Empowering Local Expertise: Operational Streamflow Forecasting for the Ruvu Catchment, Tanzania (2022-Present)

The journey of capacity building: Ruvu Catchment Streamflow Forecasting project.

In response to the critical hydrological drought of 2021/22 that threatened the water supply of Dar es Salaam, NTWAM, in partnership with Prof. Anund Killingtveit (NTNU, Norway), embarked on a visionary mission. This initiative wasn't just about developing a forecasting tool; it was about embedding the expertise to own and operate it within Tanzania. Starting as an unsolicited research project in 2022 and evolving into a government-endorsed consultancy in 2024, our journey has created a self-sustaining centre of excellence at the Wami/Ruvu Basin Water Board (WRBWB).

Key Impact Numbers:

(i) 5 Skilled Operational Hydrologists trained within WRBWB.
(ii) 2-Phased Approach: Training-of-Trainers (ToT) & Specialized Counterpart Training.
(iii) 10-Day Public Streamflow Forecasts now routinely published.
(iv) 1 Peer-Reviewed Scientific Publication documenting the methodology.
(v) 100% of trained counterpart staff now capable of independent system operation.

The Challenge & The Response

Context: The Ruvu River is the lifeblood of Dar es Salaam, supplying water to over 79% of its residents. The unprecedented water shortage of 2021/22 was a system-wide wake-up call. It

starkly revealed that the Ruvu catchment was ill-equipped to cope with climate variability, lacking both predictive tools and, critically, the local expertise for proactive management. Reactive measures were no longer sufficient.

The NTWAM Solution: Cognizant that technical solutions alone are insufficient without local ownership, NTWAM founders Prof. Preksedis Marco Ndomba and Dr. Frank Wambura designed a deliberate, two-tiered capacity-building programme.

- Phase I (2023-2024) - The "Training of Trainers" (ToT) Approach: We partnered with world-renowned hydrologist Prof. Anund Killingtveit to create a foundational pool of local experts. Through intensive online and in-person "learning-by-doing" sessions, this cohort (including Prof. Ndomba and Dr. Wambura) mastered the HBV model, from theory to advanced troubleshooting, including navigating a real-world data crisis caused by unexpected infrastructure changes.
- Phase II (2024-Present) - Intensive Counterpart Training: With the project formalized, we shifted focus to embedding deep knowledge within the client institution. Five key technical staff from WRBWB were designated as counterparts for critical forecasting system components. A 7-day in-person workshop, held in February, 2024, Kibaha, facilitated by our ToT cohort, provided hands-on training in model setup, operation, and results interpretation.

The Facilitators:

(i) Eng. Prof. Preksedis Marco Ndomba, PhD: Founder & Executive Director, NTWAM; Lead Consultant, DIT. A master trainer who guided the entire capacity-building journey.
(ii) Prof. Anund Killingtveit: Professor Emeritus, NTNU, Norway. A world-class hydrologist who provided the foundational expertise and mentored the ToT cohort.

Voices from the Field

"The Ruvu streamflow forecasting model has transformed how we monitor and respond to hydrological dynamics... I've developed a deeper understanding of modern hydrological modelling, and I've seen firsthand how predictive tools can support better governance of water resources."
— Eng. Paschal Qutaw, Designated Operator, WRBWB

"*As a woman working in water resources management, I also view this model through the lens of social impact. With improved streamflow forecasting... reducing the strain on women and freeing up time for education, income generation, and civic participation."*
— Eng. Miriam Esanju, Project Coordinator

"The introduction of the streamflow forecasting model has significantly enhanced our ability to manage and allocate water resources... This scientific approach has replaced previously manual and reactive methods."
— Eng. Elibariki Mmasay, Director, WRBWB

Photo Gallery:

Impact of the 2021/22 Critical Hydrological Drought at the Lower Ruvu DAWASA Treatment Plant.

The water diversion weir constructed in year 2022 downstream of the 1H8A flow gauging station, which rendered the existing rating curve useless.

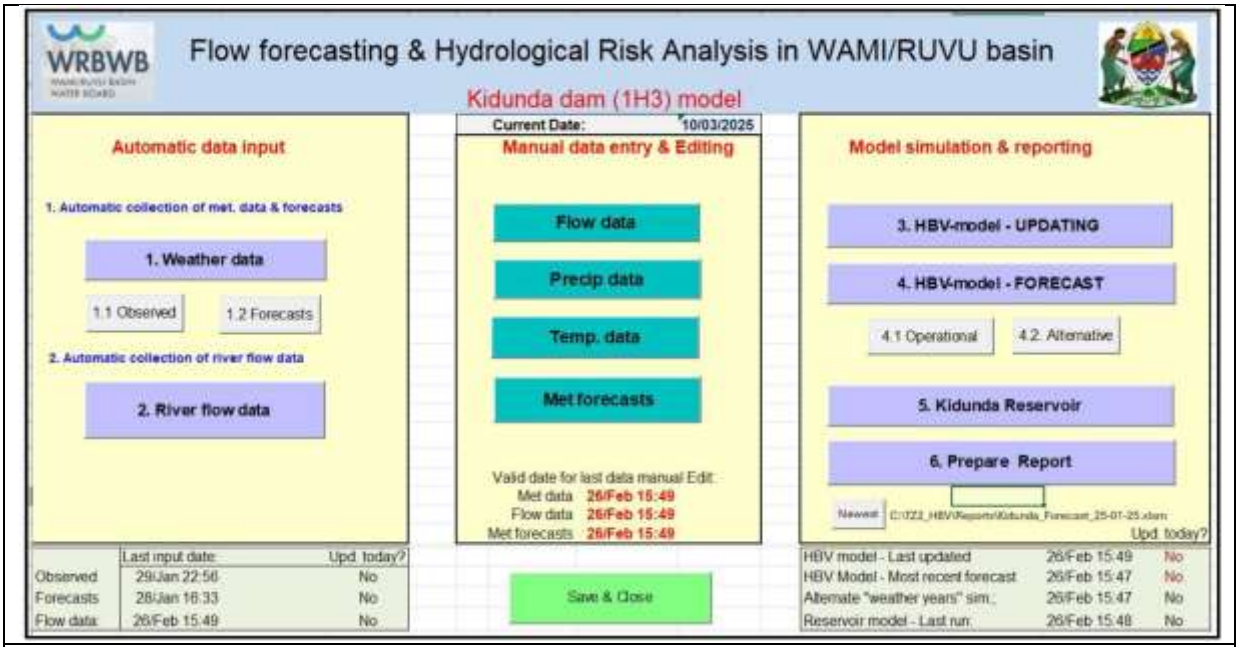
Official Group Photograph of Workshop Participants and WRBWB Counterpart Staff.
The workshop was formally opened by the Director of Water Resources, Dr. George Lugomela (*seated, center, front row*), on 18th February 2024. A video clip of the opening ceremony is available online (see Instagram Reel: *https://www.instagram.com/reel/C3idB8VIvsf/*).

Outcomes & Way Forward

The initiative's success is not just anecdotal; it's measurable and tangible.

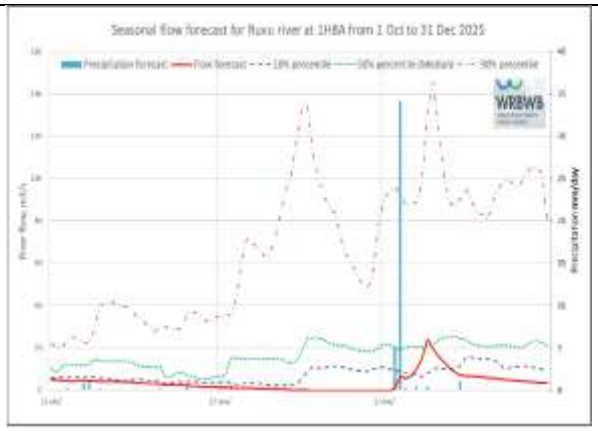
Verified Competencies & Tangible Outputs

(i) A National Nucleus of Expertise: A ToT cohort now capable of leading future initiatives and training others. This was verified when they successfully facilitated the Phase III training.
(ii) Five Skilled Operational Hydrologists: The WRBWB counterpart staff now independently run the entire Ruvu-HBV system, from data ingestion to forecast publication.
(iii) A Fully Operational, Locally-Managed System: The model is hosted on the WRBWB server, and its staff routinely publish 10-day streamflow forecasts on the WRBWB website for public use.
(iv) Peer-Reviewed Scientific Publication: Our methodology and success were documented in a paper published in the journal *Water* (https://doi.org/10.3390/w18020285).



(a) Operator interface to the Ruvu–HBV streamflow forecasting model.

(b) Streamflow forecasting room.



(c) Ruvu at Morogoro Roadbridge —Seasonal flow forecast from 1 October to 31December 2025.

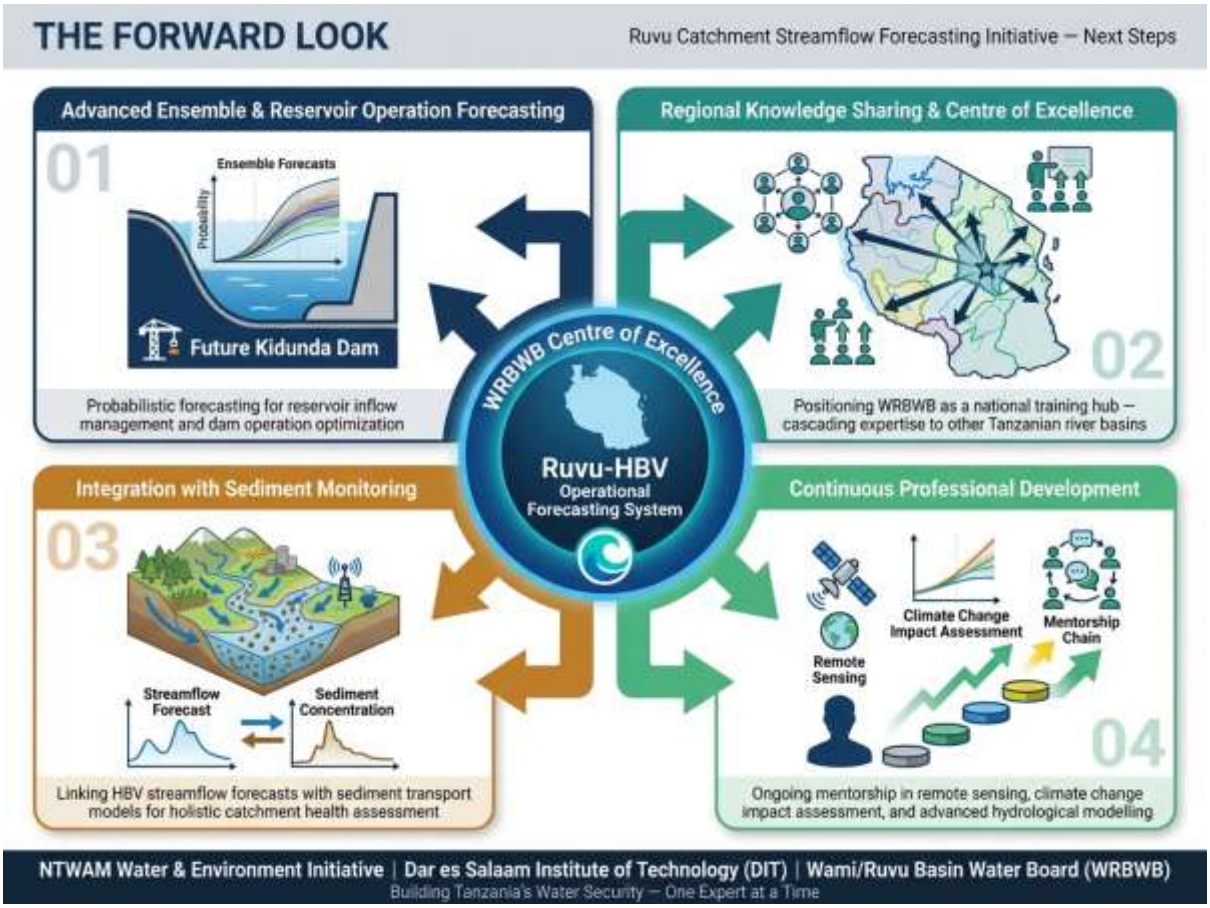
The operational Ruvu Catchment streamflow forecasting interface, showing seasonal forecasted streamflow, from 1 October to 31 December, 2025.

The trained WRBWB counterpart staff, now fully equipped to independently operate and maintain the Ruvu streamflow forecasting system, stand as a testament to the power of strategic, hands-on capacity building.

Next Steps

Building on this solid foundation, NTWAM is committed to long-term partnership and recommends:

(i) Advanced Ensemble & Reservoir Operation Training: Equipping the team for probabilistic forecasting and managing the upcoming Kidunda Dam.
(ii) Regional Knowledge Sharing: Positioning the WRBWB team as a centre of excellence to train staff from other basins in Tanzania.
(iii) Integration with Sediment Monitoring: Linking forecasts with sediment transport models for a holistic view of catchment health.
(iv) Continuous Professional Development: Ongoing mentorship in remote sensing and climate change impact assessment.



A conceptual diagram illustrating the next steps for the project