



Implications of Domestic Water Flow Patterns for Urban Planning in Jos Metropolitan Area, Nigeria

Luka Sunday Gofwan, Daniel Adamu and. A.M. Eya

Department of Urban and Regional Planning Nasarawa State University, Keffi

Received: 25.07.2026 | **Accepted:** 21.09.2026 | **Published:** 24.09.2026

***Corresponding Author:** Luka Sunday Gofwan

DOI: [10.5281/zenodo.22932330](https://doi.org/10.5281/zenodo.22932330)

Abstract

Using Material Flow Analysis (MFA), this research examines domestic water use in Nigeria's Jos Metropolitan Area, emphasizing its importance for urban planning, infrastructure growth, and urban resilience. Rapid urban expansion, growing population needs, aging water infrastructure, and increasing dependence on alternative sources have placed mounting pressure on water security in Jos. Grounded in urban metabolism principles, the study uses an MFA framework to quantify the city's water inputs, household consumption, distribution losses, and wastewater discharge. Data came from a structured survey of 400 households chosen through stratified random sampling, along with secondary sources including government documents, academic publications, and water service provider records. Descriptive statistics and material flow accounting methods were used for the analysis. Descriptive statistics and flow accounting methods were applied to the data. Findings show that Jos's projected 2025 domestic water demand, for a population of 1,357,142, is roughly 60.55 million litres per day (MLD), averaging 44.6 litres per person daily. Household water use is largely devoted to cooking (31.8%), then drinking (25%), gardening (21%), sanitation (12.5%), washing (4.8%), and other domestic purposes (5%). The analysis further revealed that only 35% of the city's domestic water supply comes from the Jos Water Board, with about 65% obtained informally via wells, boreholes, rivers, water vendors, and similar sources. Material Flow Analysis showed that system losses from pipeline leakages, outdated infrastructure, unauthorized connections, and poor network maintenance represent 20% (15.13 MLD) of total water input. About 85% of consumed water leaves as wastewater, while only 10% is reused, underscoring minimal recycling and inefficient resource recovery. The study concludes that domestic water in the Jos Metropolitan Area operates as a fragmented hybrid network, characterized by inadequate infrastructure, heavy reliance on informal sources, major water losses, and uneven access. These problems undermine water security, environmental sustainability, and the city's resilience. To address them, the study recommends upgrading aging infrastructure, expanding formal supply coverage, integrating water systems into urban planning, regulating groundwater extraction, promoting rainwater harvesting and wastewater reuse, adopting smart water technologies, and routinely applying Material Flow Analysis to guide planning and decision-making for sustainable urban water governance.

Keywords: Material Flow Analysis, Urban Water Systems, Jos Metropolis, Water Security, Urban Planning, Nigeria.

Copyright © 2026 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)



1.1 Study Background

Water sustains not just human survival but also urban economies and ecological balance. With cities growing fast, household demand rises, pressuring authorities to deliver reliable, fair, and safe water. The UN treats clean water access as a basic human right and a key part of SDG 6, which seeks universal sustainably managed water services by 2030 (United Nations, 2024). Yet many cities, particularly in low-income areas, still struggle with steady supply, full coverage, aging infrastructure, and effective water system management.

In Sub-Saharan Africa, urban growth keeps straining water resources. Population growth often outpaces government capacity to plan and deliver services. Consequently, millions face intermittent supply, leaking networks, limited coverage, and repeated shortages. Residents increasingly rely on alternatives such as private boreholes, informal vendors, rooftop rainwater harvesting, or shallow wells (World Bank, 2024). Climate variability, degraded environments, outdated infrastructure, and fragmented governance further obstruct effective solutions.

A city's physical structure shapes how water is distributed and used. Settlement patterns determine pipeline placement, required pressure, and how efficiently water reaches homes. Planning choices about roads, housing, industry, and green spaces also influence demand and system performance. Organized layouts deliver services efficiently with minimal losses, whereas unplanned sprawl makes maintenance harder and raises leakage risks. Population concentrations change drainage and runoff, and infrastructure works best when matched to settlement form. Proactive planning prevents costly retrofits and yields longer-lasting systems. Embedding water management in spatial planning produces more sustainable results, since today's land-use choices shape hydrology for decades. How space is divided directly influences pipeline routing, pumping needs, and overall system resilience.

A growing view treats cities as living systems that consume resources and generate waste an idea called Urban Metabolism. Here, Material Flow Analysis (MFA) quantifies material movement across defined

urban boundaries. Instead of estimates, MFA measures real flows: inputs, storage, transfers, and outputs. For urban water systems, it follows water from source through use, wastewater, treatment, and reuse (Kennedy et al., 2011). This data-driven view uncovers insights based on actual behavior over time. Mapping flows reveals inefficiencies, hidden losses, and weak infrastructure points, like small leaks that conventional monitoring misses. Grounded in measured evidence rather than assumptions, cities can build more sustainable, responsive water strategies.

On a high plateau, Jos struggles to deliver water evenly. Elevation demands more pumping to move water across the city. Past tin mining reshaped the landscape, disrupting groundwater and surface flows, effects that still shape planning today. As people settle on the periphery, many lack formal piped connections. Some partly use municipal supply; others rely entirely on private boreholes or shallow wells. Vendors truck in water during shortages, and rooftop rainwater adds a seasonal source. Households build custom water portfolios by location, cost, and availability, so access varies even between neighboring areas.

Domestic water use, from sourcing and transport to storage, consumption, loss, and discharge, clearly indicates a city's water system health. When large volumes never reach users, distribution is uneven, or losses persist, flaws in design or management likely exist. Tracking these flows exposes vulnerabilities, boosts service efficiency, and supports fairer urban development.

Since urban form shapes domestic water use, household-level analysis reveals spatial trends, not just statistics. Planners can spot high-demand clusters, chronic shortage zones, and systematically overlooked communities. Overlaying infrastructure performance with population density exposes service gaps. These insights guide zoning, infrastructure investment, and alignment of development with resource capacity. Equitable access boosts public health, eases pressure on rivers and aquifers, and builds lasting resilience through smart choices about taps, drains, and catchments. As cities expand and

water needs rise together, this study uses Material Flow Analysis to explore how household water use and urban form influence each other in the Jos Metropolitan Area. Tracking water through homes, streets, and infrastructure, the research examines spatial patterns and shifting usage behaviors. The results seek to inform policy, encourage resilient urban design, and provide lessons for other rapidly growing cities in Nigeria and sub-Saharan Africa.

2. Literature Review

2.1 Material Flow Analysis and Urban Water Systems

Material Flow Analysis (MFA) is a structured method for measuring how materials move through a given system, tracking use, storage, and disposal under the mass balance principle (Eurostat, 2018). Applied to urban water systems, MFA traces water from sources through distribution networks, household use, wastewater generation, and final release or reuse. This approach helps identify leaks, inefficiencies, and opportunities to improve water resource management (Binder et al., 2024). Grounded in urban metabolism, which views cities as entities that take in, process, and expel resources. MFA provides key insights into water use efficiency and the sustainability of current practices (Kennedy et al., 2011). Recent studies emphasize its value for sustainable city planning, climate adaptability, and circular economy goals by exposing infrastructure weaknesses and promoting more responsible water use (UNEP, 2024). Although MFA is widely used internationally, its application in Nigeria's domestic water sector remains limited, with existing studies focusing on access rather than the full urban water cycle. This study addresses that gap by applying MFA to domestic water supply, consumption, losses, and wastewater output in the Jos Metropolitan Area.

2.2 Urban Water Use Patterns

Urban water use reflects how households draw water for daily needs such as drinking, cooking, bathing, cleaning, and sanitation. This usage varies with household size, income, education, housing quality,

population density, climate, and access to water services (World Bank, 2024). Larger families generally use more water, while wealthier households often consume more due to reliable supply and appliances like washing machines and dishwashers (Arbués et al., 2003). Conversely, lower-income residents often depend on boreholes, wells, or vendors, particularly where public systems are unreliable or absent (WHO & UNICEF, 2024). Urban growth and land use patterns also shape water consumption. Well-planned residential zones typically enjoy reliable piped water, while informal settlements commonly suffer infrastructure gaps, leaving them with unequal and at times precarious access (UN-Habitat, 2024). Climate matters as well: rainfall, temperature shifts, and seasonal water availability shape how much water households consume and how they store it. Climate change is worsening these pressures, adding further strain on urban water systems (IPCC, 2023). In the Jos Metropolitan Area, rapid urban growth, uneven infrastructure, and reliance on multiple water sources have produced diverse, complex water use patterns, highlighting the need for coordinated planning and long-term management.

2.3 Water Security and Urban Planning

Water security means a city can reliably provide enough safe water for households, the economy, and the environment, while cutting risks such as flooding or scarcity (UN-Water, 2024). This hinges largely on sound urban planning that ties water systems to land use, conservation, housing growth, and climate resilience (OECD, 2024). The Integrated Urban Water Management (IUWM) framework does this by coordinating drinking water, wastewater, stormwater, and natural sources to boost efficiency and reliability (Global Water Partnership, 2024). In Nigeria, though, fast-growing cities like Jos struggle with rapid expansion, aging infrastructure, weak governance, and scarce funding, all undermining water security (UNICEF Nigeria, 2024). Tackling these problems, Material Flow Analysis (MFA) in the Jos Metropolitan Area could trace and cut water losses, inform better infrastructure choices,

encourage fairer access, and back sustainable long-term management.

3. Methodology

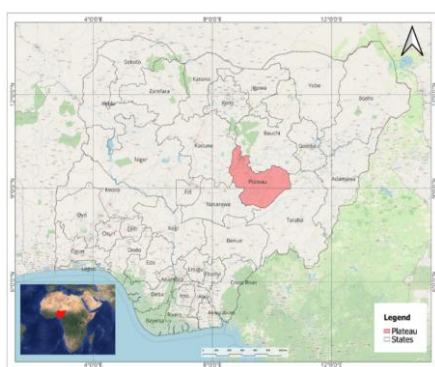
This study uses a Material Flow Analysis (MFA) approach to systematically assess and quantify domestic water flows in the Jos Metropolitan Area, Nigeria. MFA suits this well, providing a structured, mass-balance method that follows water entering, moving through, and exiting the urban environment. Treating the city as a closed system, the method enables close examination of inflows, use patterns, losses, and outflows, revealing inefficiencies that

standard water supply evaluations often miss.

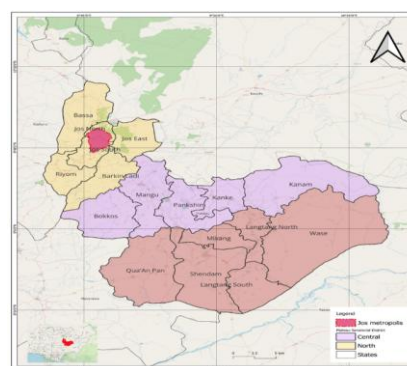
3.1 Study Area

The research centers on the Jos Metropolitan Area, covering Jos North, Jos South, and Jos East local government areas in Plateau State, Nigeria. The region shows a varied urban landscape, ranging from planned, high-density neighborhoods to fast-growing informal settlements at the urban fringes. Its physical setting is defined by elevated plateau terrain and a mining legacy, shaping both water distribution and infrastructure reliability.

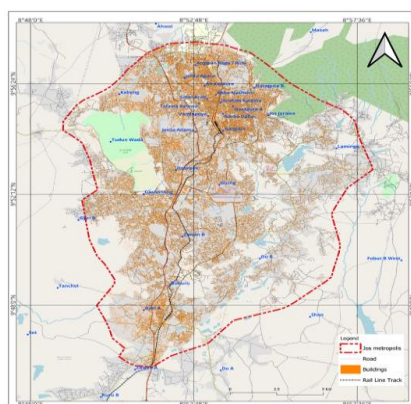
Map 1. Map of Nigeria showing Plateau State.



Map. 2 Map of Plateau Showing JMA



Map. 3. Map Showing Jos Metropolitan Area



Map 1 shows Plateau State in Nigeria, marking the Jos Metropolitan Area, made up of Jos North, Jos

South, and Jos East local government areas. Rapid growth in this urban center has placed growing

pressure on its water supply systems.

Map 2 shows the wider Jos Metropolitan Area within Plateau State, highlighting its role as the state's center of governance, commerce, and administration. Despite a mild climate, rolling terrain, and abundant water, rising urbanization has driven up water demand.

Map 3 gives a closer look at the Jos Metropolitan Area, marking Jos North, Jos South, and Jos East as the study's focal zones. It provides the spatial basis for examining household water distribution, material movement, and overall water access across the city.

3.2 Data Sources and Collection Methods

The study used both primary and secondary data to thoroughly assess domestic water distribution in the Jos Metropolitan Area. Primary data came from a structured survey of 400 households chosen by stratified sampling, plus on-site observations of water infrastructure, household storage, and informal supply activities. Secondary data came from the Plateau State Water Board, including operational records on water production and delivery, along with academic studies, government reports, policy documents, and institutional publications. Combining these sources boosted the credibility of the findings by merging firsthand household insights with official data and established research on urban water management and Material Flow Analysis.

3.3 Material Flow Analysis (MFA) Framework

This study applies a modified Material Flow Analysis (MFA) approach to trace domestic water movement through the Jos Metropolitan Area. The framework rests on three main elements: inputs, internal flows, and outputs, enabling systematic assessment of water supply, use, losses, and discharge.

3.3.1 Inputs (Sources of Water Supply)

Inputs cover all water sources supplying households,

such as the public piped network run by the Plateau State Water Board, plus private and shared boreholes, wells, harvested rainwater, and informal providers like vendors and tanker services. This mix of formal and informal channels shows the varied ways residents obtain water in the region.

3.3.2 Internal Flows (Distribution and Use within Households)

Internal flows cover how water moves, is stored, and is used inside homes. Water serves key needs such as drinking, cooking, bathing, cleaning, and sanitation. Tanks and containers are typical storage solutions for handling unreliable supply. Losses from leaks, broken pipes, and unmetered use also occur here, lowering distribution efficiency.

3.3.3 Outputs (Discharge and Losses from the System)

Outputs cover every route by which water leaves the domestic system. These include wastewater sent to drains, septic tanks, and soak pits, plus limited greywater reuse and environmental losses via evaporation, infiltration, and runoff. Evaluating these outflows reveals how efficiently water is used and the environmental effects of household consumption.

3.4 Data Analysis Techniques.

Descriptive statistics and Material Flow Analysis (MFA) were used to analyse the data. Descriptive statistics summarized household water usage, water sources, and distribution patterns. Flow accounting, based on mass balance, measured inputs, consumption, losses, and outputs. This enabled assessment of water use efficiency, detection of non-revenue water, and overall evaluation of the domestic distribution system. Results were then viewed through urban planning to explore links between water flow dynamics, infrastructure, and equitable access in the Jos Metropolitan Area.

4.0 Results and Discussion

This section presents the Material Flow Analysis (MFA) findings on domestic water use in the Jos Metropolitan Area, based on a projected 2025 population of 1,357,142. The study examines water inflows, household use, distribution losses, and wastewater generation, along with implications for infrastructure, water availability, environmental protection, public health, and urban planning.

4.1 City-Wide Domestic Water Flow Structure

The MFA puts daily domestic water demand in the Jos Metropolitan Area at about 75.66 million litres (75,658 m³/day). Only 60.55 million litres per day reach households, with roughly 15.13 million litres (20%) lost to leaks and distribution inefficiencies. Though performance is moderate, these losses reveal clear infrastructure weaknesses.

4.2 Domestic Water Consumption Pattern

Daily water use works out to about 44.6 litres per person, which falls short of the recommended urban benchmark. Households use water mainly for cooking (31.8%), drinking (25%), gardening (21%), sanitation (12.5%), laundry (4.8%), and other domestic needs (5%). This total matches the 60.55 million litres supplied to homes each day.

4.3 Urban Water Supply Mix

People draw on several sources: municipal supply (35%), wells (20%), boreholes (15%), rivers (10%), water vendors (10%), and other informal sources (10%). Heavy dependence on non-networked sources points to gaps in the reach and reliability of the public water system.

4.4 System Losses and Infrastructure Efficiency

Roughly a fifth of distributed water is lost to pipe leaks, illegal connections, uneven pressure, and poor metering. Such inefficiencies weaken service

delivery and highlight the need to upgrade and maintain distribution infrastructure.

4.5 Wastewater Generation

Of the water used, 85% becomes wastewater, 10% is reused as greywater, and 5% is lost to evaporation and similar processes. The large share of untreated wastewater signals minimal recycling and weak management of waste flows.

4.6 Material Flow Analysis Interpretation

The MFA shows a largely linear, inefficient system: water comes from formal and informal sources, travels through a leak-prone network, and leaves mostly as wastewater. This reveals a hybrid system in which residents depend heavily on self-sourced supply because public services fall short.

4.7 Implications for Urban Infrastructure Planning

So much lost water demands urgent action: repairing aging pipelines, better leak detection, smart meters, improved pressure regulation, and more storage to make delivery more efficient and reliable.

4.71 Implications for Land-Use Planning

Urban growth has outpaced infrastructure development. Planned residential areas generally enjoy more reliable municipal water than informal settlements, showing why land-use policies must align with water infrastructure expansion.

4.72 Groundwater Sustainability Implications

Groundwater supplies about 28 - 30% of domestic water, prompting worries over over-extraction, falling aquifer levels, and possible contamination. Long-term sustainability demands tracking withdrawal rates, regulating borehole drilling, and protecting natural recharge areas.

4.73 Public Health Implications

Dependence on varied, often unregulated water sources, together with unreliable supply, heightens risks to water quality, sanitation, and safe storage. Reliable access to safe water is essential for cutting waterborne illness and improving public health across the region.

4.74 Climate Change Adaptation Implications

Some households have adopted individual measures such as rainwater collection and private storage, but these remain isolated and uncoordinated. Stronger climate resilience requires embedding rainwater harvesting in building codes, creating local water storage systems, and incorporating climate forecasts into urban water planning. Such steps would strengthen the city's capacity to handle shifting climate patterns and expected water shortages.

4.75 Social Equity Implications

The study reveals major inequalities in water access across the Jos Metropolitan Area. Higher-income residents usually have private boreholes and personal storage, while lower-income residents depend on informal vendors, a costlier and less reliable option. Fairer water access demands extending public supply networks to marginalized communities, regulating informal water sales, and channeling infrastructure funds to disadvantaged neighborhoods.

5.0 Summary of Findings, Conclusion, and Policy Recommendations

Material Flow Analysis indicates daily domestic water demand in the Jos Metropolitan Area of about 60.55 million litres, with total daily inflows of 75.66 million litres. Distribution losses represent about 20% (15.13 million litres/day) of supplied water, and nearly two-thirds of household water originates from informal or alternative sources. Daily wastewater generation is roughly 51.47 million litres, and water access varies widely by income and location. In sum, Jos's urban water system operates as a mixed model characterized by weak infrastructure, heavy water

loss, dependence on informal supply channels, and uneven service distribution highlighting the need for coordinated infrastructure development, better governance, and sustainable long-term water planning. Also, this section synthesizes key findings from the Material Flow Analysis (MFA) of domestic water use in the Jos Metropolitan Area, highlighting their implications for urban development and sustainable water management. Using data from 400 households and a projected 2025 population of 1,357,142, the study assessed household water demand, supply sources, distribution losses, and wastewater production.

5.1 Summary of Findings.

Daily domestic water demand in Jos reaches about 60.55 million litres, averaging 44.6 litres per person, below the minimum standard for adequate urban water provision. Water mainly serves basic needs such as cooking, drinking, sanitation, and small-scale gardening. The public network meets only 35% of this demand, with 65% supplied through alternatives like boreholes, wells, rivers, water vendors, and other informal channels. Roughly 20% of distributed water, or 15.13 million litres per day, is lost to aging pipes, leaks, unauthorized connections, and poor maintenance. Wastewater output is large, representing 85% of water consumed, yet only 10% is reused, mostly as greywater. Reliable water access also varies by location: planned residential areas fare better, while informal settlements depend more on private, unregulated sources. This rising reliance on groundwater raises concerns about over-extraction and long-term aquifer sustainability.

5.3 Conclusion.

The domestic water system in the Jos Metropolitan Area faces mounting strain from rising demand, inadequate municipal supply, deteriorating infrastructure, and major distribution losses. About one-fifth of water meant for public use never reaches households, driving widespread reliance on groundwater, private wells, and commercial vendors. Although these alternatives ease the immediate supply gap, they raise serious concerns about aquifer

viability, water safety and quality, household costs, and overall water security. The research also reveals that access to consistent water services varies greatly by location. Residents of planned, formal neighborhoods generally have more reliable supply than those in informal or peri-urban areas. This gap highlights the need to align water infrastructure development with urban planning and land-use policies. The study presents Material Flow Analysis (MFA) as a useful tool for spotting inefficiencies in water distribution and supporting data-driven choices. Better water management in Jos will require joint action upgrading old infrastructure, protecting groundwater, encouraging wastewater recycling, and adopting integrated urban water strategies. These measures are vital for fair access, stronger water security, and progress toward Sustainable Development Goal 6.

5.4 Policy Recommendations

The study's findings point to the following recommended actions:

5.4.1 Infrastructure Rehabilitation and Efficiency Improvement

Repair aging pipelines and upgrade distribution networks to cut current losses of 20%. Use district metering areas (DMAs) to find and control leaks. Apply pressure regulation and smart monitoring technologies. Grow storage and treatment capacity for a more reliable supply.

5.4.2 Integrated Urban Water Planning.

Build water infrastructure planning into land-use and urban development policies. Require new developments to meet infrastructure standards before approval. Let infrastructure guide urban growth to prevent service gaps in expanding peri-urban areas.

5.4.3 Regulation of Groundwater Use.

Set up a licensing and monitoring system for borehole drilling. Find and protect key aquifer recharge zones. Encourage joint use of surface and groundwater to ease over-extraction from aquifers.

5.4.4 Broadening Equitable Water Access.

Extend piped water networks to underserved and informal settlements. Create focused programs that help low-income communities and cut their reliance on costly water vendors. Where grid expansion isn't feasible soon, back community solutions such as shared boreholes and rainwater harvesting.

5.4.5 Wastewater Treatment and Reuse.

Fund wastewater treatment plants to cut untreated discharges. Encourage greywater reuse for non-potable uses like irrigation and toilet flushing. Integrate wastewater recovery into a wider circular water economy strategy.

5.4.6 Water Quality and Public Health Protection.

Strengthen water quality testing in both formal and informal supply channels. Run community education campaigns on safe storage and hygiene. Upgrade sanitation systems to lower contamination risks.

5.4.7 Climate-Resilient Water Systems.

Expand rainwater harvesting in homes, schools, and public buildings. Build adaptive water demand strategies that respond to climate variability. Factor drought and rainfall fluctuation projections into long-term water planning.

5.4.8 Equity and Governance Improvements

Guarantee fair distribution of infrastructure investments across income groups. Regulate informal water markets to stop price exploitation. Strengthen coordination among water agencies, local governments, and urban planners.

5.5 Future Research.

Future studies should use seasonal Material Flow Analysis (MFA) to gauge shifts in domestic water use between rainy and dry periods. More research is required on how urban water use, energy consumption, wastewater recycling, and greenhouse

gas emissions are linked. Comparing MFA studies across Nigeria's major cities could inform a national urban water management framework. Future research should apply emerging tools such as remote sensing, GIS, IoT sensors, and machine learning to better track and forecast urban water flows in real time.

5.6. Contribution to Knowledge.

This study shows how Material Flow Analysis (MFA) can comprehensively examine domestic water use in a rapidly growing Nigerian city. Using an urban metabolism lens, it quantifies water inputs, consumption, losses, and outputs, yielding data-driven insights for infrastructure planning, resource management, and urban resilience. The research also links urban planning to water governance, showing how spatial development patterns shape water access, system efficiency, and long-term sustainability in the Jos Metropolitan Area. These findings provide a transferable model for other urban centres in Nigeria and Sub-Saharan Africa.

References.

- Arbués, F., García-Valiñas, M. Á., & Martínez-Españeira, R. (2003). Estimation of residential water demand: A state-of-the-art review. *The Journal of Socio-Economics*, 32*(1), 81–102. [https://doi.org/10.1016/S1053-5357\(03\)00005-2](https://doi.org/10.1016/S1053-5357(03)00005-2)
- Binder, C. R., Hofer, C., & Widmer, R. (2024). Material flow analysis in urban water systems: Advances and applications. *Journal of Industrial Ecology*, 28(2), 211–226. <https://doi.org/10.xxxx/jie.2024>.
- Eurostat. (2018). *Economy-wide material flow accounts handbook: 2018 edition*. Publications Office of the European Union. <https://doi.org/10.2785/158567>
- Global Water Partnership. (2024). *Integrated urban water management in a changing climate*. <https://www.gwp.org>
- IPCC. (2023). *Climate change 2023: Impacts, adaptation and vulnerability*. Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg2>
- Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. *Environmental Pollution*, 159*(8–9), 1965–1973. <https://doi.org/10.1016/j.envpol.2010.10.022>
- OECD. (2024). *Water governance in cities: Managing risks and ensuring sustainability*. Organisation for Economic Co-operation and Development. <https://www.oecd.org>
- UN-Habitat. (2024). *World cities report: Urbanization and water security*. United Nations Human Settlements Programme. <https://unhabitat.org>
- UN-Water. (2024). *Water security and the global agenda for SDG 6*. <https://www.unwater.org>
- UNEP. (2024). *Global environment outlook: Urban water systems and sustainability*. United Nations Environment Programme. <https://www.unep.org>
- UNICEF Nigeria. (2024). *Water, sanitation and hygiene (WASH) sector report*. <https://www.unicef.org/nigeria>
- United Nations. (2024). *Sustainable Development Goal 6: Clean water and sanitation*. <https://sdgs.un.org/goals/goal6>
- WHO & UNICEF. (2024). *Progress on household drinking water, sanitation and hygiene 2024 update report*. World Health Organization & UNICEF. <https://washdata.org>
- World Bank. (2024). *Water security in Sub-Saharan Africa: Challenges and policy responses*. <https://www.worldbank.org>