound Wastewater Reclamation and Reuse strategy as a solution under the Water, energy and food nexus (WEF nexus). The focus lies on a wastewater reclamation and reuse concept, contributing to Water Security, in supply and sanitation. The concept shall strengthen public-private participation and local economic development.

The task is to develop a technology-based pilot solution on how to design, build and sustainably operate water infrastructure, bi-directionally harmonised with regional planning (WP1) to achieve the best possible benefit for the water ecology (WP3) and the water society (WP4), utilising digitised technology interlinked with the Data Warehouse (WP5).



**Figure 4: Photo from the target town area with existing infrastructure wastewater plant, pond and reservoir**

In the selected target town the "community-based" approach makes particular sense where wastewater treatment is mandatory under the law and the economical backbone for food production as the business of emerging farmers as well as for agricultural operating technical irrigation systems. As **figure 4**, shows, there is a wastewater plant, a wastewater pond, large reservoirs, water transfer pipes and other infrastructure connecting wastewater effluent with the irrigation systems at large and small food producing farms. Unfortunately, the plant and pond are not performing in compliance with the technical standards, and the wastewater effluent is not of sufficient quality to be reused for agricultural irrigation.



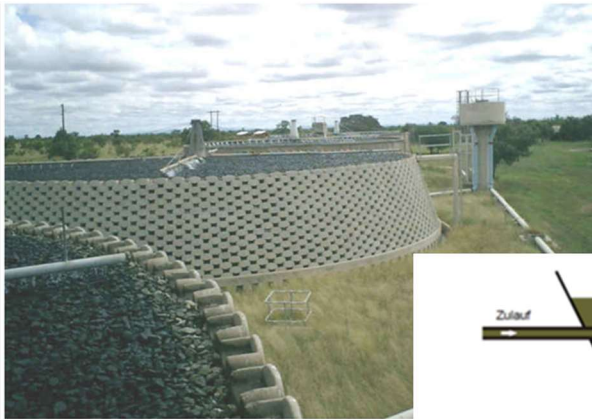
In line with the main objective of the WASA research program, the existing water infrastructure must be refurbished and converted to create a sustainable and replicable water reuse system. Out of resilient self-interest, the local association of wastewater reuse beneficiaries are eager to drive forward the establishment of improved water management in the target town. The Project has teamed up with the responsible expert from the Kaap River Valley Major Irrigation Board (KRVMIB) in close cooperation with the local bodies relevant to water infrastructure, i. e. the municipality, the emerging farmers group and others. WP2 will pilot a system that can be expanded in stages for the production, primarily of irrigation water from somehow treated (but at least already collected) municipal wastewater.

The reuse system will have three main components: The municipal wastewater treatment plant (WWTP), the existing maturation pond to be converted for advanced purification (a typical setup in many WWTPs of South Africa), the existing dams to store irrigation water, a small potable water production plant fed with irrigation water at the farm-site, a smart power management unit and (of major importance regarding the asset value) the transfer lines and equipment to the points-of-reuse. To disburden the river, the dams and the aquifer from the present water pollution will be an important issue to be considered in context to the development of the overall water reuse concept.

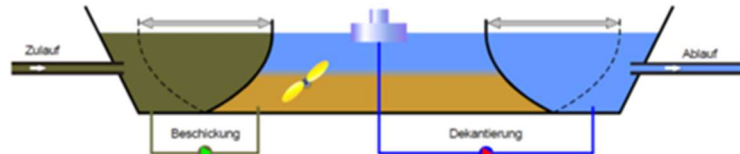
Besides the “*farms4food*”, it is the impact of “*energy&climate*” which must be researched in the context of water security - a dominating topic in academia and business since the current power supply failures, the so-called “load shedding” (see BizNews, Feb2023: “SA’s electricity and water crisis fuels inequality as affluent invest in alternative sources”). In other words: the *WEF nexus* (water, energy, food) plays a very important role when developing new technology based solutions – as does the upcoming legal obligation to avoid greenhouse gas emissions in the future.

The whole wastewater reclamation and reuse system must be integrated into a workable O&M (operation and maintenance) concept and a financing model. Besides technical and financial planning, Some kind of ESIA (Environmental, Social Impact Assessment) respectively ESG evaluation (Environmental, Social, Governance) will be done. [As mentioned above and verified, explained in detail, see <https://bmbf-grow.de/en/news/seven-sins-against-local-water-management-grow-thesis-paper> : Without professional O&M water service performance will fail, even with suitable technology installed and comfortable investment financing from national funds or development agencies]

In order to post-purify the effluent from the municipal wastewater treatment plant, the existing wastewater pond shall be converted for advanced treatment. The CoSMOS team, including German and African partners from industry and water utilities, will bring in a broad choice of technological and managerial options for pond conversion and the overall wastewater reuse system, many of them test-verified in Africa, partly under BMBF-projects like MOSA and EPoNa, others well-working for municipalities like Windhoek or industries like BiWater. **Figure 5** shows a collection of lean-tech examples for pond conversion, all with low-cost as far as this is reasonable for construction (e. g. earth tanks) and standard equipment but high tech for process control systems, sensors and certain efficient durable machinery. This means: the plant technology needs to be modified and adapted, but not totally developed from scratch. [The same applies to the potable water production plant which has already been piloted successfully under BMBF-ViWaT-Operation ].



Trickling filter built with hand-mounted stone



: Constant Water Level Sequencing Batch Reactor (CWSBR), [Source: [www.g-a-a.de](http://www.g-a-a.de)]



5: CWSBR tanks with flexible separation wall, and fine-bubble aeration [Source: CEEM]



Textile walls  
IEEM EXPOVAL

Floating reed bed  
IEEM ViWaT



Textile walls  
EXPOVAL  
Operating)

Post polishing  
bio-percolation  
Filter  
IEEM EPoNa



Figure 5: Photos from wastewater pond conversions, many of those piloted in Africa



### WP3 Water Ecosystems (DGE)

As the other work packages, WP3 can build on previous research in the region, with technologies to be further developed and improved, like the drone for aerial data collection and water sampling in non-accessible or dangerous places, e. g. with crocodiles in the river (see **figure 6**).



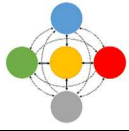
**Figure 6: A photo from the target region with the drone developed under the previous R&D project iWaGSS**

One of the core issues addressed in this WP is water quality and quantity and how to improve ecosystem functions in spite of changing conditions. Inevitably, this raises the question: what do different water users require to meet their specific needs?

With WP3, these aspects will be assessed for one selected river sub-catchment in the context of dynamic conditions, including climate change and associated changes in the underlying conditions. For a second sub-catchment, a rough assessment will follow, in context with identifying the lessons learned and how this can be done most efficiently. Upon request of African CoSMOS partners, the ideas and solutions from WP3 can be replicated in more areas. Identifying control factors for exacerbated water-related conditions play an essential role.

In general, a distinction must be made between internal and external influencing factors, such as the input pathways of pollutants from the catchment areas. In addition to point inputs, diffuse inputs and water withdrawals are of importance. Furthermore, biotic impacts in the water body, such as excessive plant growth (e.g. water hyacinths), and influencing factors that control them must be identified. In this context, the consideration of abiotic factors (e. g. water body morphology, riparian buffer strips) is needed.

Since the river sub-catchments are complex systems significantly affected by a multi-stressor network, there is usually no simple strategy to improve the overall situation. It shall be researched, which combination of measures is appropriate to fulfil the manifold demands of use in accordance with climate-resilient ecological functions of the water bodies in order to provide the relevant ecosystem services in the long run.



For this reason, it is essential that reliable information is available to analyse the situation. Based on the available retrospective monitoring data and data from WP1, the monitoring needs will be determined in WP3. In order to determine the required data set, the chemical-physical and biological parameters are to be identified, which guarantee a high significance and quality of information against the background of the respective ecological and user-specific needs. From the identified monitoring needs and the adequate monitoring strategy, the feasibility and the monitoring-technique can be selected. Accordingly, monitoring strategies can be determined that look adequate for the respective river sub-catchment and can be implemented under the given conditions (e. g. in-situ, on-site, off-site).

In order to exclude uncertainties on the management level, a water quality model will be used to broaden the knowledge base. Operating a water quality model makes it possible to simulate forecast conditions for estimating prospective water quality conditions based on the planned measures (e. g. best-case, baseline, worst-case scenarios).

On the basis of this combined approach of monitoring and modelling, a valid knowledge base will be developed for necessary water management planning. This allows for appropriate management decisions, especially since water management measures, once implemented, have a long life associated with a high level of expenses. In WP3, concepts for near-natural treatment (e. g. retention soil filters, which are very successful in GER) are to be tested for their feasibility in the Project area based on the water management information obtained. The focus is on ease of operation and low maintenance costs while providing high efficiency.

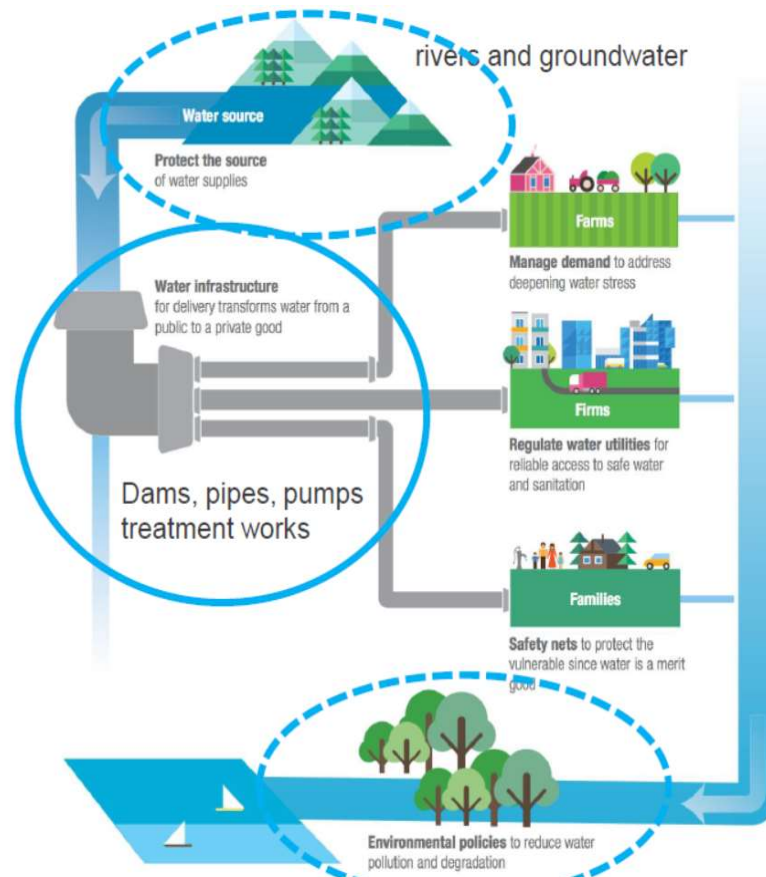
#### **WP 4 Water Society – socio-economic development with local participation**

The Centre for Ecological Intelligence from the University of Johannesburg (UJ), will lead the WP4 activities in South Africa. It will be supported by tra:ce, the UW/H International Center for Sustainable and Just Transformation. With IEEM, the UW/H-Institute of Environmental Engineering and Management, the UJ will continue to collaborate on previous research projects and align all CoSMOS activities from a water company perspective, supporting WP2 for the development of water reuse solutions.

Intensive research and innovation with IEEM under the IWRM-MOSA project followed by the workshop held by IEEM, DBSA, and WISA at the headquarters of DBSA in 2014, the agroecology framework led to the adoption of water, energy and food nexus in Southern African Development Communities (SADC) in 2018 spear-headed by Global Water Partners and the DWS. Equally, at the Global Forum for Food and Agriculture (GFFA) in Berlin in January 2023, the German Federal Ministry for Food and Agriculture, and Commissioner for Agriculture, Rural Development, Blue Economy and Sustainable Environment of the African Union (AU), have signed a declaration of intent in order to cooperate closely on key issues of food systems transformation in future. For this purpose, the German Government is initiating an “Agricultural Policy Dialogue” with the AU and this is the first of its kind on the African continent. It is to contribute to supporting the sociology of water framework (WP4) for a common African climate policy for the water, energy, agri-businesses and food nexus in supporting commercial and emerging farmers to become Water User Associations working with water utilities in the context of IWRM.

WP4 deals with the impact of water management respectively (due to the effect on the community level) of water infrastructure, water services on the farms (food production), on the firms (local business, socio-economy) with a focus on the Water Society (families, people), as shown in **figure 7**.





**Figure 7: Major fields of interest for water research under WP4 “Water Society”**

The sociological impact of water management on communities, water resource health and ecosystem integrity (catchments, wetlands and biodiversity) has become increasingly obvious to water resources planners, albeit sectoral departments and state own enterprises (SOEs) are not prioritising funding for socio-economic baseline studies. Sociological and macro-economic deficits can rapidly cause micro-economic, painful financial losses: Rising public protests which are often violent in various human settlements in South Africa clearly indicate the need for in-depth studies to evaluate the sociological consequences of developmental water services in various communities. Affects are local beneficiation and support enterprise development of water users associations and farmers for food security for sustainable economic development using Water and Society theoretical research framework, planning for water and sanitation infrastructure investment programmes and projects for households, citizens and water users.

With CoSMOS, it would be the 1st time that socio-economic research is directly interlinked with water planning and infrastructure, allowing for intradisciplinary optimization of technology based water solutions with impact on the financial valuation, budgets and strategies.

The CoSMOS project interventions on IWRM policies, strategies and plans are conceptually designed, executed and reviewed for socio-economic impact. In other words, CoSMOS like any water programme or project must be successfully measured using not only the current techno-economic excellence but also by its impact on the households, citizens and water users and their associations. Thus, CoSMOS infrastructure planning and development experts and geo-data-, ICT-specialists will include socio-economic indicators about sustainable and developmental water services. This must include improved quality of life of girls attending education in traditional African human settlements, life and health of households, citizens and water users.



For water infrastructure (WP2), WP4 will develop a system for local participation, and cover the "S" for ESIA (environmental and social impact assessment to obtain public permits). The same applies to the "S" for ESG documentation (environmental, social, and governance required for bank lending) for the water reuse infrastructure in the target community, all accompanied by training and academic education. Considering the above, the following sub-work packages are envisaged:

4.1 Communicate, reconcile and negotiate the findings, concepts, and solutions, and help to disseminate the outcomes in the municipality as Water Services Authorities, Water Boards, the province, nationwide and in other WASA co-operating African countries through SADC.

4.2 Support WP2 for the development of the concept and demonstrating the solution for water reuse in the context of agri-business with water users associations like Letaba, food security and energy. This includes sociologic field studies with a stakeholders' needs assessment.

4.3 Develop a scheme for local participation in CoSMOS research and implementation for the first main phase and (after evaluation of main phase one experiences) for the second main phase. This includes a socio-economic data bank with stakeholder mapping (linked to WP5)

4.4 Cover the "S" for ESIA (environmental, social impact assessment to acquire public permissions) as well as for ESG (environmental, social, governance valuation of bank-financed investments) for the water reuse infrastructure in the target town Barberton, Mpumalanga.

4.5 Design and carry out training, and education measures for the water services stakeholders not for WP4 only, but for all other WPs as far as requested by the CoSMOS researchers, RSA and GER partners.

## WP 5 Water Observation

Water observation under a modern and functioning system is the pre-condition of water security. Water regulators, administrators, facility operators and users must have sufficient knowledge about water flows and qualities to navigate water management, and to enforce the regulation and standards for water abstraction and wastewater discharge. Without this, water planning (WP1) and water infrastructure (WP2) cannot succeed to create the desired benefit for water ecology (WP3) and water society (WP4). Modern sensors and ICT are applied, well-selected and adapted to the working conditions in Africa, to be verified and demonstrated in the target regions, see **figure 8**.

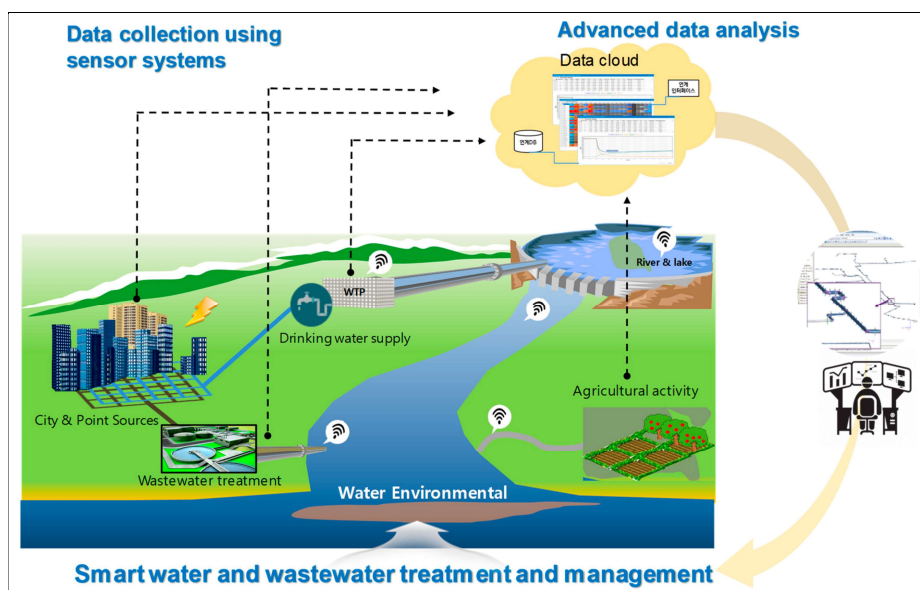


Figure 8: Water Observation System with ICT (Source: Jungsu Park et al 2020, [www.mdpi.com/2073-4441/12/2/510](http://www.mdpi.com/2073-4441/12/2/510))



Work package 5 consists of the following major tasks:

- 5.1 In close coordination, especially with WP 1, 3, and 4 and aiming to fill the Data Warehouse (WP 5.5), remaining data gaps as well as significant, reliable and easy-to-handle indicators and parameters for their respective closure must be identified. A high degree of applicability will be as important as the robustness and consistency of the data to be gathered.
- 5.2 It will be analysed, if, how and to what benefits local stakeholders can be involved in the data gathering process, which is necessary to close the identified data gaps. The benefits of engaging local communities in the processes of sustainable water management will be communicated. In close coordination, especially with the local project partners citizen science approaches will be designed where needed.
- 5.3 Tailor-made technically and socially appropriate data admission concepts have to be implemented, ranging from easy-to-use, barrier-free applications for citizens or tourists, low-cost sensor technologies, standard-compliant sensor data transmission, sensor data integration and quality assurance, statistical models for inter- and/or extrapolation of sensor data, assignment of and incentives for tasks to specific local stakeholders.
- 5.4 Data will be evaluated with regard to the requirements of WP3 and the legal thresholds in South Africa, if available.
- 5.5 Finally, all data from all work packages shall be compiled in the CoSMOS Water Data Warehouse. From a data point of view, WP5.5 shall develop the CoSMOS “single point of access” which collects all data and information observed and computed in other CoSMOS work packages, integrates them in a harmonised comprehensive data model and provides the user-friendly, purpose-oriented views and information services needed by the addressed stakeholders for their specific water management tasks and requirements.

To this end, 3 data-processing phases will have to be implemented under the sub-work package 5.5:

- i) Data Ingestion is concerned with the establishment of technical communication interfaces to all project-relevant data sources, developed within CoSMOS as well as existing ones, also taking into account data update and maintenance processes for the long-term operation of the system without degradation of the database. To the most possible extent, interfaces shall be based on open standards.
- ii) Data Fusion and Data Storage combine the very heterogeneous data (user-generated vs. remote-sensing vs. official data, relational vs. sensor vs. geo vs. image data, etc.) in a single data model and efficient storage, implements data quality assurance and define roles and rights for data access.
- iii) Data Analysis and Provision of Information Services realises a Web-based platform for user-friendly data access and use-case-specific information services. A focus shall be laid upon pragmatic decision support by intuitive visualisation and data access, as well as on real-time information services with proactive early warning services.



## **8 COST ESTIMATE AND TIME PLAN OF THE MAIN PROJECT, 1<sup>ST</sup> PHASE**

The total grant is below the maximum amount of m 2 € set in the BMBF WASA call after the deduction of the financial self-contribution from German companies. The budget of the Project will include 100,000 € of fees for South African contractors. The duration of the Main Project 1<sup>st</sup> phase is planned to be four years in total. Detailed numbers and milestones will be provided with the Project Outline by 15 June 2023.

## **9 CO-FUNDING AND IN-KIND CONTRIBUTION FROM THE PROJECT PARTNERS**

### **9.1 German partners of the Project**

The GER Universities with its Institutes will be co-funding the gap between full-costs and expenses (as eligible under Aza regulation), reduced by the 20% grant to support the University administrations. As an average, the self-contribution can be estimated to make 30% of the expenses (comparing the unit-costs paid for the institutions eligible to receive 100% cost-based funding with the unit-costs of universities minus 20%).

The GER companies which are full partners of the Project will self-contribute 50% of the Project costs (may be less for SME). All other Project partners are not eligible for BMBF-funding.

Details and amounts in € will be provided with ten cost estimates in the Project Outline by 15 June 2023.

### **9.2 South African partners of the Project**

The three African Universities deliver significant in-kind contributions, mainly the intellectual property and work time of the Professors, the provision of meeting rooms, office workplaces, labs and other facilities for the GER partners as required under the Project.

All African University partners of the Project will apply for funding under the WRC, which is open for applications of WASA-Project Outlines which have been selected by the BMBF for detailed Main-Project application (which will have been decided, hopefully, by the end of 2023). Furthermore, all African University partners of the Project are seeking other funding opportunities - and the significant effort for this can be counted as additional self-contribution.

The University of Johannesburg, as a selected South African partner, will lead the local activities of WP4 in the target areas re-financed by synergising its work input for CoSMOS with other ongoing research projects, funded by third parties. Joint applications are under preparation, and already, addressed for example, at the EU and WRC. UMGENI Water, Rand Water and Sentech (Pty) Ltd will bear the costs if the Project team delivers services to replicate the Project outcomes upon request (i) in their service areas and (ii) by integrating the Internet of Things into the water networks of water utilities and water authorities.

Sponsored by SENTECH, the UJ will employ three post-graduates to work for CoSMOS as doctoral students, with one of the GER professors to be appointed as a co-mentors. Taking a salary of 5.670 Rand per month for 3 years, the total amount is about 10,000 € per person, i. e. 30,000 € in total.

## **10 INITIAL OUTCOMES AND EXPECTED Utilization FOR THE MAIN PROJECT**

Outcomes and opportunities from the Initial Project justify the expectation that the outcomes from a future Main Project CoSMOS will lead to utilization scientific and commercial utilization values.



## 10.1 Outcomes achieved under the Initial Project

The Initial Project has been granted under the BMBF with the objective that international networking between African and German researchers is built or strengthened as needed for research to develop solutions for water security in Africa. The core delivery of the Initial Project is the Final Report with the necessary description of the structure, content and further detail of a Main Project to be applied under the WASA program, in line with the objectives and expectations of the sponsors in Africa (here: DWS through WRC) and in GER (here: BMBF through its project agencies PTKA and DLR) have agreed upon.

A research consortium with project partners from all fields and functions required under the WASA call has been established as listed in Table 1 page 3 including highly qualified and Africa-experienced academia as well as very capable practitioners. LoI (Letters of Intent) with information about the profile and special expectations from the different partners has been acquired and will be provided with the Project Outline by 15 June 2023.

A strongly motivated core team of young professionals and leaders of the Project has been found and actively involved in the Initial Project and will be available for the Main Project (unless a further delay or loss in research content with devaluated perspectives of scientific and commercial utilization potential should occur). To name one of the team members: Mr Justin Wigget, a RSA citizen already with BMBF-sponsored water research under iWaGSS, is a researcher at the RUB and the perfect person to communicate between GER and RSA. Dr George F. Tsibani, Professor of Practice at the UJ, collaborating with the GER for a decade (i. a. under the MOSA project) has been appointed as “Professor Praxis” by the UJ on 12 April 2023, acknowledging his academic success so far, acknowledging his contribution to developing the CoSMOS project and enable him to bridge between RSA and DE.

The structure and content for the Main Project have been created, detailed for the 1<sup>st</sup> stage with perspectives for the 2<sup>nd</sup> phase, negotiated and agreed upon with the RSA and GER project partners, based on an update of desk-research, on field missions in the target regions and on a R&D-need analysis done after consultation of WRC, DWS, GIZ and other important GOs, experts and stakeholders.

Important pre-conditions for a successful Main Project have been clarified, and several problems resolved beforehand. To give an example:

- The DWS has announced to further support municipalities, wherever this looks promising, but to remove the water service authority from communities, that fail (W&S 08.2022 and infrastructure news 09.2022). That law enforcement is the weak point in RSA, rather than the lack of water legislation, has been discussed for decades - not only under the previous BMBF-funded research like under the BMBF-funded projects MOSA or iWaGSS.
- Some facts were updated when discussing the Initial Project with DWS. Inspired by the discussions on the community and on the national level during the Initial Project, and (more important) upon urgent complaints from local water users, the DWS has decided to support the Project target town on the way to compliance with the water legislation, especially with the wastewater effluent standards.
- The responsible local administration leaders have been policed to repair, rehabilitate the municipal wastewater treatment plant in the Project target town to make it work under sufficient O&M. The and rehabilitation works, with new equipment and repairs, with improvements of civil constructions and replacement-machines, electric appliances, sponsored by the RSA government, has started - luckily before the end of the Initial Project.
- As it looks, the effluent standards from the municipal wastewater plant will be complied with in the future, hopefully before the commencement of the Main Project. This is a very important issue to make the implementation of the intended water reuse solution easier.



## 10.2 Expected utilization of outcomes for the Main Project

**I) The Ambassador of South Africa in Berlin,** H. E. Mr Phumelele Stone Si RSan, has advised and promised to politically support the innovation team of CoSMOS. He suggests (quoted from internal Minutes of Meeting 1 Feb. 2023) “As soon as the Main Project is started, Professor Karl Rudolph as initiator of CoSMOS with his colleagues, and Ms Ntombifuthi Vilakazi from UMGENI Water shall arrange a formal meeting with the South African ambassador to consolidate the work which has been done by CoSMOS complemented by Umgeni Water initiatives on IWRM and development of water facilities and operations.

*The next German-South African Business Forum focusing on Water, Energy and Food Infrastructure Investment should be organised so that the proposed Project initiative using five pillars is repackaged to align with UMGENI Water Growth Strategy (Vision 2050) performance targets including the new mandate of water boards in South Africa as announced by the Department of Water and Sanitation (DWS) in Feb. 2022 informed by the Economic Recovery and Reconstruction Plan (ERRP, 2019).*

*The CoSMOS approach and its pillars will be implemented by the Republic of South Africa and German Public and Private Partners (PPP) or entities to address water for growth and development driven by the fourth industrial revolution (4IR). This is informed by the 18-19 February 2022 National Water and Sanitation Summit at Gallagher Estate hosted by the DWS and supported by Mayors of Water Services Authorities (WSAs) and Chief Executive Officers (CEOs) of Water Utilities like Umgeni Water”.*

*The CoSMOS upscaling will include a collaboration with a bankable water utility such as Umgeni Water targeting a partnership with a minimum of three metropolitan cities in South Africa. This proposed collaboration is recognised as a necessary water and sanitation infrastructure investment model to attract private sector providers (PSPs) in B2WB.*

*Accordingly, Umgeni Water will act as a Programme Implementation Agency (PIA) with GER-RSA water, energy and food partners as per the discussion at the workshop held on 30-31 January 2023 in Berlin. The water utility is seen to be in a good position to be able to properly package the CoSMOS project model at a meso- and macro-levels using existing German-South Africa Cooperation already initiated by BMBF.*

*Umgeni Water as PIA will also lead the implementation of blended financing with the participation of PSPs, developmental finance institutions (DFIs) and the National Treasury (NT). This will be achieved in April 2023 onwards through a participatory process of WUAs, selected metropolitan cities and private services providers (PSPs) within the water resource management fields to address food and water security. The latter is due to the observation that IWRM depends on collaboration and partnerships of the identified Public and Private Partners at all levels, from WUAs to water utilities in the SADC economic bloc, and international organisations, based on a co-funding model, and wider societal awareness of the need for water security and the sustainable management of water resources.*

*With various Umgeni Water IWRM and strategic catchments, it is deduced that the CoSMOS research can be synergised and institutionalise through Umgeni Water having initiatives with Côte d'Ivoire (Ivory Coast), Namibia, Royal Kingdom of Eswatini Water and Lesotho Highland Water. These initiatives should inform GER-AU dialogue with water as a socio-economic constraining resource for economic growth and development in Africa as a cradle of humankind.”*



II) Quoted from the Lols, which have been signed with partners from the water business sector, respectively from MoM (internal Minutes of Meeting), the following Main Project Utilization values are expected.

#### a) Universities

The academic applicants from GER and partners from RSA are eager to stabilize and increase its capacities and fields of WEF-relevant activities under their respective science, technology and socio-economical profile in education and research, advisory services to public and industrial, business partners or clients. Refereed publications, awarded bachelor-, master and doctoral-degrees, capacity building and dissemination measures like public workshops, events and number, importance of participants etc. are the common utilization criteria applied by the referees which will be explained in detail and numbers the project agencies in the Main Project application.

#### b) Companies (listed as in table 1, page 3. If marked with \*, the text is quoted from the Lol)

**MaSy\***: Martin Systems GmbH is a company under the Wilo SE, providing equipment for water supply, wastewater treatment and waste treatment all over the world with around 70 employees at four locations in Germany for over 20 years. Martin Systems has established a membrane technology which can produce potable water in small and medium quantities. Under the BMBF funded research project ViWaT-Operation, co-ordinated by IEEM, this technology has been adapted to contaminated raw water sources and challenging working conditions regarding operation and maintenance. We are interested in further developing our technology to extend water reuse from non-potable water to potable water (post purification of a small quantity of irrigation water to serve drinking water for the people on site) using solar energy with smart power management to bridge shortcomings of public electricity supply. Therefore, Martin Systems is interested to participate in the development of water reuse technology-based solutions and of applicable digitization, to be incorporated into viable business models.

**Eva\***: The Erftverband Aquatec GmbH will support the CoSMOS project, especially regarding WP3, but also regarding all other WPs on demand within its technical and personnel capacities. The Erftverband Aquatec GmbH, as the service company under the municipal association "Erftverband" is interested to support the CoSMOS project regarding added value following the community-based approach to contribute to the quality of life of people and the water-bound environment.

**DiSy**, already successful in applying IT-based software and service systems in the water sector, is eager to strengthen and expand its business referenced with prominent international research projects like CoSMOS, continuing in the emerging RSA water sector, based on experiences as an industrial partner of the BMBF-funded project iWaGSS.

**IGF\***: Following the participation of Falko Wagner in the CoSMOS summer school on 17 October 2022 with representatives of the South African, Falko Wagner with the IGF Jena intends to co-operate with CoSMOS to apply the specific CoSMOS-approach. Falko Wagner will focus on the transfer of knowledge about re-establishing river connectivity for fish and macroinvertebrates from the northern hemisphere to the species and communities in South African rivers which are characterized by high discharge fluctuations. The second field of activity would be the conservation and restoration of habitats for important aquatic umbrella species.

**KRVIMB\***: The Kaap River Valley Major Irrigation Board is a Water Users Association established under the the applicable South-African Water Law with legal responsibilities for water management and monitoring in its service area in and around Barberton and the right to use the wastewater effluent. The KRIMB is convinced of the community-based approach of CoSMOS and is eager to collaborate with WP2 (Water Infrastructure), in context to WP4 (Water Society) and all other work packages.



Together with... additional local partners, we are interested to support the CoSMOS project and finally taking over the O&M of the converted pond with the whole water reuse system. We are convinced that our joint efforts will lead to enormous added value and contribute to the quality of life for the people and improve the food production with the irrigation water from the converted pond, the receiving dams and the whole river system.

**LWUA:** This letter is to confirm that the LWUA (the Letaba Water Users Association) intends to further support the CoSMOS project by:

- Provision of local knowledge and local support as well as to support field campaigns for the German CoSMOS project partners e.g., data collection, networking with local stakeholders
- Offer insights into the hydrological boundary conditions of the Groot Letaba River Subcatchment.
- Offer insights into the social and economic interactions of the users within the Groot Letaba RiversSub-catchment.
- Provide, where possible, raw monitoring data on the quantity and quality of Ground- and Surface water
- Clarification of questions that may arise in describing the Groot Letaba Sub-Catchment system.

**IUCMA\*:** IUCMA (The Inkomati Ushu Catchment Management Agency) has been identified as a key partner based on the pre-feasibility work that was done in the Kaap catchment. This letter is to confirm that the IUCMA intends to support the CoSMOS project by:

- Provision of local knowledge and local support as well as support field campaigns for the German CoSMOS project partners e.g. data collection, networking with local stakeholders, provided there will be a disbursement budget allocated in the proposal for such.
- Offer insights into the hydrological boundary conditions of the Kaap River sub-catchment
- Offer insights into the social and economic interactions of the users of the Kaap River Sub-catchment as well as transboundary interactions
- Provide, where possible, raw monitoring data of quantity and quality of Ground- and Surface water.

**SANParks Kruger Park\*:** We, South African National Parks (SANParks) custodians of the Kruger National Park, and the CoSMOS team, are looking back on long lasting cooperation mainly with the BMBF-funded water research projects MOSA and iWaGSS. Our mission is to develop, protect, expand, manage and promote a system of sustainable national parks that represents natural and cultural heritage assets, through innovation, excellence, responsible tourism and just socio- economic benefit for current and future generations. We are certain that the Project can bring huge benefits to improve water security, in the Letaba River Catchment (Oiiifants Water Management Area) and the Kaap sub-catchment of the Crocodile River (Inkomati-Usuthu Water Management Area).

WP1 Water Modelling will build on existing models, instead of trying to "re-invent the wheel, will accomplish hydrodynamics in the Letaba and introduce localized water quality data for "water accounting" in the Kaap

WP2 Water Infrastructure will address reclamation and re-use which is critical in these overallocated catchments and develop wastewater services with - decentralised - business models through CPPP and PPP

WP3 Water Ecology will contribute to a consistent water based ecosystem services mapping including emerging contaminants if ever and as far as possible, anticipate El Nino effects from late 2023 onwards

WP4 Water Society will help to design and reconcile novel operations for increased assurance of supply (emerging farmers), and explore alternative water service delivery models under community practice

WP5 Water Observation will link into existing platforms (like BioSmart DSS, and FBIS Freshwater Research Centre), ensure compatibility with existing data management systems of IUCMA Kaap) with the data warehouse is open for water service providers, experts and citizens on a regional and local, communal levels.

**NAFASI Water\*:** With a focus on water reclamation and desalination technology for application in complex desalination, water reuse and wastewater purification systems, Nafasi Water is one of the leading water technology and water utility service companies in South Africa. As a 100 % black-owned South African Company, Nafasi is partnering with industry, government and local communities to provide sustainable solutions to broader water security challenges.





Following the presentations of Prof Rudolph at the “Water Security Driven by IR 4.0”- conference in Johannesburg on 27 Oct. 2023 and the CoSMOS Conference in Berlin 30-31 Jan. 2023, Nafasi Water sees valuable synergies mainly with WP2, but also WP5 and others. Nafasi Waters participation could entail:

- (i) Technology options selection, design, building and sustainably operating water infrastructure (i.e., WWTP)
- (ii) Design water reuse and solid waste reuse pathways (iii) Remote monitoring of piloted solutions
- (iv) Collectively apply for funds, co-proposals for South African calls.

**EMNAM\*:** EMNAM Environmental Engineering & Consulting Ltd.: Thabo Mohlala (shareholding CEO) intends to co-operate with CoSMOS to apply the specific CoSMOS-approach and to transfer solutions to be developed into the Project areas. Thabo Mohlala will support the Project in conducting field campaigns thematically related to biomonitoring of water bodies and groundwater management.

**UMGENI Water\*:** As discussed with the South African Embassy on the 01 February 2023 in Berlin, Umgeni Water and IEEM partnership will include a number of flagship projects to be implemented in Mpumalanga, KwaZulu/Natal and Eastern Cape provinces with the Water Services Authorities (WSAs) especially the metropolitan cities, Water User Associations (WSAs) and emerging black farmers around various water sources. Some of the IWRM projects and plans identified by Umgeni Water, from the CoSMOS workshop and subsequent engagements that unfolded, include:

- Water, Energy, Food, Eco-tourism and Hospitality programmes aligned to the German Federal Minister of Food and Agriculture and Commissioner for Agriculture, Rural Development, Blue Economy and Sustainable Environment of the African Union (AU) and regional bulk infrastructure between African states in terms of the African Union (AU) Infrastructure Plan;
- Inter-provincial programmes to cover Mpumalanga best practices from CoSMOS for replication in
- KwaZulu/Natal and Eastern Cape Water Services Authorities (WSAs), Water Users Associations (WUAs) and emerging black farmers to accelerate improved water quality and resilience for
- economic growth and development;
- Skills transfer plan for engineering and scientific competencies of the workforce using Internet of Things (IoT), multispectral sensors, multiparameter analysers, water quality satellite monitoring,
- digital surface modelling of water sources in catchment management areas (CMAs), use of drones
- for water resources monitoring, sonar sensor and digital underwater maps, and big data analytics
- including automation and digitalisation of water assets; and
- A joint DE- RSA water, energy and food partners... to develop and implement a joint plan of action.

**SENTECH:** Sentech (Pty) Limited is wholly owned by the Government of the Republic of South Africa (RSA) as represented by the Minister of Communications and Digital Technologies... As part of its research collaboration, Sentech actively seeks partnerships with local, regional, continental, and international industries in research, technology innovation and commercialization activities in the field of Broadband and Multimedia Communications. The target is to contribute to the system of innovation and in world-class research and educational outputs, outcomes, and throughputs for the benefit of African smart societies. Through partnership with German and South African research and innovation institutions, such as the IEEM, Sentech would like... to participate in implementation ...CoSMOS) to meet African Union (AU) Agenda 2063 performance targets aligned to the South African National Development Plan 2030 vision. Through the envisaged partnership ... under the "Water Security for Africa" (WASA) strategy... Sentech's interest is to implement a Big Data Analytics capability with Intelligent Geodata Management and Modelling to generate appropriate information on water resources. This is expected to enable a design a sustainable water reuse and wastewater management and utilization. The objective is to tackle a utilization problem related to water quality and supply deficits at river basin level.



## List of LoI's

<b>Nr.</b>	<b>Classification</b>	<b>Acronyms and names of partner and supporting institution</b>
1	Water industry	<b>MaSy</b> Martin Systems GmbH @ wilo
2	Water operator	<b>EVa</b> Erftverband aquatec GmbH with IBC
3	Academia	<b>UJ</b> University of Johannesburg
4	Academia	<b>UM</b> University of Mpumalanga
5	Academia	<b>UPTA</b> University of Pretoria
6	Water user	<b>KRVMIB</b> Kaap River Valley Major Irrigation Board
7	Water user	<b>LWUA</b> Letaba Water Users Association
8	Water mgt. agency	<b>IUCMA</b> Inkomati-Usuthu Catchment Management Agency
9	Water industry	<b>NW</b> Nafasi Water (Pty) Ltd
10	Water user	<b>SANParks</b> (Kruger Park)
11	SME	<b>Emnam</b> Environmental Engineering & Consulting Pty Ltd.
12	Water operator	<b>UMGENI</b> Water SOE
13	ICT company	<b>SENTECH</b> SOC
14	Academia	<b>IGF Jena</b>
15	NGO	<b>JM</b> Knowledge Manager at Charities Aid Foundation
16	GO	<b>DWS</b> Department: Water and Sanitation
17	GO	<b>GIZ</b> Deutsche Gesellschaft f. Intern. Zusammenarbeit

CoSMOS consortium partner (no LoI necessary):

- TH-OWL- Technische Hochschule Ostwestfalen-Lippe,
- RUB – Ruhr University Bochum,
- UW/H – University of Witten-Herdecke
- DGE - Die Gewässer-Experten!,
- Chromguren - chromguren Planungs- und Beratungs-GmbH & Co. KG,
- Disy - Disy Informationssysteme GmbH,

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IEEM gGmbH  
Alfred-Herrhausen-Str. 44  
58455 Witten

## LETTER OF INTENT

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" under the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions. Our main interest is for the CoSMOS work package 2, water reuse with a pilot solution replicable all over Africa.

Martin Systems GmbH is a company under the Wilo SE providing equipment for water supply, wastewater treatment and waste treatment all over the world with around 70 employees at four locations in Germany for over 20 years. Martin Systems has established a membrane technology which can produce potable water in small and medium quantities. Under the BMBF funded research project ViWaT-Operation, co-ordinated by IEEM, , this technology has been adapted to contaminated raw water sources and challenging working conditions regarding operation and maintenance. We are interested to further develop our technology to extend water reuse from non-potable water to potable water (post purification of a small quantity of irrigation water to serve drinking water for the people on site) using solar energy with smart power management to bridge shortcomings of public electricity supply.

Therefore, Martin Systems is interested to participate in the development of water reuse technology-based solutions and of applicable digitization, to be incorporated in viable business models. The undersigned confirms to participate as associated partner, bringing in the views and experiences from water industry to synergize with the academic research. Details shall be determined at a later stage of the project (hopefully) under the first phase main of the Project.

Place, 8th May 2023

Signed:  Dr.-Ing. Jose Ordonez.

**MARTIN Systems GmbH**  
Friedrichstr. 95  
10117 Berlin  
Germany

**Contact**  
Phone: +49 30 2005 970 0  
eMail: [info@martin-systems.com](mailto:info@martin-systems.com)  
Web: [www.martin-systems.com](http://www.martin-systems.com)

**Managing Directors**  
Daniel Crawford  
Mark Grigo  
Michael Harms  
Veikko Ehrsam

**Registered Office**  
Amtsgericht Charlottenburg  
HRB 199776 B  
VAT: DE269938643

Erftverband aquatec GmbH

IEEM gGmbH

Prof. Rudolph, Dr. Walenzik

mail@uni-wh-ieem.de

## LETTER OF INTENT

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions.

The First Main Phase shall include five **Work-Packages**:

**WP1 Planning** Geodata-Management and Modelling

**WP2 Infrastructure** Water Reuse with Pilot Solution

**WP3 Water Ecology** with Near-to-Nature Solutions

**WP4 Society** Socio-Economic Development and Local Participation

**WP5 Observation** Community-based Monitoring with Data-Warehouse

Modifications of project title and content are subject of outstanding discussion with all partners.

The partners have agreed to develop joint research activities in close cooperation with each other and relevant stakeholders from Germany and South Africa (as well as partners from other project-related countries) to further develop individual exchange of information and to strengthen cooperation and scientific exchange among the institutions and individuals involved.

The Erftverband aquatec GmbH will support the CoSMOS project especially regarding WP3, but also regarding all other WPs on demand within its technical and personnel capacities. The Erftverband aquatec GmbH, as the service company under the municipal association "Erftverband" is interested to support the CoSMOS project regarding added value following the community-based approach to contribute to the quality of life of people and the water-bound environment.

Erftverband aquatec GmbH  
Am Erftverband 6  
50126 Bergheim  
Tel. (02271) 88-0  
[www.erftverband-aquatec.de](http://www.erftverband-aquatec.de)

Kreissparkasse Köln  
IBAN DE05 3705 0299 0142 0045 40  
Swift-BIC COKSDE33

Finanzamt Bergheim  
St.-Nr. 203/5906/0588  
Sicherheits-Nr. 00060297  
UStId-Nr. DE228801678

Erftverband aquatec GmbH  
Handelsregister  
Köln HRB 40972  
Geschäftsführer:  
Dr. Bernd Bucher  
Prof. Heinrich Schäfer

The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Bergheim, 31. January 2023

Signed

A handwritten signature in blue ink, appearing to read "Heinrich Schäfer".

Professor Heinrich Schäfer

Erftverband aquatec GmbH  
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Geschäftsführer:  
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**OFFICE OF THE DIRECTOR  
CENTRE FOR ECOLOGICAL INTELLIGENCE  
Professor Michael Rudolph  
Telephone: +27 82 492 4768  
E-mail: michaelr@uj.ac.za**

24 February, 2023

Attention: Prof. Karl Rudolph (CE) and Dr. Walenzik (CFO)

Dr George Tsibani: Senior Research Associate, Faculty of Engineering and Built Environment,  
University of Johannesburg

## **LETTER OF INTENT**

### **Dear colleagues**

The German Federal Ministry of Education and Research (BMBF) is funding the initial phase of the project; entitled "Community-based Sustainable Water Management and Observation System – CoSMOS" which is part of the research program "Water Security for Africa" (WASA).

On behalf of a group of German and South African universities and Water Sector partners, the consortium intends to submit a project outline for the first main phase of CoSMOS.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling systems to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, while simultaneously being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing semi-natural technologies and lean-tech solutions.

The First Main Phase shall include five Work-Packages:

WP1 Water Planning Geodata-Management and Modelling

WP2 Water Infrastructure Water Reuse with Pilot Solution

WP3 Water Ecology with Near-to-Nature Solutions

WP4 Water Society Socio-Economic Development and Local Participation

WP5 Water Observation Community-based Monitoring with Data-Warehouse.

Modifications of the project title and content are subject to further discussions with all partners.

CEI is working on scholarly and applied research on urban agriculture, food systems, enterprise and entrepreneurship, water, energy, and waste technology through critical reflection and evaluation. Ongoing research addresses integrated land use, water and food systems in various provinces (incl. Mpumalanga) which offer living laboratories and incubation hubs for relevant and practical experiential learning opportunities to undergraduate and postgraduate students from diverse disciplines thus promoting a transdisciplinary and integrated approach to the complex water system. CEI offers teaching and training programmes in the water-energy and food nexus, water- and agri-enterprises and more.

With its expert team from sociology, CEI wishes to express its interest in and to take responsibility for and lead activities for the WP4 "Water Society".

This document confirms our commitment to join the project as an active partner.

Depending on decisions from BMBF regarding the workplan, timelines and budget of the project as well as details of work input and cost recovery shall be negotiated at a later stage. We trust that these negotiations will be finalised in the first phase main project.

Signed in Auckland Park on 24 February 2023

Centre for Ecological Intelligence

School of Electrical Engineering Science, Auckland Park Campus

Faculty of Engineering & the Built Environment

BDS Wits, MSc Wits, MPH Harvard

Signed Prof Michael Rudolph

A handwritten signature in black ink, appearing to read 'M. Rudolph', is written over a light grey rectangular background.

27 February 2023

IEEM, Prof. Rudolph, Dr. Walenzik  
[mail@uni-wh-ieem.de](mailto:mail@uni-wh-ieem.de)

**LETTER OF INTENT TO PARTICIPATE ON THE COMMUNITY-BASED SUSTAINABLE WATER MANAGEMENT AND OBSERVATION SYSTEM – COSMOS.**

Dear Prof. Walenzik,

Regarding the German Federal Ministry of Education and Research (BMBF) funding for the Project “Community-based Sustainable Water Management and Observation System – CoSMOS” as part of the research program "Water Security for Africa" (WASA). In collaboration, our university with our German partners and stakeholders of the water sector, we intended to submit a Project Outline for a subsequent First Main Phase, also entitled Community-based Sustainable Water Management and Observation System - CoSMOS. The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions. The First Main Phase shall include five Work-Packages:

- WP1 Planning Geodata-Management and Modelling
- WP2 Infrastructure Water Reuse with Pilot Solution
- WP3 Water Ecology with Near-to-Nature Solutions
- WP4 Society Socio-Economic Development and Local Participation
- WP5 Observation Community-based Monitoring with Data-Warehouse.

The University of Mpumalanga intends to co-operate with CoSMOS to apply the specific CoSMOS-approach and to transfer solutions to be developed into the project areas. UMP will support the project providing specialist services and post-graduat students to contribute to WP3, WP4, and WP5 including contributions to ecosystem and human community wellbeing monitoring, determination of the risk of multiple stressors affecting both the ecosystem and human communities on appropriate spatial scales and the sustainable management of water resources of trans-boundary ecosystems through regional scale ecological risk framework aligned to existing water resource management approaches. The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

For any more information please contact us. Kind regards,



Professor. Gordon O'Brien  
Signed in Nelspruit on 27 January 2023.





Centre for Environmental Studies  
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0002 Pretoria, South Africa  
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maris.cllassen@up.ac.za

IEEM gGmbH  
Prof. Rudolph, Dr. Gabriele Walenzik  
mail@uni-wh-ieem.de

## LETTER OF COOPERATION

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project “Community-based Sustainable Water Management and Observation System – CoSMOS” as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent main phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

This main Project shall combine intelligent geodata management and modelling to generate appropriate information on water resources with the pilot solution designed for sustainable water reuse and utilization of wastewater. It will address water-related quality and supply deficits at the community and river basin levels. The concept will strengthen public participation and local socio-economic development, and lead to ecological optimisation of water bodies and biotope networks. CoSMOS can build on its previous R&D outcomes and implementation in the target region and has located a pilot community with ideal conditions to leverage R&D funding and replicate the pilot solution throughout the WASA area. Modifications of project title and content are subject of outstanding discussion with all partners.

This letter is to confirm that Dr. Claassen intends to further support the CoSMOS project by:

- Provision of local knowledge and local support and support for field campaigns for the German CoSMOS project partners e.g. data collection, networking with local stakeholders
- Alignment of the project proposal with ongoing and planned South African research projects
- Offering insights into the national frameworks in place for Water Resources Management in South Africa as well as implementation strategies
- Clarification of questions that may arise in describing the two river sub-basins systems

Pretoria, 25 November 2022

Dr Marius Claassen  
Extraordinary Lecturer  
Natural and Agricultural Sciences



# Kaap River Valley

## Major Irrigation Board / Hoofbesproeiingsraad

12 JUDGE STREET  
PO BOX 451  
BARBERTON  
1300

TEL: (013) 712 4200  
CEL: 071 403 3670  
E-MAIL:  
MAJORBOARD@ROSEINNES.CO.ZA

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IEEM gGmbH  
Prof. Rudolph, Dr. Walenzik  
mail@uni-wh-ieem.de

### **LETTER OF INTENT**

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project “Community-based Sustainable Water Management and Observation System – CoSMOS” as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions.

The First Main Phase shall include five **Work-Packages**:

**WP1 Water Planning** Geodata-Management and Modelling

**WP2 Water Infrastructure** Water Reuse with Pilot Solution

**WP3 Water Ecology** with Near-to-Nature Solutions

**WP4 Water Society** Socio-Economic Development and Local Participation

**WP5 Water Observation** Community-based Monitoring with a Data-Warehouse.

Modifications of project title and content are subject of outstanding discussion with all partners.

The partners have agreed to develop joint research activities in close cooperation with each other and relevant stakeholders from Germany and South Africa (as well as partners from other project-related countries) to further develop individual exchange of information and to strengthen cooperation and scientific exchange among the institutions and individuals involved.

The Kaap River Valley Major Irrigation Board (KRVMIB) is a Water Users Association with additional responsibilities for water management and monitoring in the Kaap River catchment, which consists of the Noordkaap, Suidkaap, Queens, Eureka, Low’s Creek and Laer-Kaap irrigation boards. The KRVMIB is a sub catchment of the Crocodile River. (Under the South-African Water Act, Act 36 of 1956). The KRVMIB is convinced of the community-based approach of CoSMOS and eager to collaborate with WP2 (Water Infrastructure), in context to WP4 (Water Society) and all other work packages. Together with 7 additional local partners, we

are interested to support the CoSMOS project and finally take over the O&M of the converted pond with the whole water reuse system. We are convinced that our joint efforts will lead to enormous added value and contribute to the quality of life for the people and and improve the food production with the irrigation water from the converted pond, the receiving dams and the whole river system.

The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

The seven local partners, all resident in Barberton, confirm to be including in the same way under the local coordination of the Kaap River Valley Major Irrigation Board and have given consent that the KRVMIB may sign on their behalves.

Signed at:

Barberton, South Africa

Date:

May 18<sup>th</sup>, 2023

Signed,



Maré Le Roux

Senior Water Control Officer

Kaap River Valley Major Irrigation Board



## LETABA WATER USER ASSOCIATION



060 629 0297



060 629 0297



[admin@lwg.co.za](mailto:admin@lwg.co.za)



Farm California 507LT/87

23° 50' 44.1" 30° 22' 09.4"



PO Box 1220

Tzaneen

0850

IEEM gGmbH

Prof. Rudolph, Dr. Gabriele Walenzik

mail@uni-wh-ieem.de

### LETTER OF INTENT

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent main phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

This main Project shall combine intelligent geodata management and modelling approaches to generate appropriate information on water resources, their current and historical use activities as well as future threats and opportunities. It will address water-related quality and supply deficits at the-community and river sub-catchment levels and will lead to ecological optimisation of water bodies and biotope networks. The CoSMOS concept can build on its previous R&D experiences gained and outcomes and implementation in the target region.

This letter is to confirm that the LWUA intends to further support the CoSMOS project by:

- Provision of local knowledge and local support as well as to support field campaigns for the German CoSMOS project partners e.g., data collection, networking with local stakeholders
- Offer insights into the hydrological boundary conditions of the Groot Letaba River Sub-catchment.
- Offer insights into the social and economic interactions of the users within the Groot Letaba River Sub-catchment.
- Provide, where possible, raw monitoring data of quantity and quality of Ground- and Surface water
- Clarification of questions that may arise in describing the Groot Letaba Sub-Catchment system.

Tzaneen, 11 April 2023

Signed

Jacques Kruger

*Chief Executive Officer*

Suite 801, 8th Floor  
The MAXSA Building  
13 Streak Street  
Mbombela

Private Bag X11214  
Mbombela  
1200

Tel 013 753 9000  
Fax 013 753 2786



Ref: 5/4/2

Contact: Dr T Sawunyama

Email: sawunyamat@iucma.co.za

Date: 28 November 2022

IEEM gGmbH

Prof. Rudolph, Dr. Gabriele Walenzik

[mail@uni-wh-ieem.de](mailto:mail@uni-wh-ieem.de)

### **LETTER OF INTENT: COSMOS PROJECT**

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent main phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

This main Project shall combine intelligent geodata management and modelling to generate appropriate information on water resources with the pilot solution designed for sustainable water allocation, reuse and utilization of wastewater, for example in the Kaap River Catchment. It will address water-related quality and supply deficits at the community and river catchment levels. The concept will strengthen public participation and local socio-economic development, and lead to ecological optimisation of water bodies and biotope networks. CoSMOS can build on its previous Research and Development (R&D) outcomes and implementation in the target region and has located a pilot community with ideal conditions to leverage R&D funding and replicate the pilot solution throughout the Water Security and Southern Africa (WASA) area.

Modifications of project title and content are subject of outstanding discussion with all partners.

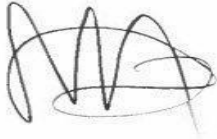
IUCMA has been identified as key partner based on the pre-feasibility work that was done in the Kaap catchment. This letter is to confirm that the IUCMA intends to support the CoSMOS project by:

- Provision of local knowledge and local support as well as to support field campaigns for the German CoSMOS project partners e.g. data collection, networking with local stakeholders provided there will be a disbursement budget allocated in the proposal for such.
- Offer insights into the hydrological boundary conditions of the Kaap River Sub-catchment

- Offer insights into the social and economic interactions of the users of the Kaap River Sub-catchment as well as trans-boundary interactions
- Provide, where possible, raw monitoring data of quantity and quality of Ground- and Surface water.

If you have any questions do not hesitate to contact me.

Yours faithfully

A handwritten signature in black ink, consisting of several overlapping loops and curves, positioned below the text 'Yours faithfully'.

Mr LC Mohalaba  
Chief Executive Officer



Oxford Corner  
32A Jellicoe Avenue  
Rosebank  
2196  
South Africa

**Att.: IEEM, Dr. Walenzik, Prof. Rudolph**

**mail@uni-wh-icem.de**

## **LETTER OF INTENT**

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project “Community-based Sustainable Water Management and Observation System – CoSMOS” under the research program “Water Security for Africa” (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions. CoSMOS shall have five **Work-Packages**:

**WP1 Planning** Geodata-Management and Modelling

**WP2 Infrastructure** Water Reuse with Pilot Solution

**WP3 Water Ecology** with Near-to-Nature Solutions

**WP4 Society** Socio-Economic Development and Local Participation

**WP5 Observation** Community-based Monitoring with Data-Warehouse.

Modifications of project title and content are subject of outstanding discussion with all partners.

With a focus on water reclamation and desalination technology for application in complex desalination, water reuse and wastewater purification systems, Nafasi Water is one of the leading water technology and water utility service companies in South Africa. As a 100 % black-owned South African, Nafasi is partner with industry, government and local communities to provide sustainable solutions to broader water security challenges. Following the presentations of Prof Rudolph at the “Water Security Driven by IR 4.0” conference in Johannesburg 27 Oct. 2023 and the CoSMOS Conference in Berlin 30-31 Jan. 2023, Nafasi Water sees valuable synergies mainly with WP 2, but also WP5 and others. Nafasi Waters participation could entail:

- (i) Technology options selection, design, building and sustainably operating water infrastructure (i.e., WWTP)
- (ii) Design water reuse and solid waste reuse pathways
- (iii) Remote monitoring of piloted solutions
- (iv) Collectively apply for funds, co-proposals for South African calls.

The undersigned confirms to join the Project as partner with valid interest to participate and this is subject to mutually agreed terms of reference, e.g. Intellectual Property (IP). Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Yours sincerely,

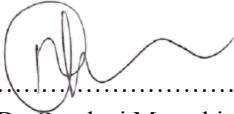


.....  
Dr. Palesa Diale – Process Engineer(Research)

24/02/2023

.....  
DATE

**Supported by:**




.....  
Dr. Rendani Mamphiswana – Head: R&I

24/02/2023

.....  
DATE

**Approved by:**



Digitally signed by  
Brendan Petschel  
Date: 2023.02.24  
10:39:54 +02'00'

.....  
Brendan Petschel – Executive: New Business

.....  
DATE



To develop, expand, manage and promote a system of sustainable national parks that represent biodiversity and heritage assets, through innovation and best practice for the just and equitable benefit of current and future generations.



Att.: IEEM, Dr. Walenzik, Prof. Rudolph  
[mail@uni-wh-ieem.de](mailto:mail@uni-wh-ieem.de)

**LETTER OF SUPPORT**

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" under the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

We, South African National Parks (SANParks) custodians of the Kruger National Park, and the CoSMOS team, are looking back on long lasting cooperation mainly with the BMBF-funded water research projects MOSA and iWaGSS. Our mission is to develop, protect, expand, manage and promote a system of sustainable national parks that represents natural and cultural heritage assets, through innovation, excellence, responsible tourism and just socio- economic benefit for current and future generations. We are certain that the project can bring huge benefit to improve water security, in the Letaba River Catchment (Olifants Water Management Area) and the Kaap sub-catchment of the Crocodile River (Inkomati-Usuthu Water Management Area)

From the 5 CoSMOS work-packages we as SANParks would highlight the beneficial areas of co-operation *inter alia*:

**WP 1 Water Modelling** will build on existing models, instead of trying to "re-invent the wheel, will accomplish hydrodynamics in the Letaba and introduce localized water quality data for "water accounting" in the Kaap

**WP 2 Water Infrastructure** will address reclamation and re-use which is critical in these over-allocated catchments and develop waste water services with - decentralised – business models through CPPP and PPP

**WP 3 Water Ecology** will contribute to a consistent water based ecosystem services mapping including emerging contaminants, if ever and as far as possible, anticipate El Nino effects from late 2023 onwards

**WP 4 Water Society** will help to design and reconcile novel operations for increased assurance of supply (emerging farmers), and explore alternative water service delivery models under community practice

**WP 5 Water Observation** will link into existing platforms (like BioSmart DSS, FBIS Freshwater Research Centre), ensure compatibility with existing data management systems of IUCMA Kaap) with the data warehouse open for water service providers, experts and citizens on regional and local, communal level

Herewith we confirm our intention to participate as CoSMOS partner, bringing in the views and experiences from water management to serve the needs of protected areas and the beneficial ecosystem services provide around the protected area estate. Furthermore, to synergize with the academic research agenda and foster closer international and domestic collaboration, of benefit to the Republic of South Africa and neighbouring states. Details shall be determined at a later stage of the project (hopefully) under the first phase main of the Project.

We wish the CoSMOS consortium the best for the next stages of the project development and our Regional Integration unit supported by the KNP Freshwater Team will provide the necessary support.

Yours sincerely

**Mr Oscar Mthimkhulu**  
**Managing Executive – Kruger National Park**  
**Kruger National Park**

addo elephant  
agulhas  
IAi-IAis / richtersveld  
augrabies  
bontebok  
camdeboo  
garden route  
golden gate highland:  
groenkloof  
karoo  
kgalagadi transfronti  
kruger  
mapungubwe  
marakele  
mokala  
mountain zebra  
namaqua  
table mountain  
tankwa karoo  
west coast



**Emnam Environmental**  
& Engineering Consulting (Pty) Ltd

15 January 2023

**Thabo D. Mohlala**  
Director-Water and Environmental Specialist  
**Emnam Environmental & Engineering Consulting  
(PTY) Ltd**  
219 Kagiso Street, Phalaborwa  
1390

**Att.: IEEM, Prof. Rudolph, Dr. Walenzik**

mail@uni-wh-ieem.de

## **LETTER OF INTENT**

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled **Community-based Sustainable Water Management and Observation System - CoSMOS**.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions.

The First Main Phase shall include five **Work-Packages**:

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**WP4 Society** Socio-Economic Development and Local Participation

**WP5 Observation** Community-based Monitoring with Data-Warehouse.

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**Emnam Environmental**  
& Engineering Consulting (Pty) Ltd

Modifications of project title and content are subject of outstanding discussion with all partners.

Thabo Mohlala intends to co-operate with CoSMOS to apply the specific CoSMOS-approach and to transfer solutions to be developed into the project areas. Thabo Mohlala will support the project in conducting field campaigns thematically related to biomonitoring of water bodies and groundwater management.

The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Phalaborwa, 15. January 2023

Signed



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Ref: IEEM/Umgeni  
Enquiries: Dr Ntsapokazi Deppa  
ntsapokazi.deppa@umgeni.co.za  
Date: 03 March 2023

The (CEO General Director)  
Institute of Environmental Engineering & Management  
Alfred-Herrhausen-Str. 44  
58455 University of Witten,  
Germany

Attention: Prof. Dr.-Ing. Dr. rer. pol. Dr. h.c. Karl-Ulrich Rudolph (CEO General Director)  
and Dr. Gabriele Walenzik (CFO)

Per E-Mail: [karl-ulrich.rudolph@uni-wh-ieem.de](mailto:karl-ulrich.rudolph@uni-wh-ieem.de)

**RE: THE INSTITUTE OF ENVIRONMENTAL ENGINEERING AND MANAGEMENT (IEEM) AND UMGENI  
WATER JOINT PARTNERSHIP FOR WATER, ENERGY, FOOD, ECO-TOURISM AND HOSPITALITY  
INITIATIVES DRIVEN BY FOURTH INDUSTRIAL REVOLUTION (4IR) AND REPLICATION OF THE BEST  
PRACTICES FROM CoSMOS IN MPUMALANGA**

1. Reference is made to the two-day Community Based Sustainable Water Management and Observation Systems (CoSMOS) Workshop held on the 30-31 January 2023 in Berlin funded by German Federal Education and Research (BMBF) under the Institute of Environmental Engineering and Management (IEEM) at the University of Witten, in Germany.
2. Umgeni Water was established in 1974 to provide water and sanitation services to water institutions and customers in KwaZulu/Natal, and is the second biggest water supplier in South Africa. The entity is a state-owned entity established in terms of Section 84 of the Water Services Act, 108 of 1997 and a schedule 3B national government business enterprise in terms of Public Finance Management Act (PFMA) by the Department of Finance or National Treasury in South Africa. The Institute of Environmental Engineering and Management (IEEM) CoSMOS project is aligned with Umgeni Water Strategy Vision 2050 performance targets and is endorsed by office of the Minister of Water and Sanitation (DWS). It is therefore envisaged in this Letter of Intent (LoI) that Umgeni Water will enter into a partnership agreement with the Institute of Environmental Engineering and Management (IEEM) on water, energy, food, tourism and hospitality initiatives driven by the Fourth Industrial Revolution (4IR), Fifth Industrial Revolution (5IR), Artificial Intelligence (AI),

**UMGENI WATER**

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E-mail: [Info@umgeni.co.za](mailto:Info@umgeni.co.za) Internet: <http://www.umgeni.co.za>

**Acting Chief Executive: Dr Siphon Manana**

Non-Executive Directors: Z Mathenjwa (Chairperson) • N Chamane • S Shabalala • M Zakwe • V Reddy • W Mapena • T Nkhahle • L Ngcobo • B Zulu • S Badat • S Chamane •

- Internet of Things (IoT), Big Data Analytics, Fifth-Generation wireless (5G) and Sixth-Generation wireless (6G).
3. As discussed with the South African Embassy on the 01 February 2023 in Berlin, Umgeni Water and IEEM partnership will include a number of flagship projects to be implemented in Mpumalanga, KwaZulu/Natal and Eastern Cape provinces with the Water Services Authorities (WSAs) especially the metropolitan cities, Water User Associations (WSAs) and emerging black farmers around various water sources, subject to funding made available by German Federal Education and Research (BMBF) and the German Federal Minister of Food and Agriculture, Cem Özdemir, and Commissioner for Agriculture, Rural Development, as part of both Blue Economy and Sustainable Environment of the African Union (AU) and African Continental Free Trade Area (AfCTA).
  4. Some of the Integrated Water Resources Management (IWRM) projects and plan identified by Umgeni Water, from the CoSMOS workshop and subsequent engagements that unfolded, include:
    - 4.1 Water, Energy, Food, Eco-tourism and Hospitality programmes aligned to the German Federal Minister of Food and Agriculture, Cem Özdemir, and Commissioner for Agriculture, Rural Development, Blue Economy and Sustainable Environment of the African Union (AU) and regional bulk infrastructure between African states in terms of African Union (AU) Infrastructure Plan;
    - 4.2 Inter-provincial programmes to cover Mpumalanga best practices from CoSMOS for replication in KwaZulu/Natal and Eastern Cape Water Services Authorities (WSAs), Water Users Associations (WUAs) and emerging black farmers to accelerate improved water quality and resilience for economic growth and development;
    - 4.3 Skills transfer plan for engineering and scientific competencies of the workforce using Internet of Things (IoT), multispectral sensors, multiparameter analysers, water quality satellite monitoring, digital surface modelling of water sources in catchment management areas (CMAs), use of drones for water resources monitoring, sonar sensor and digital underwater maps, and big data analytics including automation and digitalisation of water assets; and
    - 4.4 A joint German-South Africa water, energy and food partners in the new financial year to develop and implement a joint plan of action.

Yours Sincerely



**DR SIPHO MANANA**

**ACTING CHIEF EXECUTIVE OFFICER**

**UMGENI WATER**

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310 Burger Street • Pietermaritzburg 3201 • Republic of South Africa  
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Honeydew  
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Tel: (011) 471 4788  
[ngwenyad@sentech.co.za](mailto:ngwenyad@sentech.co.za)

21 February 2023

Institute of Environmental Engineering and Management  
At the Witten/Herdecke University  
44 Alfred-Herrhausen Street  
Witten  
Germany  
58455

**Attention: Prof. Dr. -Ing. rer. pol. Karl -Ulrich Rudolph (CEO)**

**RE: LETTER OF INTENT IN IMPLEMENTING OF COMMUNITY-BASED SUSTAINABLE WATER MANAGEMENT AND OBSERVATION SYSTEMS (CoSMOS) FUNDED BY GERMAN FEDERAL EDUCATION AND RESEARCH (BMBF)**

Dear colleagues

Sentech (Pty) Limited is wholly owned by the Government of the Republic of South Africa (RSA) as represented by the Minister of Communications and Digital Technologies. It is a State-Owned Enterprise (SOE) established in terms of the Sentech Act (Act 63 of 1996) and is listed as a schedule 3B public entity in terms of the Public Finance Management Act (PFMA).

As part of its research collaboration, Sentech actively seeks partnerships with local, regional, continental, and international industries in research, technology innovation and commercialization activities in the field of Broadband and Multimedia Communications. The target is to contribute to the system of innovation and in world-class research and educational outputs, outcomes, and throughputs for the benefit of African smart societies.

Through partnership with German and South African research and innovation institutions, such as the Institute for Environmental Engineering and Management (IEEM), Sentech would like to express its interest to participate in implementation of Community-Based Sustainable Water Management and Observation Systems (CoSMOS) to meet African Union (AU) Agenda 2063 performance targets aligned to the South African National Development Plan 2030 vision. Through the envisaged partnership with the German Federal Ministry of Education and Research (BMBF) funded CoSMOS under the "Water Security for Africa" (WASA) strategy by IEEM, Sentech's interest is to implement a Big Data Analytics capability with Intelligent Geodata Management and Modelling to generate appropriate information on water resources. This is expected to enable a design a sustainable water reuse and

wastewater management and utilization. The objective is to tackle a utilization problem related to water quality and supply deficits at river basin level.

Dr. George Tsibani, in association with the University of Johannesburg, will lead the Water and Society theme for the entire project, making use of concepts from the domains of resource optimization, queueing theory and deep learning to include, and exploring the role of fourth industrial revolution (4IR) technologies in management of water resources.

A presentation was made by Dr. George Tsibani on 9 November 2022 to eight South African universities, funded by Sentech, to prioritize IOT in water and sanitation. Based on the report compiled by Dr George Tsibani covering proceedings of the CoSMOS final workshop on **30-31 January 2023**, Sentech's intent is to participate in the following five CoSMOS pillars or five Work-Packages (WP):

- **WP1:** Water Planning Geodata-Management and Modelling
- **WP2:** Water Infrastructure Water Reuse with Pilot Solution in Gauteng, KwaZulu/Natal with Umgeni Water and Eastern Cape two metropolitan cities
- **WP3:** Water and Wastewater Ecology with Near-to-Nature Solutions by implementing Short Learning Programmes through the University of Johannesburg (UJ) : Centre for Ecological Intelligence and Nuclear Energy and Centre for Water under Faculty of Built Environment
- **WP4:** Water Society Socio-Economic Development and Local Participation
- **WP5:** Water Observation Community-based Monitoring with Data-Warehouse.

It is envisaged that the initiative will lead to new business scope, including IOT generated new enterprises and business supporting catchment management areas, water user associations and water boards and authorities covering most provinces of South Africa. Sentech activities in 5G and Cloud computing will be the nerve centre of the utility business, water digitalisation of water utilities, and develop new strategies in water back to business.

The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Yours Sincerely



**Mr Dumisa Ngwenya (Head: Research and Innovation )**

**CC Dr Fumene George Tsibani : UJ Senior Research Associate , Umgeni Water Board Advisor and CEO of Mthenganya and Associates (Pty) Ltd**



Dr. rer. nat. Falko Wagner

*Institut für Gewässerökologie &  
Fischereibiologie (IGF)*  
JENA

IGF, Dr. rer. nat. Falko Wagner,  
Sandweg 3, 07745 Jena

IEEM, Prof. Rudolph, Dr. Walenzik  
mail@uni-wh-ieem.de

Institute of Aquatic Ecology and  
Fish Biology (IGF)

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### LETTER OF INTEND

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent First Main Phase, also entitled Community-based Sustainable Water Management and Observation System - CoSMOS.

The R&D project focuses on a combination of Community-based Observation & Monitoring as well as Intelligent Geodata Management and Modelling to generate appropriate information on water resources to design a sustainable Water Reuse and Wastewater and Utilization Concept to tackle water-related quality and supply deficits on river basin level. The concept will be used to strengthen Public Participation and Local Economic Development, being flanked by concrete measures to improve the ecosystem status by Ecological Optimisation of Water Bodies and Biotope Networks and implementing Semi-natural Technologies and Lean-tech Solutions.

The First Main Phase shall include five Work-Packages:

WP1 Planning Geodata-Management and Modelling

WP2 Infrastructure Water Reuse with Pilot Solution

WP3 Water Ecology with Near-to-Nature Solutions

WP4 Society Socio-Economic Development and Local Participation

WP5 Observation Community-based Monitoring with Data-Warehouse.

Modifications of project title and content are subject of outstanding discussion with all partners.

Following the participation of Falko Wagner in the CoSMOS summer school on 17 October 2022 with representatives of the South African, Falko with the IGF Jena intends to co-operate with CoSMOS to apply the specific CoSMOS-approach. Falko will focus on the transfer of the knowledge about re-establishing river connectivity for fish and macroinvertebrates from the northern hemisphere to the species and communities in South African rivers which are characterized by high discharge fluctuations. The second field of activity would be the conservation and restoration of habitats for important aquatic umbrella species.

The undersigned confirms to join the Project as partner with valid interest to participate. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Jena, 31. February 2023

Signed



**From:** Judith Mtsewu

[nonelwa@hotmail.com](mailto:nonelwa@hotmail.com)

**Att.:** IEEM, Prof. Rudolph, Dr. Walenzik

mail@uni-wh-ieem.de

## **LETTER OF INTENT**

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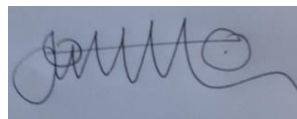
Following the participation of Judith Mtsewu in two CoSMOS conferences, including the CoSMOS Final Conference on 30-31 January 2023 with representatives of the South African and the German Embassy, Judith intends to co-operate with CoSMOS to apply the specific CoSMOS-approach. Judith will join the CoSMOS project as its social partner. Judith’s contribution will focus on articulating and deepening the community-based segment of CoSMOS for enhanced outcomes.

The undersigned confirms to join the Project as partner with valid interest to participate and contribute. Depending on decisions from BMBF regarding the workplan, timelines and budget of the project, details of work input and cost recovery shall be negotiated at a later stage of the project and (hopefully) under the first phase main project.

Johannesburg, South Africa

6 March 2023

Sincerely,



Judith Mtsewu, Signature:



## water & sanitation

Department:  
Water and Sanitation  
REPUBLIC OF SOUTH AFRICA

Private Bag X313, Pretoria 0001 / Sedibeng Building, 185 Francis Baard Street, Pretoria  
Tel: 012 336 7500 / Fax: 012 323 4470 or 012 326 2715

**Enquiries:** BL Mwaka

**Telephone:** 012 336 8188

**Ref:** DWS/CoSMOS

### By Hand

IEEM gGmbH  
Prof. Rudolph, Dr. Gabriele Walenzik  
[mail@uni-wh-ieem.de](mailto:mail@uni-wh-ieem.de)

Dear Professor Rudolph,

### **COMMUNITY-BASED SUSTAINABLE WATER MANAGEMENT AND OBSERVATION SYSTEM, (COSMOS)**

The meeting held on 5 July 2022 and the subsequent workshop held on 17 and 18 November has reference.

It was brought to the attention to the Department of Water and Sanitation (DWS) that:

The German Federal Ministry of Education and Research (BMBF) is funding the Initial Project "Community-based Sustainable Water Management and Observation System – CoSMOS" as part of the research program "Water Security for Africa" (WASA). On behalf of a group of German and South African universities and water sector partners, it is intended to submit a Project Outline for a subsequent main phase, also entitled Community-based Sustainable Water Management and Observation System - CoSMOS.

This main Project shall combine intelligent geodata management and modelling to generate appropriate information on water resources with the pilot solution designed for sustainable water reuse and utilization of wastewater. It will address water-related quality and supply deficits at-the-community and river basin levels. The concept will strengthen public participation and local socio-economic development, and lead to ecological optimisation of water bodies and biotope networks. CoSMOS can build on its previous R&D outcomes and implementation in the target region and has located a pilot community with ideal conditions to leverage R&D funding and replicate the pilot solution throughout the WASA area.

It was subsequently requested and agreed that regarding the above project description that the DWS Directorate: Water Resource Management Planning will support the CoSMOS project by:



NATIONAL DEVELOPMENT PLAN  
Our future - make it work

- Where possible facilitate networking and linking of the project to the DWS key strategic areas, and other ongoing activities, and projects,
- Contribution to and participation in workshops and events, and
- Provision of critical guidance and recommendations on activities and outcomes of the project.

Yours sincerely

  
**BL MWAKA**  
**DIRECTOR, WATER RESOURCE MANAGEMENT PLANNING**

**DATE:** 1/12/2022



**NATIONAL DEVELOPMENT PLAN**  
Our Future - make it work

giz 333 Grosvenor Street • Hatfield Pretoria • South Africa

Att.: IEEM, Dr. Walenzik, Prof. Rudolph  
mail@uni-wh-ieem.de

### To whom it may concern

Sir/ Madam

This letter serves to confirm that GIZ Natural Resources Stewardship Programme in South Africa is familiar with the work of IEEM and its' partners in South Africa. GIZ NatuReS and IEEM have remained in touch over the years during the BMBF funded research projects MOSA (IWRM South Africa in the Middle and Lower Olifant Catchment) and iWaGSS (integrated Water Governance Support System). I have followed progress and remain impressed by the calibre of work undertaken in Limpopo Province and Kruger National Park. Through this collaboration we've become aware of the German Federal Ministry of Education and Research (BMBF) funded "Community-based Sustainable Water Management and Observation System – CoSMOS" under the research program "Water Security for Africa" (WASA) and have participated in information sharing events including : a virtual **presentation by** Prof. Christian Jolk and Prof. Karl on the ideas, structure and research activities planned in a virtual meeting on 5 July 2022. We also received documentation of the Final Workshop of the Initial CoSMOS project held in Berlin 30,31 January 2023. While GIZ NatuReS is not a water governance programme, we would be very interested to continue with the fruitful information exchange and to learn from some of your research insights and lessons.

It remains a pleasure to collaborate with Prof Rudolph and the IEEM Team. We wish the team well with its future endeavors!

Yours sincerely

  
Dr. Faith Lawrence

Natural Resources Stewardship Programme, South Africa

### German Development Cooperation

Natural Resources Stewardship Programme  
333 Grosvenor Street  
Hatfield Pretoria, South Africa 0028  
T +27 12 423 5900  
F  
Email: [faith.lawrence@giz.de](mailto:faith.lawrence@giz.de)

Our reference: Letter of Support IEEM, Cosmos project

17 March 2023

Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH

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Registration no. HRB 12394

Chairman of the Supervisory Board  
Martin Jäger

Management Board  
Tanja Gönner (Chair)  
Ingrid-Gabriela Hoven  
Thorsten Schäfer-Gümbel