



Climate Risk Cascade

Overview of Climate Effects in Water Service Providers

Heavier rain increases silt load in raw water

Heavier rainfall raises silt loads in raw water, straining treatment from intake to distribution.

1 INTAKE **Abstraction**
Silt accumulates at the intake, cutting abstraction capacity and forcing repeated, costly desilting.

2 CONVEYANCE **Bulk meter & Pumps**
Silt shortens bulk-meter and pump life, so losses on intake-plant stretch go undetected (unless costly ultrasonic meters are purchased) and pumps need to be replaced more frequently.

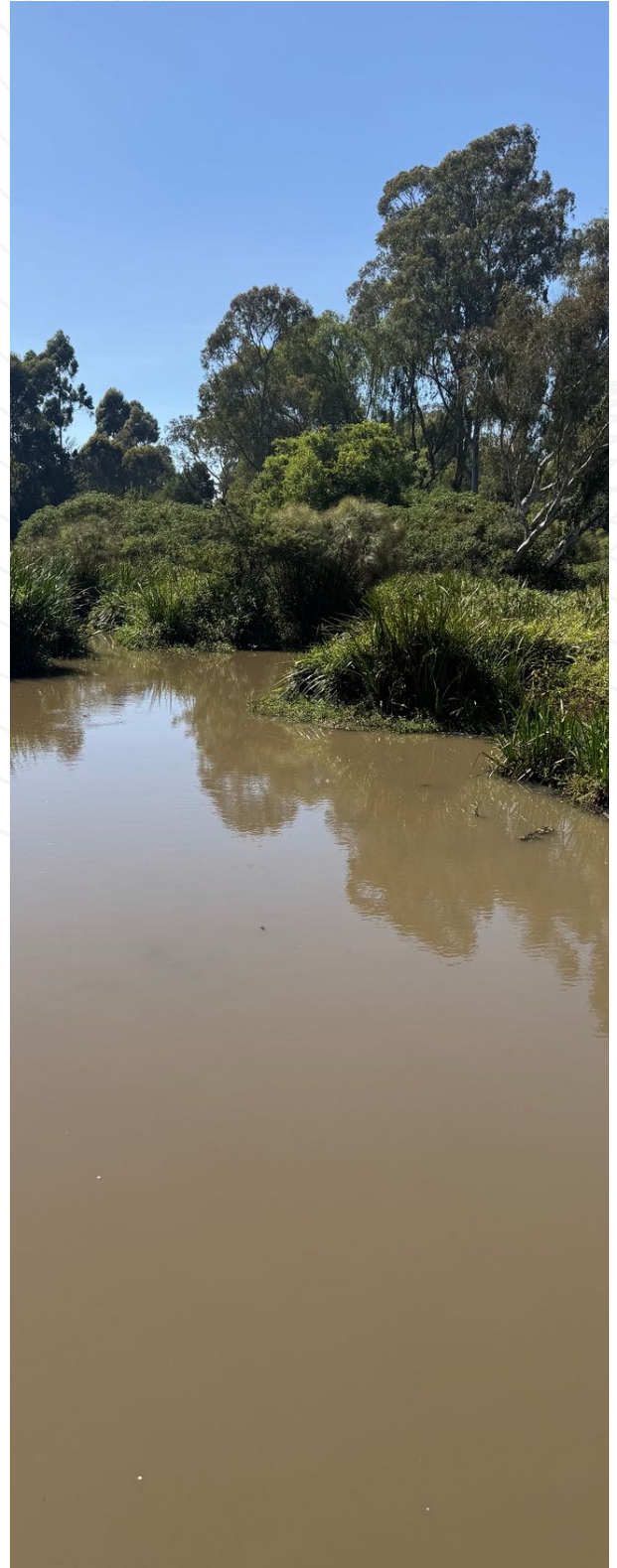
3 DOSING **Chemical Treatment**
More silt means more Alum, but manual jar tests can't track turbidity in real time - dosing becomes guesswork.

4 BACKWASH **Sedimentation**
Ponds need more cleaning; backwash of sand filters alone can use up to 15% of abstracted water and cuts output.

5 DISTRIBUTION **Metering**
Residual silt shortens consumer-meter life, raising maintenance costs and undermining billing accuracy

CONSEQUENCES FOR THE WSP

Increased O&M costs for desilting, chemicals & meter replacement, **reduced production capacity** because of effects on abstraction & backwash downtime and **increased NRW & revenue loss** because of commercial losses



Climate & pollution degrade source water

Heavy rainfall and extended dry periods both degrade source water quality. Untreated wastewater further exacerbates this.

1 SOURCE **Pollution**
Wastewater from non-sewered customers pollutes intakes and rivers - worse in heavy rain and dry-season low flows.

2 TREATMENT **Costs Rise**
Dirtier raw water needs more chemicals — chlorine above all and higher overall treatment cost.

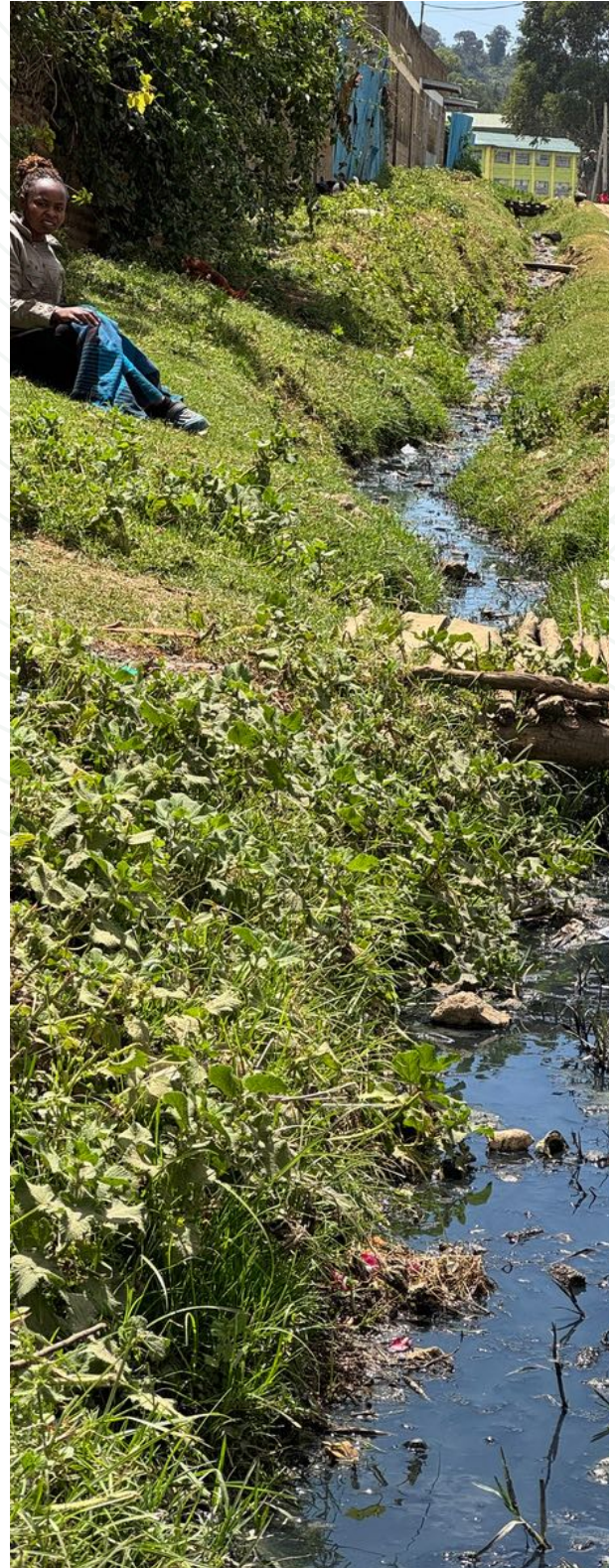
3 CAPITAL **Investment Capacity**
Rising costs leave little room to fund treatment upgrades or sewer network expansion.

4 CONNECTIONS **Stay Low**
Without capital for connections, most wastewater customers remain off the network.

5 REVENUE **Uncollected**
Unconnected customers can't be billed the 75% wastewater top-up -> no revenue to treat wastewater or protect the source.

CONSEQUENCES FOR THE WSP

The Wastewater Finance Trap: No revenue to treat wastewater or protect the source - the cycle repeats exacerbating water quality issues each rainy/dry season



Losses exacerbate availability challenges

Non-revenue water (NRW) compounds reduced water availability, as significant amounts of abstracted water are lost.

1 **CONTEXT** **Availability**
Already-scarce supply is stretched further before it even reaches customers.

2 **LOSSES** **High NRW**
Driven by infrastructure and data gaps above. Managed reactively and unsystematically as a result so it stays high.

3 **COSTS** **Rise**
Water lost or unbilled still costs money to produce and distribute, with nothing recovered in revenue.

4 **CAPITAL** **Investment Capacity**
Rising costs leave little room to fund source conservation or new source development.

5 **SOURCE** **Development Stalls**
Conservation and new-source investment go unfunded, so availability does not improve.

CONSEQUENCES FOR THE WSP

The NRW Data Trap: Weak data and decision-making keep NRW high and starve the investment in conservation or new sources that would fix it.



Inability to invest into sources

Land-use change and climate variability reduce natural aquifer recharge, lowering borehole yields and leaving utilities unable to meet rising demand.

1 RECHARGE Aquifer Decline
Land-use change stops infiltration, and utilities have not invested in systematic recharge measures -> aquifer levels fall.

2 YIELD Borehole Capacity Declines
As aquifers fail to recharge, existing boreholes yield less water over time.

3 CAPITAL Investment Unaffordable
Replacing lost capacity would need significant new borehole investment but utilities lack the capital.

4 GAP Supply Falls Behind
Capacity to supply water declines while demand keeps rising, widening the gap.

5 REVENUE Potential Unrealized
Utilities can't access the revenue unmet demand represents - revenue that would fund sustainable source management and expansion.

CONSEQUENCES FOR THE WSP

The Aquifer Recharge Trap: Land-use change and unfunded recharge shrink borehole capacity, in consequence the utility cannot generate sufficient revenue to invest in recharge or new boreholes.



Weak monitoring limits climate response

Limited monitoring capacity leaves utilities unable to see climate risks coming or gauge their impact, weakening both investment decisions and emergency response.

1 DATA **Not Collected**
Rainfall, source yield, water quality and NRW are rarely tracked systematically, so climate signals go unseen.

2 ANALYSIS **Not Used**
What data exists isn't analyzed or fed into planning, so trends and early warning signs aren't identified.

3 INVESTMENT **Misdirected**
Without evidence of where risk is highest, scarce mitigation capital is spread thin or spent on the wrong priorities.

4 RESPONSE **Too Slow**
When floods, droughts or pollution events hit, utilities lack real-time information to react before damage spreads.

5 RISK **Compounds**
Undetected problems recur and worsen each season, deepening costs and vulnerability over time.

CONSEQUENCES FOR THE WSP

The Monitoring Blind Spot: without data to see risks coming or measure their impact, utilities can neither invest efficiently in mitigation nor respond effectively when climate effects hit.



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