

From Unsolicited Research to National Legacy: NTWAM Water & Environment Initiative and Tanzania's National Streamflow Forecasting System

A Publicity & Impact Report

NTWAM Water & Environment Initiative | March 2026

Executive Summary

What began as a voluntary, unsolicited research response to a water crisis has become a landmark in African applied hydrology. The **NTWAM Water & Environment Initiative (NTWAM)** — in partnership with the Wami/Ruvu Basin Water Board (WRBWB), the Dar es Salaam Institute of Technology (DIT), and Prof. Anund Killingveit (NTNU, Norway) — designed, built, and operationalised Tanzania's first river-basin streamflow forecasting system. On **22nd March 2026**, the system was inaugurated by the **Vice President of the United Republic of Tanzania, Dr. Emmanuel Nchimbi**, as the **National Streamflow Forecasting System** — recognised as a model for Sub-Saharan Africa.

The achievement is not merely technical. It is a proof of concept for a new pipeline in African applied research: from crisis-driven inquiry → structured capacity building → government ownership → national policy instrument.

"Tanzania has become a model for Sub-Saharan Africa for implementing water projects and has been recognised in line with Africa's Agenda 2063."

— *Minister for Water, Eng. James Aweso, Daily News, 22 March 2026*

Key Findings

- **Crisis catalyst → national asset:** The 2021/22 hydrological drought that cut water supply to 79% of Dar es Salaam's residents exposed a fundamental gap — no predictive tools, no local expertise.
- **Two-phase capacity model:** NTWAM's Training of Trainers (ToT) + intensive counterpart programme produced 5 fully independent operational hydrologists within WRBWB, 100% of whom now run the system without external support.

- **Peer-reviewed and publicly operational:** The methodology is documented in the international journal *Water* (DOI: 10.3390/w18020285), and 10-day public streamflow forecasts are routinely published on the WRBWB website.
- **Nationally inaugurated:** The Vice President's inauguration on World Water Day 2026 elevates the Ruvu system from a basin tool to a national blueprint for operational hydrology across Tanzania.
- **Replicable blueprint:** NTWAM's pipeline — unsolicited research → ToT → counterpart training → govt. endorsement → national recognition — is now poised for replication across Tanzania's nine major river basins.

1. Background: The Ruvu Crisis That Sparked a Mission

The Ruvu River is the hydrological lifeline of Dar es Salaam, Tanzania's commercial capital. It supplies over **79% of the city's domestic water** through the DAWASA (Dar es Salaam Water and Sewerage Authority) treatment infrastructure at Lower and Upper Ruvu plants.

The **hydrological drought of 2021/22** was catastrophic. River levels fell to critically low levels, intake pumps were impaired, and millions of residents faced acute water shortages — residents queuing for water became a daily reality. The crisis exposed a hard truth: the Ruvu catchment operated with no streamflow prediction capability and no local technical cadre trained in modern hydrological modelling.

Compounding the challenge, a new **water diversion weir** was constructed in 2022 downstream of the 1H8A gauging station — rendering the existing rating curves invalid and making flow measurement even more difficult.

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.

Figure 1. Impact of the 2021/22 Critical Hydrological Drought at the Lower Ruvu DAWASA Treatment Plant (top), and the water diversion weir constructed in 2022 downstream of the 1H8A flow gauging station (bottom), which rendered the existing rating curve obsolete.

The crisis demanded a paradigm shift: from **reactive water management to proactive, science-based decision-making**. NTWAM stepped in — without a client commission, without a contract — because no one else did.

2. NTWAM's Role: Architect of an Applied Research Pipeline

2.1 The Unsolicited Research Initiative (2022)

In 2022, NTWAM founders **Prof. Preksedis Marco Ndomba** (Executive Director, NTWAM; Lead Consultant, DIT) and **Dr. Frank Wambura** initiated applied research on the Ruvu catchment entirely on their own impetus. Their diagnosis was precise: Tanzania needed not just a forecasting tool, but **local ownership** of that tool. Importing technology without embedding expertise would only reproduce dependency.

This conviction shaped everything that followed.

NTWAM secured a strategic partnership with **Prof. Anund Killingtveit**, Professor Emeritus at the Norwegian University of Science and Technology (NTNU) — one of the world's foremost operational hydrologists — to bring the **HBV (Hydrologiska Byråns Vattenbalansavdelning) hydrological model** to the Ruvu catchment.

2.2 The NTWAM Pipeline: From Research Idea to Operations

The journey followed a deliberate, five-stage pipeline:

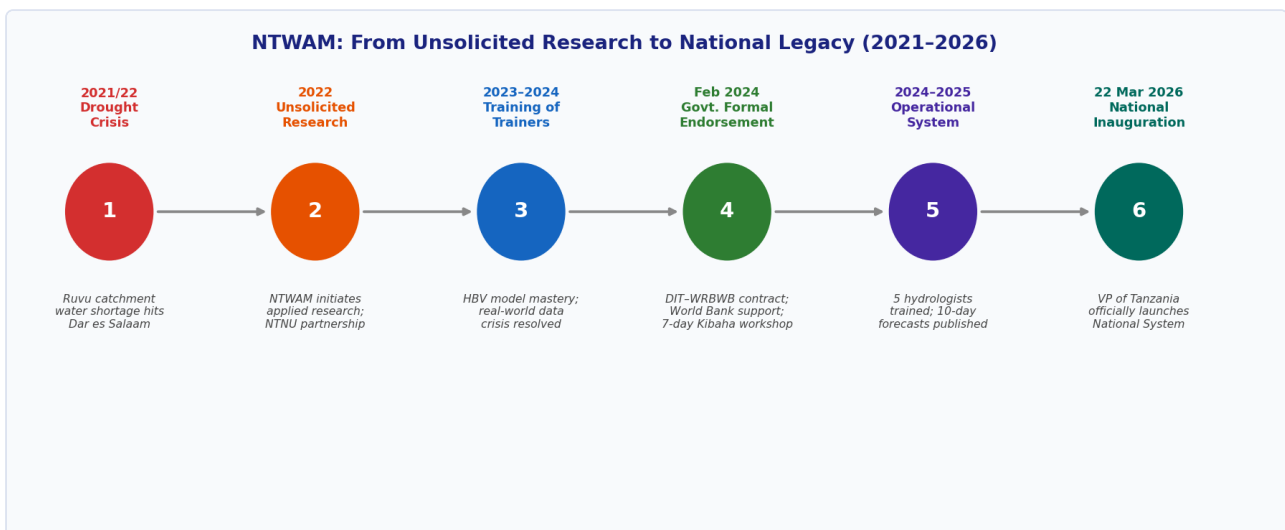


Figure 2. NTWAM's research-to-operations pipeline, showing the progression from the 2021/22 drought crisis through unsolicited research, capacity building phases, government endorsement, and national inauguration in March 2026.

Stage	Period	Description
Crisis	2021/22	Hydrological drought exposes zero predictive capacity in Ruvu catchment
Unsolicited Research	2022	NTWAM–NTNU partnership; HBV model adaptation begins
Training of Trainers (ToT)	2023– 2024	NTWAM core team masters HBV; real-world data crisis navigated
Govt. Endorsement & Counterpart Training	Feb 2024	DIT–WRBWB formal contract; 7-day Kibaha workshop; 5 staff trained
Fully Operational & National System	2024– 2026	WRBWB independently operates; VP inaugurates as National System

Table 1. NTWAM's five-stage applied research-to-operations pipeline for the Ruvu Catchment Streamflow Forecasting System.

3. The Capacity-Building Architecture

NTWAM's defining innovation was **not** the HBV model itself — it was the architecture for ensuring the model would be owned, operated, and extended by Tanzanians.

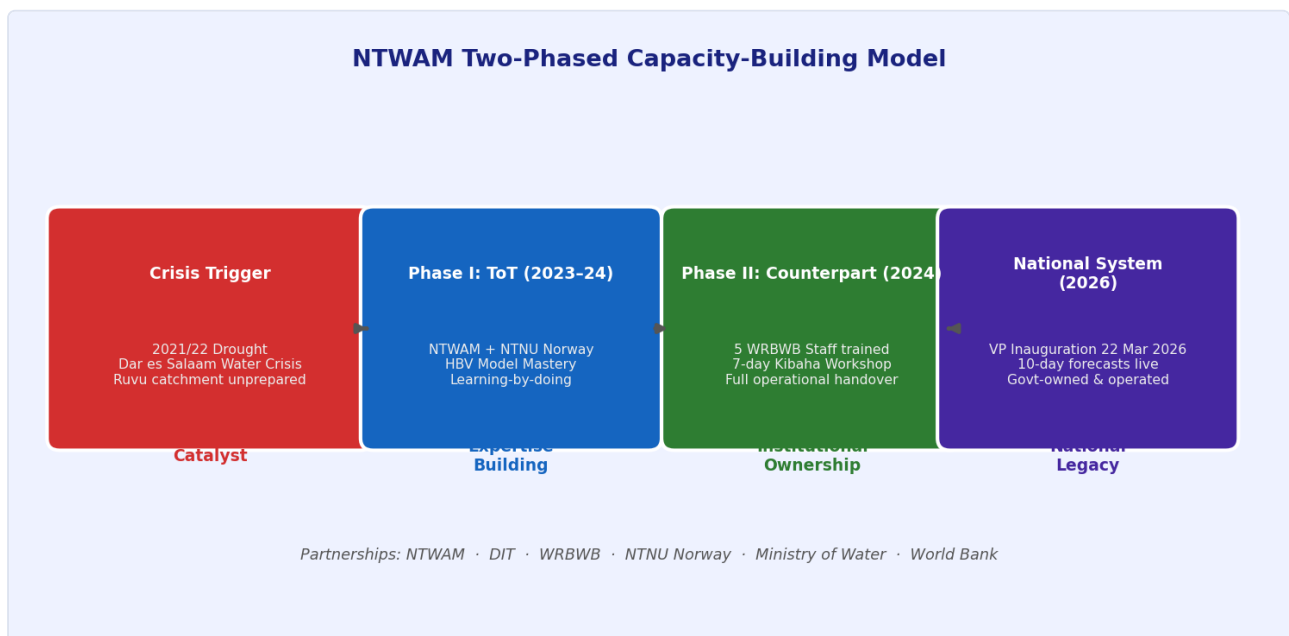


Figure 3. NTWAM's two-phased capacity-building model, from crisis catalyst through institutional ownership to national legacy.

Phase I (2023–2024): Training of Trainers (ToT)

NTWAM created a **national nucleus of hydrological expertise** through intensive online and in-person "learning-by-doing" sessions facilitated by Prof. Killingtveit. The ToT cohort — including Prof. Ndomba and Dr. Wambura — did not just learn to run the HBV model. They mastered it to the level of advanced troubleshooting, including navigating a real-world data crisis caused by the unforeseen 2022 weir construction that had invalidated flow measurements.

This troubleshooting under live conditions was crucial: it produced trainers capable of handling the unexpected, not just trained operators of a textbook system.

Phase II (2024–Present): Intensive Counterpart Training

With the project formalised as a **government-endorsed consultancy in 2024**, NTWAM shifted to embedding knowledge inside WRBWB. Five designated technical staff were selected as counterparts. A **7-day in-person workshop** in Kibaha (February 2024), formally opened by the Director of Water Resources **Dr. George Lugomela**, provided comprehensive hands-on training covering:

- Model setup and parameterisation
- Automated and manual data ingestion
- HBV model updating and forecasting runs
- Results interpretation and public dissemination



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/C3idB8V1vsf/>).

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>).

Figure 4. Official group photograph of the Phase II workshop participants and WRBWB counterpart staff at Kibaha, February 2024. The workshop was formally opened by the Director of Water Resources, Dr. George Lugomela (seated, centre, front row).

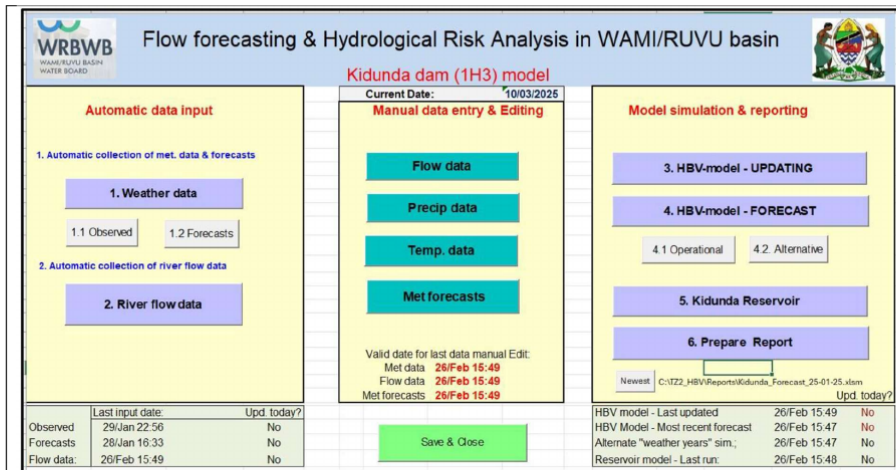
Key Facilitators

Person	Role	Contribution
Prof. Preksedis Marco Ndomba	Founder & Executive Director, NTWAM; Lead Consultant, DIT	Master trainer; guided entire capacity-building journey; principal investigator
Dr. Frank Wambura	Co-founder, NTWAM	Co-designed programme; core ToT cohort member
Prof. Anund Killingtveit	Professor Emeritus, NTNU Norway	World-class hydrologist; foundational HBV expertise; ToT mentor
Dr. George Lugomela	Director of Water Resources, Ministry of Water	Officially opened Phase II workshop; government endorsement
Eng. Elibariki Mmasay	Director, WRBWB	Institutional champion for operational adoption
Eng. Paschal Qutaw	Designated Operator, WRBWB	Primary system operator post-training
Eng. Miriam Esanju	Project Coordinator	Operational coordination; gender lens advocate

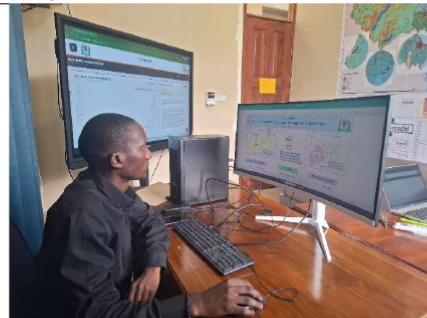
Table 2. Key facilitators and their roles in the NTWAM Ruvu Catchment Streamflow Forecasting Initiative.

4. The Operational System: What It Does

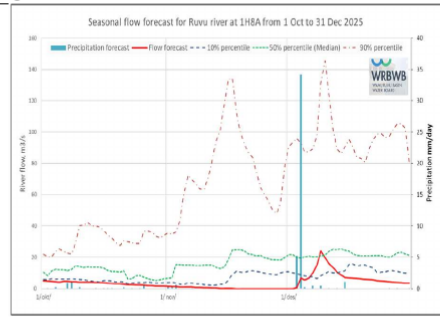
The **Ruvu–HBV Streamflow Forecasting System** is a fully operational, locally managed hydrological forecasting platform hosted on the WRBWB server infrastructure. It represents a complete operational pipeline:



(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 31 December 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.

Figure 5. The operational Ruvu Catchment streamflow forecasting system: (a) operator interface to the Ruvu–HBV model; (b) the streamflow forecasting room at WRBWB; (c) seasonal flow forecast for the Ruvu River at Morogoro Road Bridge, October–December 2025.

System Technical Capabilities:

Capability	Description
Model	HBV (Hydrologiska Byråns Vattenbalansavdelning) hydrological model
Forecast horizon	10-day deterministic public forecasts + seasonal probabilistic forecasts
Data inputs	Automatic meteorological data, observed river flows, gridded climate forecasts
Hosting	WRBWB server infrastructure — fully locally managed
Output dissemination	Published on WRBWB public website
Operations	100% independent operation by 5 trained WRBWB staff
Scientific documentation	Peer-reviewed paper, <i>Water</i> journal (DOI: 10.3390/w18020285)

Table 3. Technical specifications of the operational Ruvu–HBV Streamflow Forecasting System.

5. Verified Impact and Outcomes

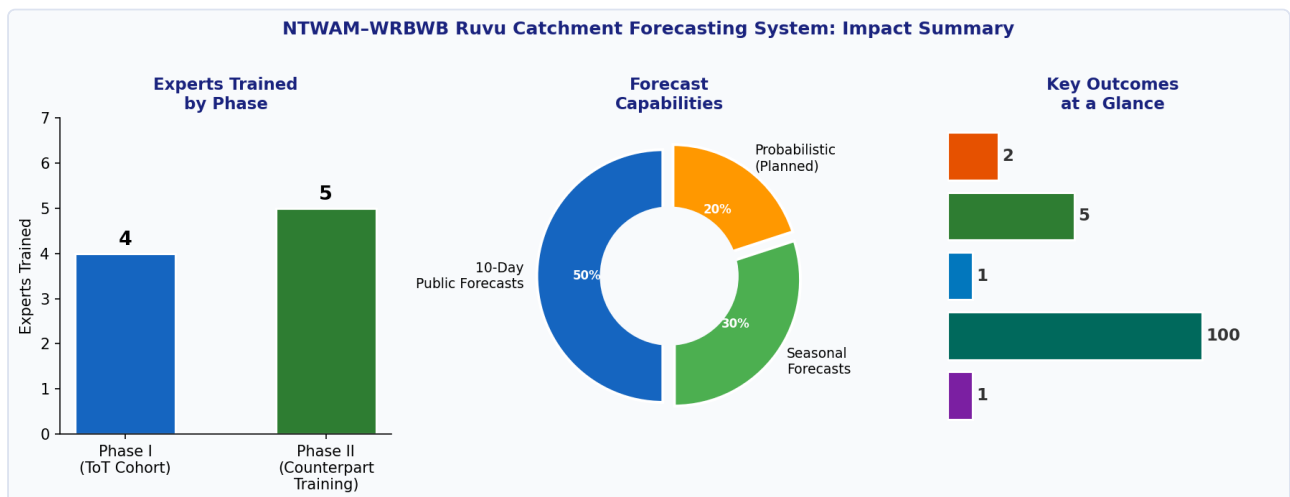


Figure 6. Impact summary of the NTWAM–WRBWB Ruvu Catchment initiative: capacity building by phase, forecast capabilities delivered, and key outcome metrics.

Quantified Outcomes

Metric	Achievement
Operational hydrologists	5 WRBWB staff independently operate the full system
Independence rate	100% — zero external support required for daily operations
Training phases	2 structured phases (ToT + Counterpart)
Public forecast product	10-day streamflow forecasts routinely published
Scientific output	1 peer-reviewed publication in <i>Water</i> (MDPI), 2025
System ownership	Government-hosted, government-managed, government-disseminated
National recognition	Inaugurated by VP of Tanzania on World Water Day 2026

Table 4. Verified quantified outcomes of the NTWAM Ruvu Catchment Streamflow Forecasting Initiative.

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, we reduce the strain on women and free 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."

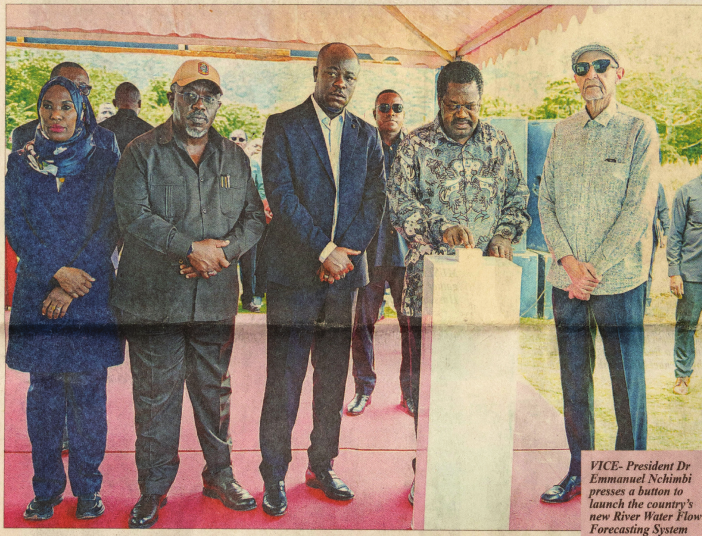
— **Eng. Elibariki Mmasay**, Director, WRBWB

6. National Recognition: The 22nd March 2026 Inauguration

On **22nd March 2026** — World Water Day — the Ruvu Catchment Streamflow Forecasting System was officially elevated to the **National Streamflow Forecasting System** at inauguration ceremonies during the 2026 Water Week celebrations in Morogoro, by the **Vice President of the United Republic of Tanzania, Dr. Emmanuel Nchimbi**.

TZ strengthens water security

● VP stresses protection of water sources to ensure sustainable future



VICE-President Dr Emmanuel Nchimbi presses a button to launch the country's new River Water Flow Forecasting System at Mindu Dam in Morogoro Region, marking World Water Day yesterday. Looking on are the Speaker of the National Assembly, Mussa Azzan Zungu, Minister for Water Jumua Aweso (centre), Morogoro Regional Commissioner, Adam Malima (second left) and Permanent Secretary of the ministry, Eng Mwajuma Waziri. (Photo by YPO)

By SOPHIA KUMKANA
VICE-PRESIDENT Dr Emmanuel Nchimbi has called on all development stakeholders to protect water sources, stressing that safeguarding water is crucial to ending shortages and securing a sustainable future for coming generations.

Speaking yesterday during the climax of the 2026 Water Week celebrations in Morogoro, Dr Nchimbi described the national water grid project as a critical step toward eliminating water scarcity across Tanzania.

Continued from page 1 of clean water.

He directed the Ministry of Water to install water meters across various usage points to reduce losses and improve consumer accountability.

He encouraged the ministry to explore new revenue streams, citing Tanga Water Authority's water bond as a successful example for other authorities to follow.

Dr Nchimbi highlighted Tanzania's achievements under the 2002 Water Policy (2025 Edition), noting that over 85.2 per cent of rural residents and 92.5 per cent of urban residents now have access to clean and safe water.

To date, 10,758 villages have been reached with clean water services, leaving only 1,575 villages remaining. I commend the Ministry of Water for focusing on completing these areas," he said.

He recalled President

"We must invest in the water sector as guided by our policies, including protecting, conserving and expanding our water sources. As we implement Vision 2050, the national water grid must remain a top priority," he said.

He urged all ministries and public institutions to collaborate closely in addressing water-related challenges, aligning with the government under the leadership of President Samia Suluhu Hassan's vision of a country free from water scarcity.

"Water is essential in every sector, and there is no person for whom water is unimportant," Dr Nchimbi added.

The Vice-President also stressed the importance of environmental sanitation, calling on authorities to ensure the proper functioning of wastewater systems to prevent contamination.

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Speaking on the 2026 World Water Day theme

"Water and Gender Equality," he stressed that women and girls remain the most affected by water scarcity, often facing safety risks when collecting water.

He noted that globally, water-related challenges affecting women result in economic losses equivalent to nearly 5 per cent of global GDP, or over 170 billion US dollars annually.

"The theme challenges all Tanzanians to actively participate, recognising that planning and implementing water projects is a shared responsibility between men and women to ensure accountability and sustainability," he said.

Minister for Water Jumua Aweso assured the Vice-President that, following President Samia's directive, the ministry is fully committed to providing reliable water services to both urban and rural Tanzanians.

Figure 7. Tanzania's Vice President Dr. Emmanuel Nchimbi presses the button to launch the country's new River Water Flow Forecasting System at Mindu Dam, Morogoro Regional Commissioner's office area. Also seen are the Speaker of the National Assembly, the Minister for Water, and the Morogoro Regional Commissioner. (Source: Daily News, Tanzania, 22 March 2026)

The Vice President called on all development stakeholders to protect water sources, stressing that safeguarding water is crucial to ending shortages and securing a sustainable future. He noted that Tanzania had become a continental model for implementing water projects in alignment with Africa's Agenda 2063.

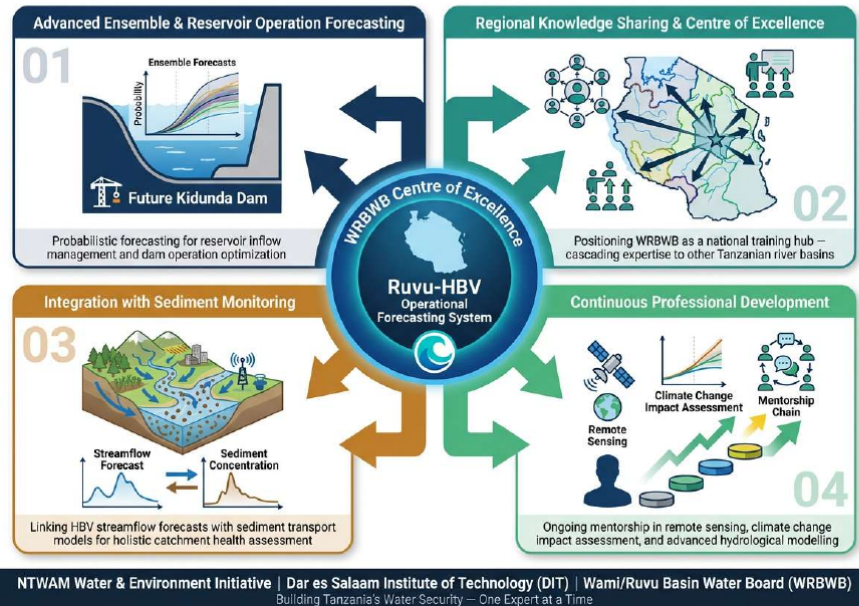
The inauguration publicly validated NTWAM's complete pipeline: what started as voluntary applied research in 2022 now stands as a government-owned national infrastructure asset — operated by Tanzanian professionals, peer-reviewed in international literature, and inaugurated at the highest level of state.

7. The Way Forward: Scaling the Blueprint

NTWAM's next-steps framework is structured around four strategic pillars, designed to scale the Ruvu model into a national and regional centre of excellence:

THE FORWARD LOOK

Ruvu Catchment Streamflow Forecasting Initiative – Next Steps



A conceptual diagram illustrating the next steps for the project

Figure 8. Conceptual diagram of NTWAM's forward-looking strategy: (1) Advanced Ensemble & Reservoir Operation Forecasting for the upcoming Kidunda Dam; (2) Regional Knowledge Sharing via WRBWB as national training hub; (3) Integration with Sediment Monitoring; (4) Continuous Professional Development.

Pillar	Initiative	Rationale
01	Advanced Ensemble & Reservoir Operation Forecasting	Equip WRBWB for probabilistic forecasting and the upcoming Kidunda Dam
02	Regional Knowledge Sharing & Centre of Excellence	Position WRBWB as national hub; cascade expertise to other Tanzanian basins
03	Integration with Sediment Monitoring	Link streamflow forecasts with sediment transport models for holistic catchment health
04	Continuous Professional Development	Ongoing mentorship in remote sensing, earth observation, and climate change impact assessment

Table 5. NTWAM's four strategic pillars for scaling the national streamflow forecasting capability.

These pillars, combined with the replicable pipeline NTWAM has established, position Tanzania to extend operational forecasting to all nine major river basins — creating a continental benchmark for locally-owned, science-based water resource management.

8. Conclusion: A New Standard for Applied Research in Africa

The NTWAM Ruvu Catchment initiative demonstrates that the path from scientific research to operational national infrastructure need not be long, expensive, or externally dependent — if it is designed around local ownership from the start.

Three principles defined NTWAM's success:

- 1. Embedding, not transferring:** Technology transfer without expertise embedding creates perpetual dependency. NTWAM trained trainers who trained operators who now train others.
- 2. Crisis as catalyst, not victim:** Rather than waiting for government commission, NTWAM identified the gap, mobilised international expertise, and delivered proof of concept — making the case for formal endorsement through results.
- 3. Publication as accountability:** Documenting the methodology in a peer-reviewed journal (*Water*, DOI: 10.3390/w18020285) created an accountability mechanism and a scientific foundation for scaling.

The inauguration by the Vice President on World Water Day 2026 is not just recognition of a system — it is recognition of a **new pipeline for applied water research in Tanzania and across Sub-Saharan Africa.**

References

1. Ndomba, P.M. et al. (2025). *Ruvu Catchment HBV Streamflow Forecasting System Methodology*. *Water* (MDPI). DOI: [10.3390/w18020285](https://doi.org/10.3390/w18020285)
2. NTWAM Water & Environment Initiative (2024). *Empowering Local Expertise: Operational Streamflow Forecasting for the Ruvu Catchment, Tanzania (2022–Present)*. Training & Capacity Building Report.
3. NTWAM Water & Environment Initiative (2026). *From Unsolicited Research to National Legacy: NTWAM's Journey in Establishing Tanzania's National Streamflow Forecasting System*. Institutional Report.
4. Kumkana, S. (2026, March 22). *TZ Strengthens Water Security — VP Stresses Protection of Water Sources to Ensure Sustainable Future*. *Daily News*, Tanzania.
5. WRBWB (2025). *Ruvu–HBV Operational Forecasting System — Public Forecast Portal*. Wami/Ruvu Basin Water Board website.
6. Vice President's Office, Tanzania (2026). *Remarks by H.E. Dr. Emmanuel Nchimbi at the 2026 World Water Day Celebrations and National Streamflow Forecasting System Inauguration*. Morogoro, Tanzania, 22 March 2026.

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"Building Tanzania's Water Security — One Expert at a Time"