Verifying the extent and role of transboundary aquifer services in the Pafuri-Sengwe Node of the Great Limpopo Transfrontier Conservation Area

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This analysis is the intellectual property of the World Bank and is submitted with World Bank Permission. It was completed by a team comprising Sarah Moyer, Maryna Storie, Piet Theron, Lindley Itimu, Nsuku Nxumalo, Kevin Pietersen and Edward Riddell. The work was funded by the Cooperation in International Waters (CIWA)’s Southern Africa Drought Resilience Initiative (SADRI).

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Borderland communities

- Dependence on groundwater in transborder areas
  - Vulnerable communities
  - Women
  - Youth
- Internally displaced people and refugees
- Forgotten Communities
- Water shocks and stressors
  - Drought
  - Flooding
  - Disease
  - Water shortages/quality
  - Food shortages
  - Pests (e.g. locusts)
  - State collapse or crisis

Dug well used by a community for water supply

Limpopo dry riverbed at a border crossing into South Africa from Botswana.
Project Objective (supported by World Bank/SADRI)

➢ Determine the **extent of water availability** in targeted groundwater aquifers, wetlands, and river systems

➢ Assess the current **demand and usage** of this water

➢ Evaluate **governance practices** in place for managing this water

➢ **Identify, develop, and recommend** short, medium and long-term **actions** for water management leading to building community drought resilience.
The governments of Mozambique, South Africa and Zimbabwe signed a treaty to collaborate to establish the Greater Limpopo Transfrontier Conservation Area (GLTFCA).

The study area, Pafuri-Sengwe Node, is located within the northern part of GLTFCA, in the Limpopo River Basin.
Communities in the Pafuri-Sengwe Node

- **Isolated** from main transportation routes, major economic hubs, and markets.
- Communities across borders remain closely connected and even directly reliant on each other for goods and supplies – especially since the area is far away from markets, supply chains, urban areas and distribution hubs.
• The lithological groupings form low-permeability formations; fissured aquifers and unconsolidated intergranular aquifers,

• There are upper cretaceous formations that can be potentially classified as Karst aquifers but are relatively low-yielding and can be considered low-permeability formations

• The unconsolidated intergranular aquifers are associated with the alluvial deposits of the Limpopo River and its major tributaries
Groundwater recharge and discharge processes are episodic in the Node – groundwater levels only respond after overcoming a certain rainfall threshold. The threshold can be:

- a **series** of individual rainfall events which forms part of a prevailing regional weather system or
- a **single**, heavy rainfall event over a short period

For Example

In the Kruger National Park, if rainfall of intensity **100 mm/24 hours** does not happen, direct recharge to the aquifer does not occur and the water evaporates from the soil matrix.
Groundwater recharge and discharge

The seasonal flows of the river systems also influence recharge to the alluvial aquifer system.

During the wet season, runoff recharges the alluvial aquifer; surface flows decline during the dry winter times resulting in dislocated pools during the dry winter months fed by sub-surface flows. Various researchers found that regional groundwater contributions maintain the perennial rivers of the low-land areas at their lower reaches.

Limited information is available to calculate discharge to river systems. Groundwater – surface water interaction requires follow-up work.
Groundwater recharge and discharge

The graph presents a graphic demonstration of drought conditions (General Recession since 2013).

In this borehole, for example, reaching a groundwater level status of **17%** - meaning **very high severity** (grey line), and **22%** meaning **high severity** (yellow line), meaning **implementing restrictions** on groundwater abstraction at these levels would be necessary. Such restrictions require consideration of high-volume users in particular.
Some findings:

Water Quality – Nitrates

Excessive levels of nitrates in groundwater and prolonged ingestion are dangerous to human health, including issues such as methemoglobinemia, colorectal cancer, thyroid disease, and neural tube effects.

No boreholes exceed the WHO guidelines of 50 mg/L. (Mozambique and Zimbabwe uses the WHO water quality standard).

Several boreholes exceed the South African permissible limits for 11 mg/L of nitrate concentration.

The highest nitrate measured was 31 mg/L.

Fluoride

In drinking water, at higher concentrations, fluoride harm human health, causing fluorosis, ranging in severity from mild dental mottling to a crippling skeletal form.

In the Node, several boreholes exceed the WHO permissible limits for levels above 1.5 mg/L for fluoride concentrations.

(Zimbabwe, Mozambique and South Africa use the same standard as WHO).

The highest fluoride measure was 5.5 mg/L.
Site Visit Observations

➢ Communities rely on **surface water** close to the river and wetlands, but in communities away from the river, there is reliance on groundwater sources using hand pumps

➢ There is **limited formal institutional support** for the **operation and maintenance** of groundwater infrastructure (boreholes, hand pumps)

➢ Communities use **informal by-laws set by traditional authorities** to manage the boreholes

➢ Some communities use **untreated water** from a shallow well and brackish groundwater

➢ There are several **non-functional boreholes** in the communities mainly due to the **unavailability of spare parts** resulting especially during and even after the closure of the borders at Pafuri Gate during the Covid-19 pandemic
Thank you!

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