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KENYA PHYSICAL WATER ACCOUNTS

2021 – 2023



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Acronyms and Abbreviations

BETA	Bottom-Up Economic Transformation Agenda
EMCA	Environmental Management and Coordination Act
GDP	Gross Domestic Product
GPS	Global Program on Sustainability
ISIC	International Standard Industrial Classification of All Economic Activities
IWRM	Integrated Water Resources Management
KMD	Kenya Meteorological Department
KNBS	Kenya National Bureau of Statistics
MTP	Medium Term Plan
MTP IV	Fourth Medium Term Plan
NCA	Natural Capital Accounting
NIA	National Irrigation Authority
NP-AEEA	National Plan for the Advancement of Environmental-Economic Accounting
NRW	Non-Revenue Water
PSUT	Physical Supply and Use Table
SDG	Sustainable Development Goal
SEEA	System of Environmental-Economic Accounting
SEEA-CF	SEEA Central Framework
SEEA-Water	System of Environmental-Economic Accounting for Water
SNA	System of National Accounts
UN	United Nations
WASH	Water, Sanitation and Hygiene
WASREB	Water Services Regulatory Board
WIP	Water Incorporated into Products
WRA	Water Resources Authority

Glossary

Abstraction: The withdrawal of water from any surface water or groundwater source for use within the economy. Abstraction is the primary entry point in the Physical Supply Table and is distinguished from precipitation, which enters the accounting system as a direct environmental flow rather than a managed withdrawal. Abstraction volumes are subject to regulatory permitting under the Water Act 2016 (amended 2025).

Evapotranspiration: The combined loss of water to the atmosphere through soil evaporation and vegetation transpiration. Evapotranspiration represents an irreversible atmospheric loss within the accounting period and cannot be recaptured for productive use. It is particularly significant in Kenya given the scale of rainfed agriculture and the extent of natural vegetation across the country's diverse agro-ecological zones.

Groundwater recharge: The process by which precipitation infiltrates the soil surface and percolates downwards to replenish aquifer systems. Groundwater recharge is a critical supply-restoration indicator in the accounts, directly dependent on rainfall and therefore sensitive to inter-annual climate variability. Recharge volumes in a high-rainfall year should not be treated as a reliable long-run baseline.

Integrated Water Resources Management (IWRM): A planning and governance approach that promotes the coordinated development and management of water, land, and related resources across sectors and administrative boundaries. The Physical Supply and Use Tables provide the statistical foundation for IWRM by enabling economy-wide analysis of water availability, use, and efficiency.

International Standard Industrial Classification of All Economic Activities (ISIC): The international standard for classifying economic activities, maintained by the United Nations Statistics Division. ISIC Revision 4 is used throughout this report to organize water use data by sector, ensuring consistency with national accounts statistics and enabling international comparability.

Managed water abstraction: Water withdrawn from surface water sources, including rivers, reservoirs, and lakes, or from groundwater sources including aquifers and boreholes, for use in economic activities. Managed water abstraction is subject to regulatory permission under the Water Act 2016 (amended 2025) and is distinguished from soil water use by rainfed agriculture, which records precipitation falling on cultivated land and used by crops. The distinction is analytically significant: managed abstraction competes across sectors for a finite resource and is governed through permit frameworks, while soil water use is determined by climate variability and is not subject to the same allocation governance. In this report, references to the "managed water economy" refer to all water flows excluding soil water use in rainfed agriculture.

Natural Capital Accounting (NCA): An internationally recognized statistical approach for integrating information on the environment and natural resources into national accounting and statistical systems. NCA is based on the conceptual and methodological framework of the United Nations System of Environmental-Economic Accounting (UN SEEA), which is fully aligned with the System of National Accounts (SNA).

Non-revenue water (NRW): The volume of water lost between the point of abstraction by a utility and the point of delivery to the end

user, principally through leakage, pipe bursts, and metering inaccuracies. Non-revenue water represents a supply-side inefficiency that does not appear in end-use figures and is tracked separately within the accounts. Reductions in non-revenue water represent real water made available for productive use without additional abstraction.

Physical Supply Table: Records all water entering the accounting system from the natural environment, including precipitation, surface water abstraction, groundwater abstraction, and cross-border imports. The Physical Supply Table forms one half of the Physical Supply and Use Table framework under SEEA-Water.

Physical Supply and Use Tables (PSUTs): The core accounting instrument of the SEEA-Water framework. The PSUTs record how water flows from its natural origins through the economy via productive use by industries and households, and back to the environment through runoff, groundwater recharge, evapotranspiration, and wastewater discharge. All flows are measured in physical units, specifically cubic metres per annum, and are organized by economic sector using the ISIC classification.

Physical Use Table: Records water use disaggregated by economic sector using the ISIC classification, including own-use abstraction, utility-distributed water consumption, wastewater generation, and return flows. The Physical Use Table forms the second half of the PSUT framework and is the primary source for computing water use efficiency indicators.

Precipitation: Water falling to the earth's surface as rain, snow, or other forms of atmospheric moisture. In the accounts, precipitation used by rainfed agriculture is recorded as soil water use.

Rainfed agriculture: Crop production that relies on precipitation falling on cultivated land and entering the soil, with no supplementary irrigation. In Kenya's accounts, the use of soil water by rainfed agriculture is the dominant driver of national water use totals. Soil water is sourced exclusively from precipitation rather than surface water or groundwater abstractions. This water use is therefore not governed by the same permit and allocation frameworks that apply to managed abstraction, and its availability depends on climatic conditions.

Return flows: Water returned to the natural water cycle after productive use, including through surface runoff, groundwater recharge, and treated or untreated wastewater discharge. Return flows are the dominant physical outflow pathway in the PSUT framework and confirm the internal consistency of the water balance.

Soil water: Water held in the unsaturated soil zone above the water table, replenished by precipitation infiltrating the soil surface and drawn down by crops through root uptake and evapotranspiration. Under the SEEA-Water framework, soil water is the resource that supplies rainfed agricultural production. In these accounts, the volume of soil water used by rainfed agriculture is estimated from effective precipitation falling on cultivated land. Soil water is governed by climate variability rather than by the permit-based frameworks that apply to surface water and groundwater abstraction.

Surface runoff: Precipitation or meltwater that flows over the land surface and into rivers, lakes, or other water bodies without infiltrating the soil. Surface runoff is recorded under return flows in

the Physical Supply and Use Tables and is the largest single component of total return flows to inland water resources in Kenya's accounts.

System of Environmental-Economic Accounting for Water (SEEA-Water): The United Nations statistical standard providing the methodological foundation for national water accounting. SEEA-Water establishes an internationally standardized methodology for integrating water resource data with economic statistics, enabling rigorous analysis of the relationship between water resources and economic activity. It is the global benchmark for national water accounting and provides the conceptual architecture for Kenya's Physical Supply and Use Tables.

System of National Accounts (SNA): The internationally agreed standard framework for measuring economic activity. The SEEA-Water framework is designed to be fully consistent with the SNA, enabling water resource data to be integrated directly with conventional macroeconomic statistics such as Gross Domestic Product.

Wastewater: Water that has been used in economic activities and carries dissolved or suspended matter as a result. The accounts distinguish between wastewater directed to formal treatment facilities and wastewater discharged untreated directly to surface waters, storm drains, or land surfaces. Both flows affect downstream water availability, quality, and the cost of treating water for subsequent use.

Water incorporated into products (WIP): The volume of water physically embedded in outputs, including agricultural produce, manufactured goods, and processed water, that does not return to the natural water cycle within the accounting period. WIP is the most analytically precise measure of net water consumption in the accounts, eliminating the double-counting inherent in gross abstraction figures.

Water stress: A condition in which water demand approaches or exceeds available supply, or in which water quality constraints limit usable supply. Water stress is monitored under SDG 6.4.2 and is assessed using data on freshwater withdrawal relative to available freshwater resources. The Physical Supply and Use Tables provide the abstraction and return flow data required to compute this indicator.

Foreword



Water is central to Kenya's economic and social life. It sustains agriculture, generates electricity, supports industry, and underpins the health and livelihoods of millions of Kenyans. Despite this, decisions on water allocation, investment, and management have historically been made without a complete, integrated statistical picture of how water moves through the economy. This report addresses that gap.

The Kenya Physical Water Accounts, 2021–2023 are the first edition of Kenya's water accounts compiled in accordance with the United Nations System of Environmental-Economic Accounting for Water (SEEA-Water). They record, for the first time in a single consistent framework, how water is abstracted from the natural environment, distributed through utilities, used across economic sectors and households, and returned to the environment through runoff, recharge, evapotranspiration, and wastewater discharge.

The production of these accounts is part of Kenya's broader commitment to natural capital accounting under the National Plan for the Advancement of Environmental-Economic Accounting (NP-AEEA) 2025 to 2028. Alongside the energy, land, forest, and ecosystem accounts being developed in parallel, the water accounts form part of a growing statistical infrastructure that positions Kenya among a small but growing number of African countries systematically measuring the contribution of natural resources to economic development.

The accounts demonstrate that Kenya's water system is under growing pressure. Managed water abstraction is increasing across productive sectors, a significant share of abstraction occurs without valid permits, and groundwater use is rising without the monitoring systems needed to assess whether it is sustainable. These are findings that national planning, basin-level governance, and regulatory enforcement can act on directly.

KNBS is committed to producing these accounts on an annual basis and to improving their quality and coverage with each successive edition. I wish to thank all the institutions, technical experts, and development partners who contributed to this first edition, and I look forward to its continued use in evidence-based water governance in Kenya.



Dr. Daniel Mwirigi M'Amanja

Chairperson, Board of Directors
Kenya National Bureau of Statistics



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- Frankline Komolkori_ Kenya Meteorological Department

Your collective inputs have strengthened the quality and credibility of this first edition.

Macdonald George Obudho, PhD, EBS, MBS

Director General
Kenya National Bureau of Statistics

Executive Summary

This report presents Kenya's Physical Water Supply and Use Accounts for 2021, 2022, and 2023, compiled by the Kenya National Bureau of Statistics in accordance with the United Nations System of Environmental-Economic Accounting for Water (SEEA-Water). It is the first edition of these accounts and records water flows between the natural environment and the economy, covering abstraction by source, distribution by utilities, sectoral water use, and return flows.

Total national water supply stood at 304,495.2 million cubic meters in 2021, declined marginally to 296,590.8 million cubic meters in 2022, then nearly doubled to 579,812.2 million cubic meters in 2023. This increase is almost entirely explained by the El Niño rainfall event of 2023, which drove rainfed agricultural water use from 247,016.7 million cubic meters in 2022 to 529,108.8 million cubic meters in 2023. When rainfed agriculture is set aside, the managed water economy grew modestly and consistently, from 48.3 billion cubic meters in 2021 to 50.7 billion cubic meters in 2023. This distinction between precipitation-dependent and abstraction-based water use is fundamental to interpreting the accounts and to designing effective water governance.

Among sectors that abstract water directly, irrigated agriculture recorded the sharpest growth at 31.8 percent over the period, while construction remained the largest managed water consumer at 7,977.1 million cubic meters in 2023. Hydropower water use was effectively unchanged across all three years, reflecting its baseload nature, though it remains acutely sensitive to upstream flow changes. Groundwater abstraction grew across every productive sector, including households, where it accounts for 56.4 percent of supply, signalling a structural diversification of sources that is not yet matched by systematic aquifer monitoring.

A persistent compliance gap between actual abstraction and permitted volumes widened from 16 billion cubic meters in 2021 to 18.2 billion cubic meters in 2023, with irrigated agriculture contributing disproportionately to unpermitted volumes. Wastewater treatment improved from 33.3 percent to 45.5 percent over the period, though 185.4 million cubic meters of untreated effluent was still discharged in 2023. Non-revenue water declined by 8.5 percent, reflecting genuine gains in utility infrastructure management.

These accounts establish the first statistical baseline for evidence-based water governance in Kenya, providing the empirical foundation for SDG 6.4 monitoring, basin-level allocation planning, and compliance enforcement. Annual production of the accounts, formalized data sharing with contributing agencies, and systematic aquifer monitoring are the immediate priorities for building on this foundation.



304,495.2 million m3

Total national water use stood at 304,495.2 million cubic metres in 2021, declined marginally to 296,590.8 million cubic metres in 2022, then nearly doubled to 579,812.2 million cubic metres in 2023.



31.8%

Among sectors that abstract water directly, irrigated agriculture recorded the sharpest growth at 31.8 per cent over the period.



01 Introduction

1.1 Overview

This chapter presents the conceptual, institutional, and policy framework underpinning the development of water accounts for Kenya within the Natural Capital Accounting (NCA) framework. It situates water accounting within internationally agreed statistical standards, most notably the United Nations System of Environmental-Economic Accounting (UN SEEA), and within Kenya's national development, governance, and legal architecture. In doing so, the chapter establishes the analytical foundation upon which the water accounts are compiled, interpreted, and applied for economic planning and policy decision-making.

The chapter further articulates the relevance of water accounting as a core instrument for macroeconomic analysis, sectoral planning, and sustainable resource management in Kenya. It outlines the institutional arrangements that support the compilation, validation, and use of the accounts, emphasizing inter-agency coordination and alignment with national statistical systems.

Structurally, the chapter progresses from conceptual foundations to applied relevance, covering the NCA and SEEA frameworks, the rationale for water accounting, the scope and objectives of the accounts, and the legal and institutional landscape within which they are compiled.

The report is organized as follows. Chapter 2 describes the methodology, data sources, compilation process, and assumptions underpinning the accounts. Chapter 3 presents the analytical findings from the Physical Supply and Use Tables, covering water supply and water use. Chapter 4 sets out recommendations drawn directly from the accounts. The full Physical Supply and Use Tables for 2021, 2022, and 2023 along with a hydrological overview of Kenya's water resources are provided in the *Appendices*.

1.2 Natural Capital Accounting

Natural Capital Accounting (NCA) is an internationally recognized statistical approach for integrating environmental and natural resource information into national accounting systems. It addresses a fundamental limitation of conventional economic statistics: the invisibility of the role that natural resources and ecosystems play in supporting economic production and human wellbeing. The conceptual and methodological basis for NCA is provided by the United Nations System of Environmental-Economic Accounting (UN SEEA), which is fully aligned with the System of National Accounts (SNA).

Natural Capital Accounting rests on the recognition that economic activity depends on stocks of natural capital, including water, land, forests, soils, and ecosystems, as well as the flows of goods and services those assets generate. Conventional macroeconomic indicators such as GDP measure the value of goods and services produced within a period, but do not account for changes in the quantity, quality, or availability of the natural assets that underpin production. NCA addresses this gap by organizing environmental information within an accounting structure that enables systematic measurement of resource stocks, their use, and changes over time.

Within the SEEA framework, NCA is designed to complement, not replace, existing economic accounts. Applying consistent concepts, classifications, and accounting principles, it enables the integration of environmental information with economic statistics in a way that supports coherence, comparability, and temporal consistency. This strengthens the relevance of official statistics for assessing trade-offs between economic growth, resource use, and environmental sustainability.

Kenya's reliance on climate-sensitive and natural resource-dependent sectors makes this framework directly applicable. Agriculture depends heavily on rainfall and irrigation and remains central to livelihoods, food security, and rural employment. Hydropower generation is directly tied to river flows and reservoir conditions. Rapid urbanization and industrialization are increasing pressure on water supply and sanitation infrastructure, while ecosystem degradation threatens the long-term availability and quality of water resources. Decisions on water allocation, investment, and management have historically drawn on fragmented, sector-specific data. NCA provides a common statistical language for describing and analyzing these relationships across



sectors and institutions, and a structured, repeatable method for compiling economy-wide information on water availability, use, and sustainability.

From a national statistical and governance perspective, NCA supports four functions:

1. **Strategic Planning:** NCA provides data on water availability and use by economic activity. This enables assessment of the feasibility of water-intensive investments and alignment of national strategies such as the Bottom-Up Economic Transformation Agenda (BETA) with actual resource constraints.
2. **Fiscal and Investment Analysis:** By quantifying the contribution of natural assets to economic activity, NCA supports analysis of the economic consequences of environmental degradation and makes the case for integrating catchment protection and ecosystem restoration into public investment planning.
3. **Accountability and Monitoring:** NCA gives KNBS a structured evidence base for tracking changes in natural capital over time, and for developing indicators relevant to the green economy, climate adaptation, and sustainable development commitments.
4. **Intergenerational Sustainability:** Recording changes in natural resource stocks makes it possible to assess whether current patterns of resource use leave adequate capacity for future generations, a question that aggregate economic indicators cannot answer on their own.

1.3 SEEA Central Framework

While Kenya's national accounts measure the value of goods and services produced within a given period, they do not capture changes in the stock of natural assets that underpin production. The SEEA Central Framework addresses this gap by providing a standardized methodology for recording environmental assets alongside conventional economic statistics. By mirroring the structures of the System of National Accounts (SNA), it enables environmental data to be integrated directly into national planning and fiscal analysis rather than remaining confined to sectoral reporting systems.

The framework organizes environmental information around three categories of flow: natural inputs, which are resources extracted from the environment; products, which are goods and services produced using those resources; and residuals, which are waste and emissions returned to the environment after production. Alongside these flow accounts, the framework includes asset accounts that record the stock of natural resources at the start and end of each accounting period, tracking additions from natural growth and reductions from extraction and degradation. Together, the flow and stock accounts give a more complete picture of how an economy depends on and affects its natural resource base than conventional national accounts alone can provide.

1.4 The UN SEEA Water Framework

The United Nations System of Environmental-Economic Accounting for Water (SEEA-Water) provides the methodological foundation for these accounts. It establishes a standardized, internationally comparable approach to integrating water resource data with economic statistics and is the global benchmark for national water accounting. For Kenya, it provides the conceptual architecture for the Physical Supply and Use Tables (PSUTs) presented in this report.

The PSUTs record how water moves from its natural origins, including precipitation, river systems, and aquifers, through the economy via productive use by industries and households, and back to the



environment through runoff, groundwater recharge, evapotranspiration, and wastewater discharge. This accounting structure follows the same principles as the System of National Accounts (SNA), placing water within a governed statistical framework where stocks, flows, and economic relationships can be measured consistently over time.

1.5 Rationale for the Development of Water Accounts

Kenya's water resources have long been managed on the basis of partial information. Data on abstraction, distribution, sector use, and return flows exist, but they are scattered across multiple institutions, including WRA, WASREB, NIA, and KMD, collected at different frequencies, in different formats, and for different regulatory purposes. Decisions on water allocation, infrastructure investment, and basin management have consequently been made without a complete, consistent framework of how water moves through the economy. The development of Physical Water Accounts addresses this directly, by integrating data from across the statistical system into a single, reconciled accounting framework.

This integration is not a statistical exercise for its own sake. Water underpins Kenya's most economically critical sectors: agriculture, which depends on rainfall and irrigation; hydropower, which relies entirely on river flows and reservoir conditions; and urban water supply, which is under increasing pressure from population growth and urbanization. None of these dependencies are adequately captured in conventional economic statistics. GDP does not record whether a season's agricultural output came at the cost of aquifer depletion, or whether a drought year reduced hydropower revenues because upstream catchments were degraded. Water accounts make these relationships visible.

The case for water accounts is also grounded in Kenya's national planning commitments. The Bottom-Up Economic Transformation Agenda (BETA) identifies water as foundational to agricultural transformation, one of its five core pillars. The Kenya National Bureau of Statistics, in the National Plan for the Advancement of Environmental-Economic Accounting 2025–2028 (NP-AEEA), identified water as one of six priority natural capital accounts, based on its policy relevance, data availability, and centrality to sustainable development. Water accounts are further directly linked to monitoring progress on the Sustainable Development Goals, particularly SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy, and SDG 13 on climate action.

At the international level, Kenya is a signatory to commitments under the Paris Agreement, the Kunming-Montreal Global Biodiversity Framework, and multiple multilateral environmental agreements that require environmental data going beyond what conventional statistics provide. The water accounts presented in this report lay the statistical foundation for Kenya to meet these reporting obligations with evidence produced through its own national systems, rather than proxy indicators or external estimates.

The SEEA-Water framework enables Kenya to move beyond aggregate supply statistics to a full accounting of where water originates, which sectors

use it, how much is consumed versus returned, and how system losses are distributed across the distribution network. This is the evidential foundation required for Integrated Water Resources Management (IWRM): not a summary of how much water Kenya has, but a systematic record of how it is used, by whom, and at what cost to future availability.

1.6 Scope

This report presents the Physical Supply and Use Tables (PSUTs) for Kenya's water sector covering the three-year period 2021 to 2023. The accounts record water flows between the natural environment and the economy, encompassing abstraction from surface water and groundwater sources, distribution by water utilities, imports and exports, use by economic sector, and return flows to the environment including surface runoff, groundwater recharge, evapotranspiration, and wastewater discharge.

The accounts are physical in nature, measuring water volumes in cubic meters. Monetary valuation of water resources and water-related ecosystem services is outside the scope of this edition and is identified as a future workstream under the NP-AEEA 2025–2028. Water quality accounts are similarly not included in this edition, owing to data availability constraints. Water asset accounts, which would record opening and closing stocks of surface water and groundwater at the start and end of each accounting period, are also outside the scope of this edition. All three are identified as priority areas for subsequent editions. The spatial coverage is national. Subnational or basin-level disaggregation of the accounts is not presented in this edition.

1.7 Objectives

The Kenya Physical Water Accounts for 2021 to 2023 have been developed to serve the following objectives:

1. To provide a consistent, economy-wide statistical record of water flows between the natural environment and the economy, disaggregated by source and economic sector, for use in national and sectoral planning.
2. To support evidence-based water allocation by quantifying sectoral water use, identifying inefficiencies in distribution, and establishing a baseline against which future changes in demand can be tracked.
3. To strengthen inter-institutional coordination and data governance by integrating water-related statistics from across Kenya's national statistical system into a single, reconciled accounting framework.
4. To support Kenya's monitoring of SDG 6.4 on water-use efficiency and water stress, by providing the physical data required to compute and report these indicators at national level.
5. To establish a reproducible methodology and baseline dataset for the regular production of water accounts, in line with the NP-AEEA 2025–2028 commitment to institutionalize environmental-economic accounting within KNBS.

1.8 Legal, Policy and Institutional Frameworks

1.8.1 Legal and Policy Framework

The **Constitution of Kenya, 2010** provides the overarching legal foundation for water governance. Chapter 5 establishes the principles governing the management of land and the environment, including the obligation to ensure sustainable exploitation, utilization, management, and conservation of natural resources. Article 43(1)(d) guarantees every person the right to clean and safe water in adequate quantities.

The Water Act, 2016 (amended 2025) provides the legislative framework for the management, use, conservation, and regulation of water resources and water services in Kenya, aligned with the Constitution of Kenya, 2010. Under Sections 11 to 13 and Section 24 of the Act, the Water Resources Authority (WRA) is mandated to regulate the management and use of water resources and serves as the primary custodian of Kenya's raw water inventory. Sections 70 to 72 and Section 111 of the Act mandate the Water Services Regulatory Board (WASREB) to set standards, license water service providers, and ensure consumer protection. WASREB serves as the

primary custodian of water services data in Kenya. Both the national water resources inventory and the water services inventory are key data inputs to the water accounts compiled in this report.

The **National Water Policy, 2021** (Sessional Paper No. 1 of 2021) provides strategic direction for the water sector, with the aim of accelerating the development and management of water resources in support of national development goals and the Sustainable Development Goals.

The **Environmental Management and Coordination Act (EMCA**) provides the legal basis for environmental management in Kenya, with particular emphasis on the protection of natural resources including lakes, rivers, wetlands, forests, and highland catchment areas. The Act establishes the regulatory framework governing water use for both consumptive and industrial purposes.

Kenya's long-term national development strategy, **Vision 2030**, aims to transform the country into a newly industrializing, middle-income economy by 2030. Water is identified as a key enabler of the Economic Pillar, particularly in support of agriculture and tourism. Vision 2030 is implemented through successive medium-term plans. The current plan, the **Fourth Medium Term Plan** (MTP IV) covering 2023 to 2027, prioritizes water security and climate change adaptation, with a focus on investment in water storage infrastructure. The **Bottom-Up Economic Transformation Agenda** (BETA), which operates alongside MTP IV, identifies agricultural transformation as one of its five core pillars, and water availability is central to its implementation. The water accounts support this agenda by providing data on water abstraction trends and sectoral use patterns, enabling irrigation expansion and agricultural investment decisions to be grounded in evidence rather than projections.

1.8.2 Institutional Framework

The **Kenya National Bureau of Statistics** (KNBS) is the principal government agency for the collection, analysis, and dissemination of official statistical data in Kenya. Under the Statistics Act, CAP 112 Laws of Kenya (Rev. 2022), KNBS is the custodian of official statistical information and the coordinator of the National Statistical System. In the context of the water accounts, KNBS leads the compilation, validation, and publication of the Physical Supply and Use Tables in collaboration with the Water Statistics Technical Working Committee.

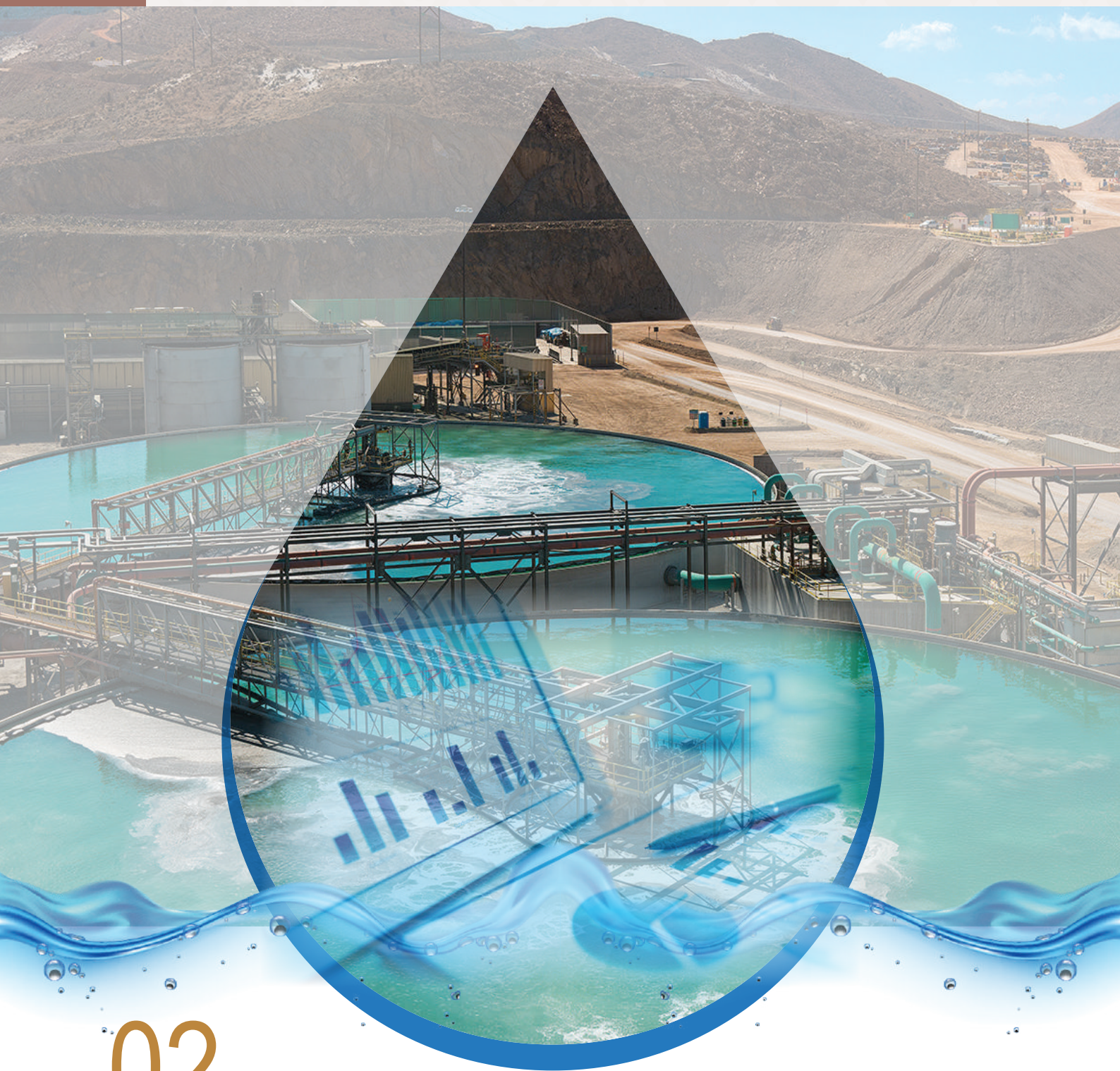
The **Ministry of Water, Sanitation and Irrigation** provides overall policy direction for the water sector through two state departments: the State Department for Water and Sanitation, and the State Department for Irrigation. The ministry's policy frameworks and sector data are key inputs to the water accounts.

The **Water Resources Authority** (WRA) is the statutory body responsible for regulating the management and use of water resources in Kenya. WRA maintains the national water abstraction permit register and collects surface water and groundwater monitoring data, both of which are primary data sources for the supply side of the accounts.

The **Water Services Regulatory Board** (WASREB) is the regulatory body for water and sewerage services in Kenya. Its mandate includes setting sector standards, licensing water service providers, and ensuring consumer protection. WASREB collects and maintains data on water production, distribution volumes, non-revenue water, and wastewater treatment, all of which contribute to the use side of the accounts.

The **Kenya Meteorological Department** (KMD) is the national authority for weather and climate monitoring. It collects data on rainfall, temperature, humidity, and related atmospheric variables using standardized protocols. KMD's rainfall and evapotranspiration data are the primary source for precipitation volumes and the use of soil water recorded in the accounts, and its seasonal outlooks inform the interpretation of inter-annual variability in water supply totals.

The **National Irrigation Authority** (NIA) is mandated to develop, manage, and regulate national irrigation schemes. NIA maintains data on irrigated area by crop and region, water abstraction for irrigation, and irrigation infrastructure, which are used to compile water use estimates for the irrigated agriculture sub-category in the accounts.



02 Methodology

This chapter describes the conceptual framework, data sources, compilation process, and analytical assumptions underpinning Kenya's Physical Water Supply and Use Accounts for 2021 to 2023. It sets out how water flows were identified, measured, classified, and organized into the Physical Supply and Use Tables (PSUTs) in accordance with the System of Environmental-Economic Accounting for Water (SEEA-Water). It also documents the assumptions made and limitations of the current compilation.

2.1 Methodology for Compiling Water Accounts

The water accounts presented in this report were compiled using the framework of the System of Environmental-Economic Accounting (SEEA) Central Framework and the associated guidance from SEEA-Water. The SEEA framework integrates environmental and economic statistics and applies the accounting principles of the System of National Accounts 2008 (SNA 2008) to environmental resources. This approach enables the systematic recording of the interactions between water resources and the economy.

The core accounts compiled for this report are the Physical Supply and Use Tables (PSUTs), which record water flows between the environment and the economy, as well as flows within the economy. These tables track water abstraction from natural sources, water distribution among economic sectors, water use by industries and households, and water returns to the environment.

2.1.1 Classification

Economic activities in the accounts are classified according to the International Standard Industrial Classification of All Economic Activities, Revision 4 (ISIC Rev.4). ISIC provides a standardized hierarchical framework for organizing productive activities into consistent categories, enabling comparison across sectors and alignment with national accounts statistics.

The core accounts compiled for this report are the Physical Supply and Use Tables (PSUTs), which record water flows between the environment and the economy, as well as flows within the economy. These tables track water abstraction from natural sources, water distribution among economic sectors, water use by industries and households, and water returns to the environment.

In the PSUTs, economic activities are organized into five columns reflecting the major water-using groups: Agriculture, Forestry and Fishing (ISIC A); Electricity, Gas, Steam and Air Conditioning (ISIC D); Water Collection, Treatment and Supply and Sewerage (ISIC E); Others, covering Mining and Quarrying, Manufacturing, Construction, and Service Activities (ISIC B, C, F through N); and Households. Within ISIC A, the accounts apply a further disaggregation into four sub-activities: rainfed agriculture, irrigated agriculture, livestock watering, and aquaculture. This disaggregation is necessary because these sub-activities have fundamentally different water source dependencies and governance implications and combining them would obscure analytically important patterns.

Water quality accounts and monetary valuations are outside the scope of this edition and are not reflected in the classification structure applied here.

The accounts record the three primary sources of water, surface water, groundwater, and soil water

as per the SEEA-Water asset classification. Soil water is the water used by rainfed agriculture. Soil water is a stock of water held in the unsaturated zone, replenished by precipitation and used by crops through evapotranspiration. Precipitation enters the accounting system as an environmental flow into the soil water stock, from which rainfed agricultural production draws its consumptive use. This means the water supply resource class that supports rainfed agriculture is soil water, while rainfed agriculture is part of the agricultural industry (ISIC Division 01). In supply tables, the volume of soil water used by rainfed agriculture is estimated from effective precipitation on cultivated land. This estimation method is consistent with SEEA-Water guidance for countries where direct soil moisture observations are limited, and is reported under the soil water source category rather than as direct precipitation supply to the industry.

2.2 Data Sources

The compilation of Kenya's water accounts relied on a combination of administrative, statistical, and environmental data sources. SEEA accounts typically draw from multiple datasets collected by different institutions for different purposes, which are then integrated into a single accounting framework. These data are used to allocate water use across industries and households.

Data Source	Indicators
National Irrigation Authority	Irrigation and surface runoff data
Kenya Meteorological Department	Precipitation/soil water data
Water Services Regulatory Board	Water consumption by institutions, households, and distribution losses
Water Resources Authority	Water abstraction; permitted volumes
Kenya Integrated Agricultural Management Information System (KIAMIS)	Arable land under rainfed agriculture and aquaculture
2019 Kenya Population and Housing Census (KPHC)	Provided data on household water use
Census of schools & school enrolment numbers from the Economic Survey	Water use in basic education institutions
Kenya Health Facility Census 2023	Health sector water use

2.3 Compilation Process

The compilation of the water accounts followed a structured process consistent with the recommendations of the System of Environmental Economic Accounting (SEEA) Central Framework and the guidance provided in SEEA-Water. This compilation process ensured that the resulting water accounts provide a coherent and integrated framework for analyzing water availability, use, and pressures on water resources across the economy. The main steps undertaken in the compilation process are summarized below.

2.3.1 Step 1: Defining the Scope and Structure of the Accounts

The first step involved defining the scope of the water accounts, including the accounting period, spatial coverage, and water resources considered (surface water and groundwater). Water supply was recorded by source whereas water use was disaggregated by economic sectors included. Economic activities were classified according to

the International Standard Industrial Classification of all economic activities (ISIC Rev.4) to ensure consistency with national accounts statistics.

- **Natural inputs** (water abstracted from the environment),
- **Products** (water supplied and used within the economy), and
- **Residuals** (wastewater and return flows to the environment).

All water flows are measured in physical units (cubic meters) and organized by economic sectors based on ISIC Rev.4. The compilation process ensured that for each water flow category total supply equals total use, consistent with the SEEA accounting principle.

2.3.2 Step 2: Identification of Key Water Flows

The major water flows between the environment and the economy were identified. These include water abstraction from natural sources, water supplied by utilities and other industries, water used by economic sectors and households, and water returned to the environment after use.

2.3.3 Step 3: Data Collection and Compilation

Data were compiled from administrative records, environmental monitoring systems, sectoral statistics, and survey data. The information was organized according to the structure of the Physical Supply and Use Tables to capture both the supply of water (from the environment and industries) and the use of water across sectors.

2.3.4 Step 4: Data Harmonization and Classification

Datasets obtained from different sources were harmonized to avoid overlaps, ensure



consistency in definitions, measurement units, and sector classifications. Where necessary, data were converted into common units (cubic meters) and aligned with SEEA concepts.

2.3.5 Step 5: Estimation and Gap Filling

Where direct data were unavailable, estimation techniques were applied using proxy indicators such as production statistics, irrigation areas, or standard coefficients. These estimates were used cautiously to address data gaps while maintaining the integrity of the accounting framework.

2.3.6 Step 6: Distribution Losses Within Water Supply Systems

Distribution losses within water supply systems were compiled using reported data from water utilities. These data capture losses occurring along transmission and distribution networks, including physical losses such as leakage as well as other components of non-revenue water where recorded. The use of observed utility data ensures a high degree of reliability and consistency in representing system inefficiencies within the accounts. These losses were explicitly incorporated into the Physical Supply and Use Tables, ensuring a comprehensive accounting of water flows and strengthening the accuracy and internal consistency of the overall water balance in line with SEEA-Water principles.

2.3.7 Step 7: Balancing and Validation of the Accounts

The final step involved reconciling the supply and use tables to ensure that total water supply equals total water use for each category of flow. Quality checks and validation procedures were applied to verify the plausibility of the results and ensure consistency with other environmental and economic statistics.

2.4 Assumptions

In compiling the water accounts, several assumptions were made to address data gaps and ensure internal consistency within the accounting framework. These assumptions were applied cautiously and were guided by available sector knowledge, international practices, and expert consultation. These include:

1. **Water use ratios** were assumed for some sectors where detailed sector-level water use data were unavailable. Estimates were derived from production indicators or national ratios.
2. **Return flow coefficients** were applied to estimate the portion of water that returns to the environment after use where direct measurements were unavailable.
3. **Spatial allocation assumptions** were used where water abstraction or use data were available only at national or regional levels but needed to be distributed across industries or administrative units.
4. **Temporal consistency assumptions** were applied to ensure comparability between datasets collected at different times or frequencies.
5. **Seventy-five percent of the water** supplied by water collection, treatment, and supply companies is assumed, on technical grounds, to become wastewater.

2.5 Limitations

Despite efforts to ensure data quality and consistency, several limitations affect the compilation of water accounts. Notwithstanding these limitations, the SEEA water accounts provide an integrated statistical framework that improves the coherence of water-related information and supports evidence-based decision-making for sustainable water resource management. The limitations experienced in the account generation are:

i. **Data availability and coverage remain a challenge.** Water-related information is often collected by multiple institutions using different definitions, classifications, and reporting periods, which may limit comparability and require adjustments before integration into the SEEA framework.

ii. **Limited direct measurement of water abstraction and return flows.** Generating data in some sectors, particularly small-scale agriculture and informal activities, necessitates the use of estimation techniques that may introduce uncertainty.

iii. **Data on groundwater abstraction and non-registered water use** may be incomplete due to limited monitoring systems.

iv. **Differences between environmental statistics and economic statistics classifications** require bridging tables and adjustments to align datasets with the SEEA accounting structure.

v. Water accounts represent a **simplified representation of complex hydrological and economic systems**, and therefore may not fully capture spatial variability, seasonal fluctuations, or ecological aspects of water resources.

> **This chapter is structured around two analytical components: water supply and water use, with water use examined both at the sectoral level and in terms of net consumptive volumes across the economy.**



03
Analytical Findings from the Physical Supply and Use Tables

This chapter presents Kenya's Physical Supply and Use Tables (PSUTs) for 2021, 2022, and 2023, alongside key water sector indicators derived from the accounts. The PSUTs record the full cycle of water movement through the economy: abstraction from surface water, groundwater, and soil water; distribution by utilities; use by industries and households; and return flows to the environment. Together, they provide a consistent, economy-wide framework of how water is supplied, allocated, and used across Kenya's productive sectors.

The data covers major water-using activities including agriculture, manufacturing, mining, electricity generation, and households, classified according to the ISIC framework as required under SEEA-Water. Beyond describing current patterns, the tables allow identification of sectoral dependencies, distribution inefficiencies, and areas where demand is approaching or exceeding sustainable thresholds.

The PSUTs also provide the empirical foundation for computing Kenya's SDG 6 water indicators, particularly SDG 6.4 on water-use efficiency and water stress. This chapter is structured around two analytical components: water supply and water use, with water use examined both at the sectoral level and in terms of net consumptive volumes across the economy.

3.1 Physical Water Supply

This section presents a comprehensive overview of water supply across different environmental flows for the period 2021 to 2023. The full Physical Supply Tables for 2021, 2022 and 2023 are provided in the Appendices. Table 1 below presents the condensed Physical Supply Table for 2023, showing water flows by source and economic sector.

The PSUTs record the full cycle of water movement through the economy: abstraction from surface water, groundwater, and soil water; distribution by utilities; use by industries and households; and return flows to the environment. Together, they provide a consistent, economy-wide framework of how water is supplied, allocated, and used across Kenya's productive sectors.

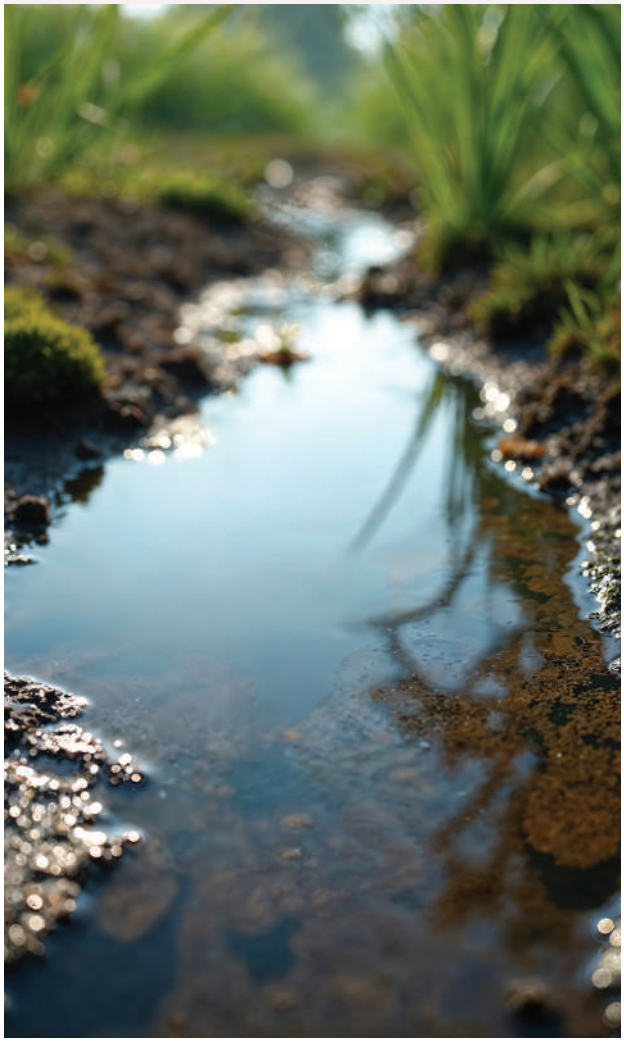


Table 1: Physical Supply Table, 2023

Cubic meters per annum

	Agriculture, Forestry and Fishing	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Others	Households	Flows from the Rest of the World (Imports)	Flows from the Environment	Total Supply
ISIC Code	**ISIC A**	**ISIC D**	**ISIC E**	**ISIC B, C, F-U**				
1. Sources of Abstracted Water:								
Surface Water							47,848,854,207	**47,848,854,207**
Ground Water							2,793,825,024	**2,793,825,024**
Soil Water							529,112,237,385	**529,112,237,385**
Unclassified Source							57,326,409	**57,326,409**
Total Supply Abstracted Water							**579,812,243,026**	**579,812,243,026**
2. Water:								
Distribution of abstracted water			453,532,187					**453,532,187**
Own use of abstracted water	111,639,858,356	30,948,969,766		14,554,788,685	268,689,078			**157,412,305,886**
From other sources (Cross-Border)						306		**306**
3. Wastewater and re-used water:								
Wastewater to treatment			154,730,995					**154,730,995**
Wastewater (untreated)			185,418,145					**185,418,145**
Own treatment of wastewater								**-**
Re-used water produced (for distribution)								**-**
4. Return flows of water:								
To inland water resources	343,107,019,178	30,948,969,766		6,392,921,406	115,152,462			**380,564,062,813**
Surface runoff	299,253,790,852							**-**
Groundwater recharge	42,219,107,115							**-**
Non-revenue water and losses in distribution			195,517,726					**195,517,726**
5. Evaporation of abstracted water, transpiration and water incorporated into products:								
Evapotranspiration	80,669,024,712							**80,669,024,712**
Total water incorporated into products	110,005,737,145	-	258,014,461	8,161,867,279	153,536,616			**118,579,155,500**

Total national water supply stood at 304,495.2 million cubic meters in 2021, declining modestly to 296,590.8 million cubic meters in 2022, a contraction of 2.6 percent, before surging to 579,812.2 million cubic meters in 2023, a year-on-year increase of 95.5 percent. The 2023 figure is nearly double the 2021 baseline. This increase is almost entirely attributable to increased precipitation and the use of soil water by rainfed agricultural systems, driven by the El Niño rainfall event of that year. It does not reflect a proportional increase in managed abstraction or consumptive use across productive sectors.

3.1.1 Water Supply by Source

The major sources of water in Kenya are precipitation/soil water, surface water, groundwater, and other sources such as imports. Table 2 presents total water supply by source for 2021, 2022, and 2023.

Table 2. Water supply by water source, 2021–2023

Water Source	2021 (m^3)	2022 (m^3)	2023 (m^3)	Δ 21 → 22	Δ 22 → 23	% share 2023
Surface Water	45,600,487,131	46,743,791,306	47,848,854,207	1,143,304,175	1,105,062,901	8.3%
Groundwater	2,570,832,542	2,725,345,092	2,793,825,024	154,512,550	68,479,932	0.5%
Soil Water	256,146,119,681	247,020,129,401	529,112,237,385	-9,125,990,280	282,092,107,984	91.3%
Unclassified Source	177,788,883	101,496,370	57,326,409	-76,292,513	-44,169,961	0.0%
Total Supply	**304,495,228,237**	**296,590,762,169**	**579,812,243,026**	**-7,904,466,068**	**283,221,480,857**	**100.0%**



Soil water use dominated total water supply across all three years, accounting for 84.1 percent in 2021, 83.3 percent in 2022, and 91.3 percent in 2023. The 2022 decline in soil water volumes, from 256,146.1 million cubic meters to 247,020.1 million cubic meters, reflects the drought conditions Kenya experienced that year. The near doubling to 529,112.2 million cubic meters in 2023 is attributable to the El Niño rainfall event. As discussed throughout this report, the dominance of soil water in national totals is driven almost entirely by the use of soil water in rainfed agricultural systems and should be read separately from the managed water supply picture.

Surface water is the second largest source, growing steadily from 45,600.5 million cubic meters in 2021 to 47,848.9 million cubic meters in 2023. Its share of total supply contracted from 15 percent to 8.3 percent over the period, not because surface water use declined, but because soil water volumes expanded so sharply in 2023. Groundwater, the third source, grew from 2,570.8 to 2,793.8 million cubic meters, an increase of 8.7 percent. Its upward trajectory across most productive sectors warrants monitoring against aquifer sustainable yield thresholds. Unclassified sources, which include cross-border imports and water not captured in official records, declined from 177.8 to 57.3 million cubic meters over the period.

As discussed throughout this report, the dominance of soil water in national totals is driven almost entirely by the use of soil water in rainfed agricultural systems and should be read separately from the managed water supply picture.

3.1.2 Abstraction vs Permitted Volumes

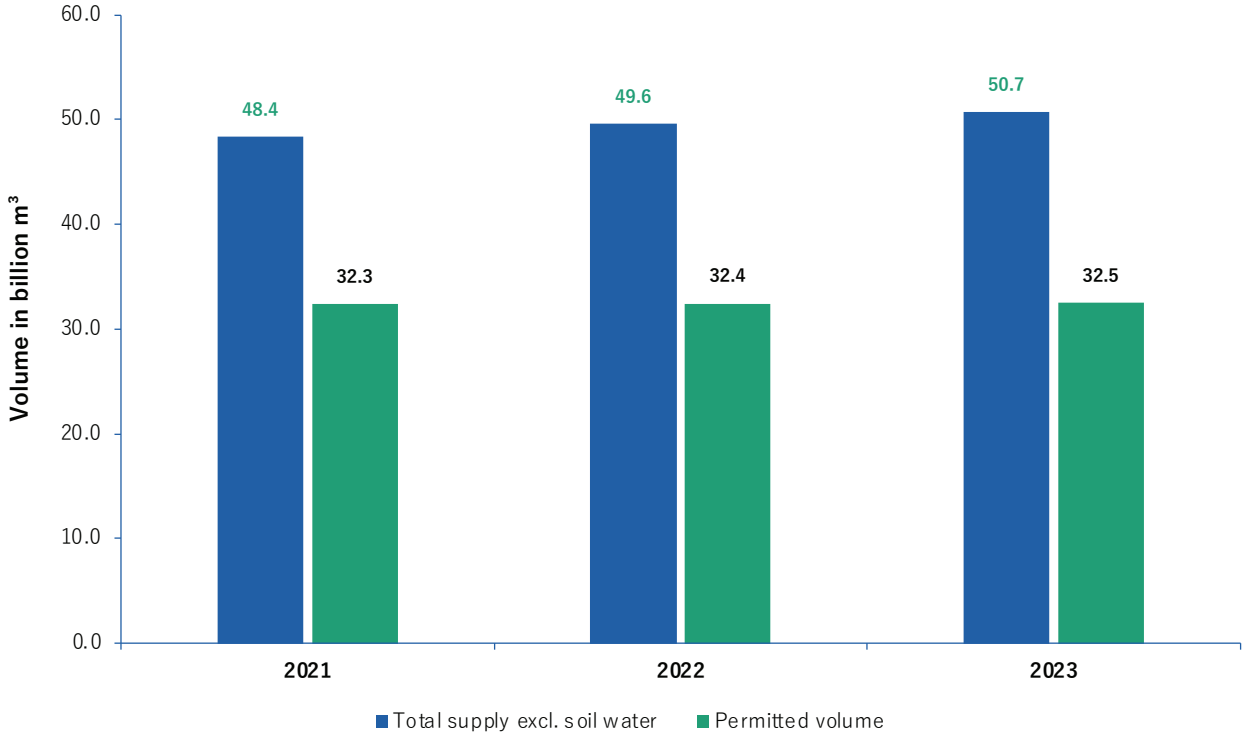
Permitted abstraction volumes used in this analysis are derived from Table 8.4(a) of the Kenya Economic Survey, sourced from the Water Resources Authority (WRA), which records actual water abstraction volumes by permitted users across all valid permits in each accounting year. These figures represent the volume of water abstracted through the formal permitting system and are distinct from total supply volumes in the PSUTs, which capture both permitted and unpermitted abstraction. The difference between the two measures is the estimated volume of water abstracted without valid regulatory authorization.

A comparison of total supply excluding soil water against permitted abstraction volumes reveals a persistent and widening gap over the three-year period. The share of total non-soil-water supply covered by permitted abstraction declined from 66.9 percent in 2021 to 65.4 percent in 2022 and 64 percent in 2023. By 2023, approximately 36 percent of all non-soil-water abstraction was occurring outside the formal permitting system. The unpermitted abstraction gap widened from 16 billion cubic meters in 2021 to 18.2 billion cubic meters in 2023.

Irrigated agriculture is a significant contributor to this gap. Irrigation accounts for approximately 8 to 10 percent of total supplied volumes, excluding soil water, but represents approximately 20 to 24 percent of unpermitted supply volumes. This disproportionate share suggests that irrigation expansion, particularly at the smallholder level, is exceeding the permitting capacity of the Water Resources Authority.

Figure 1 plots total supplied water excluding rainwater alongside permitted abstraction volumes for each year from 2021 to 2023.

Figure 1. Total supply excluding soil water vs permitted volumes, 2021–2023



The gap between the two bars is consistent across all three years and widened over the period. Total supply increased from 48.4 billion cubic meters in 2021 to 50.7 billion cubic meters in 2023, a rise of 2.3 billion cubic meters. Permitted volumes, by contrast, grew from 32.3 billion cubic meters to 32.5 billion cubic meters, an increase of 0.2 billion cubic meters. The unpermitted abstraction gap consequently widened from 16.1 billion cubic meters in 2021 to 18.2 billion cubic meters in 2023.

This gap has two compounding implications. First, it understates the true pressure on river and aquifer systems, since unpermitted abstractions fall outside the monitoring frameworks used to assess sustainable yield. Second, it limits the Water Resources Authority's ability to enforce allocation priorities during low-flow periods, when competition between users is most acute. Addressing the gap will require both accelerated permitting processes and strengthened field monitoring of actual abstraction volumes across basins.

3.2 Physical Water Use

This section presents a comprehensive overview of water consumption across different economic activities and environmental flows for the period 2021 to 2023. The full Physical Use Tables for 2021, 2022, and 2023 are provided in the *Appendices.* Table 3 below presents the condensed Physical Use Table for 2023, showing water flows by source and economic sector.

Table 3. Physical Use Table, 2023

Cubic meters per annum

	Agriculture, Forestry and Fishing	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Others	Households	Flows to the Rest of the World (Exports)	Flows to the Environment	Total Supply
ISIC Code	**ISIC A**	**ISIC D**	**ISIC E**	**ISIC B, C, F-U**				
1. Sources of Abstracted Water:								
Surface Water	4,486,068,942	30,948,969,766	253,183,955	12,047,042,411	113,589,133			**47,848,854,207**
Ground Water	186,946,739		4,830,506	2,450,419,865	151,627,915			**2,793,825,024**
Soil Water	529,108,765,354			-	3,472,031			**529,112,237,385**
Unclassified Source	-		-	57,326,409				**57,326,409**
Total Use Abstracted Water	**533,781,781,035**	**30,948,969,766**	**258,014,461**	**14,554,788,685**	**268,689,078**			**579,812,243,026**
2. Water:								
Use of distributed water	-			74,921,049	183,093,412			**258,014,461**
Non-revenue water and losses in distribution	-		195,517,726	-				**195,517,726**
Total water incorporated into products	110,005,737,145	-	258,014,461	8,161,867,279	153,536,616			**118,579,155,500**
3. Wastewater and re-used water:								
Wastewater received from other units	-		154,730,995	-				**154,730,995**
Own treatment of wastewater	-		185,418,145	-				**-**
Re-used water (distributed reuse)	-			-				**-**
4. Return flows of water:								
To inland water resources	-			-			380,564,062,813	**380,564,062,813**
To other sources	-			-			80,669,024,712	**80,669,024,712**
5. Evaporation of abstracted water, transpiration and water incorporated into products:								
Total water evaporated, transpired and incorporated into products	-			-				

Total national water use followed an uneven trajectory over the three-year period. In 2021, total water use stood at 304,495.2 million cubic meters. This declined modestly in 2022 to 296,590.8 million cubic meters, a contraction of 2.6 percent, before surging substantially in 2023 to 579,812.2 million cubic meters, representing a year-on-year increase of 95.5 percent. The 2023 surge is almost entirely attributable to the use of soil water by rainfed agriculture, where recorded water use rose from 247,016.7 million cubic meters in 2022 to 529,108.8 million cubic meters in 2023. This expansion directly mirrors the El Niño precipitation event of that year. Rainfed agricultural water use is sourced from soil water, which is the result of rainfall on cultivated land. Above-average rainfall translates immediately into higher recorded volumes of soil water use by agriculture. It does not reflect an increase in managed abstraction or a policy-driven expansion of irrigated areas. When rainfed agriculture is set aside, the underlying trajectory of managed water use across productive sectors is considerably more stable, with year-on-year changes that are moderate and consistent with population growth, infrastructure expansion, and sectoral demand drivers.

3.2.1 Water Use by Economic Activity

Figure 2 presents the full sectoral picture of water use for 2021 to 2023, including rainfed agriculture and hydropower.

Figure 2. Total water use by sector, 2021–2023

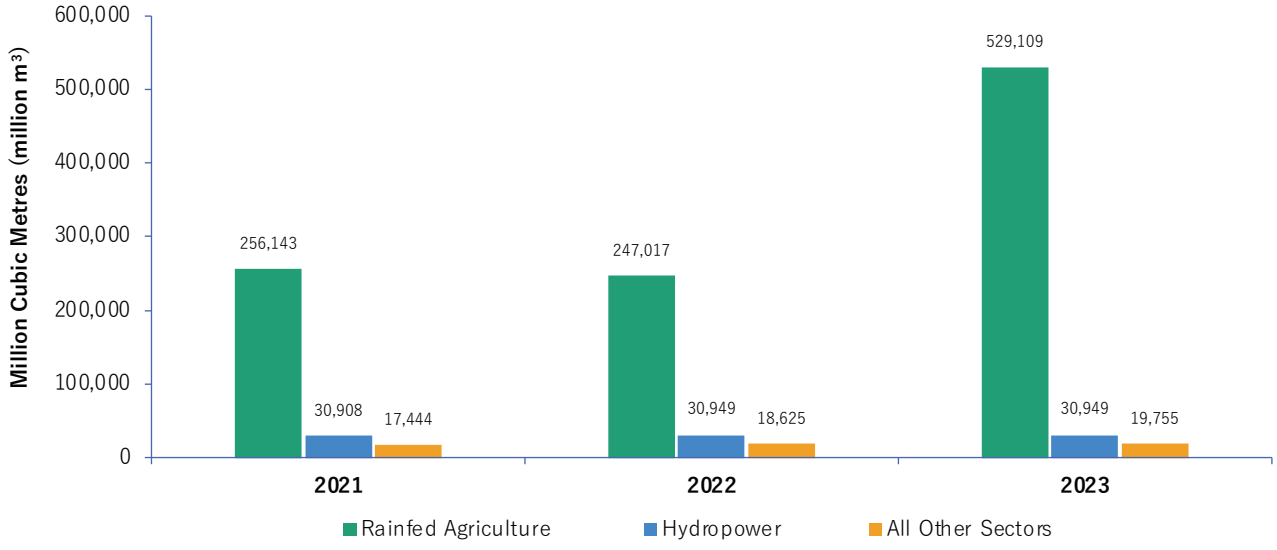
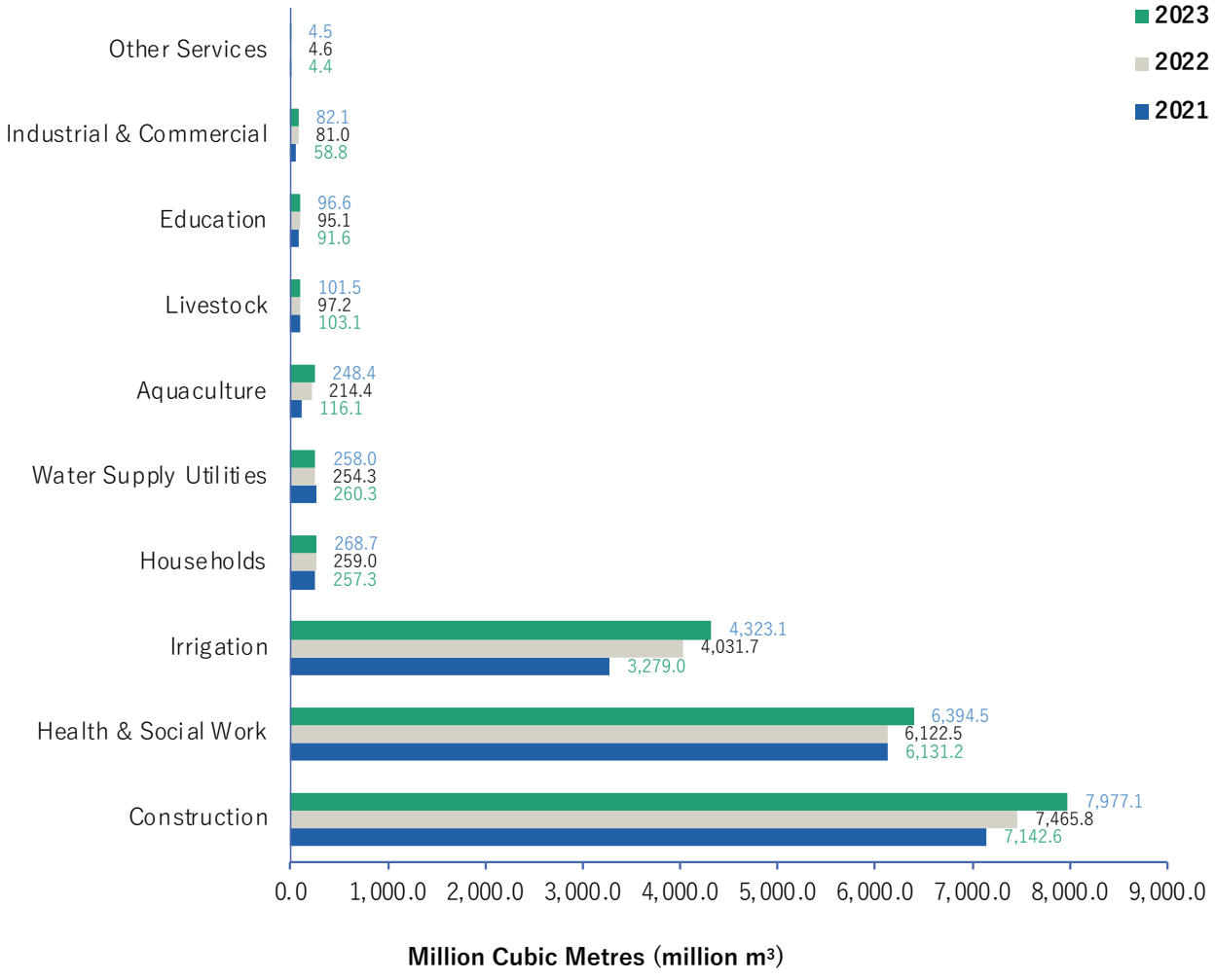


Figure 3 sets aside rainfed agriculture and hydropower, focusing on the managed water economy where allocation decisions, efficiency interventions, and infrastructure investments have a direct effect.

Figure 3. Water use by economic activity, 2021–2023 (rainfed agriculture and hydropower excluded)



The accounts show that growth in managed water demand between 2021 and 2023 was concentrated in three sectors. Construction sector grew from 7,142.6 million cubic meters in 2021 to 7,977.1 million cubic meters in 2023, an increase of 11.7 percent, consistent with Kenya's sustained infrastructure investment program. Irrigated agriculture grew from 3,279 million cubic meters in 2021 to 4,323.1 million cubic meters in 2023, an increase of 31.8 percent, making it the fastest growing sector by absolute volume among the managed water users. The aquaculture sub-sector recorded the highest growth rate over the period, expanding from 116.1 million cubic meters in 2021 to 248.4 million cubic meters in 2023, an increase of 114 percent, though its absolute volumes remain modest relative to other sectors. The health and social work sector grew from 6,131.2 million cubic meters in 2021 to 6,394.5 million cubic meters in 2023. Construc-

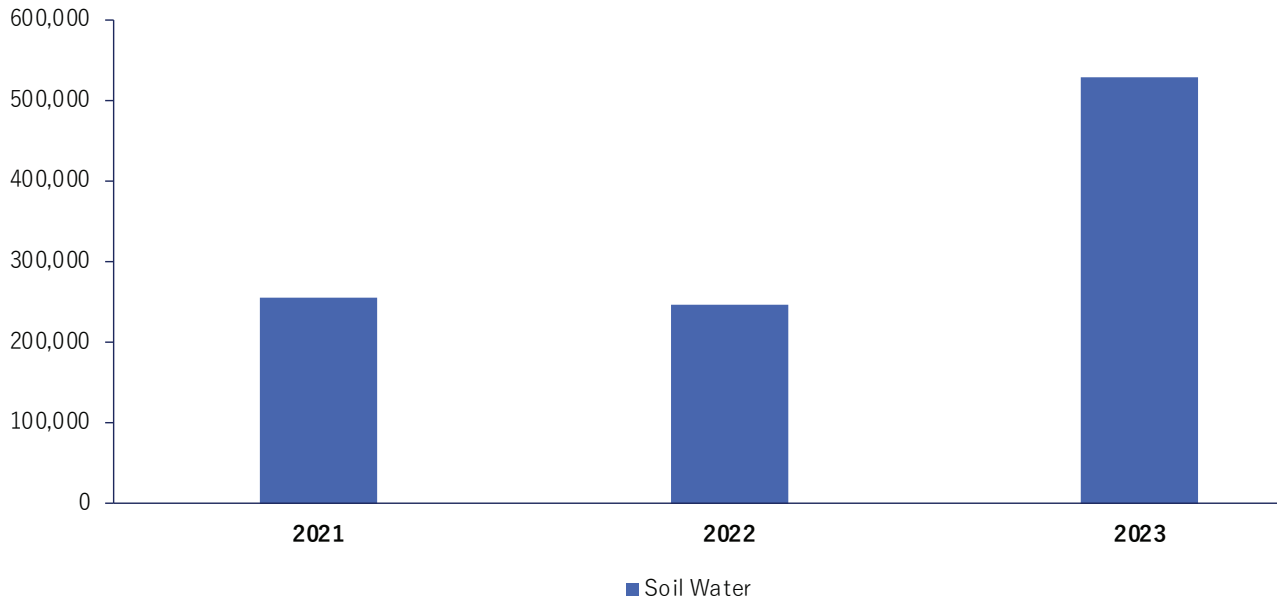
tion, irrigated agriculture, and health and social work sectors, as the three largest consumers of managed water, are the most relevant focus for efficiency interventions aimed at SDG 6.4 compliance. The aquaculture sub-sector, while still modest in absolute volume, warrants monitoring given its rapid rate of expansion.

3.2.1.1 Sectoral Analysis

Agriculture is Kenya's most water-intensive economic sector and the dominant driver of national water use totals. In aggregate, agricultural activities, including rainfed, irrigated, livestock, and aquaculture, consumed 259,641 million cubic meters in 2021, declining slightly to 251,360.0 million cubic meters in 2022, before surging to 533,781.8 million cubic meters in 2023. In 2023, agriculture accounted for 92.1 percent of total industry water use, almost entirely through rainfed systems.

Rainfed agriculture consumed 256,142.9 million cubic meters of soil water in 2021, declining to 247,016.7 million cubic meters in 2022, before expanding to 529,108.8 million cubic meters in 2023, an increase of 114.2 percent. Its water use is sourced from soil water replenished by precipitation falling on cultivated land, with no recorded surface water or groundwater abstraction. Since rainfed soil water use does not compete directly with other abstractors for river or aquifer resources, its governance implications differ fundamentally from those of irrigated water, though it remains subject to climate risk and land degradation that reduce infiltration and productive water availability.

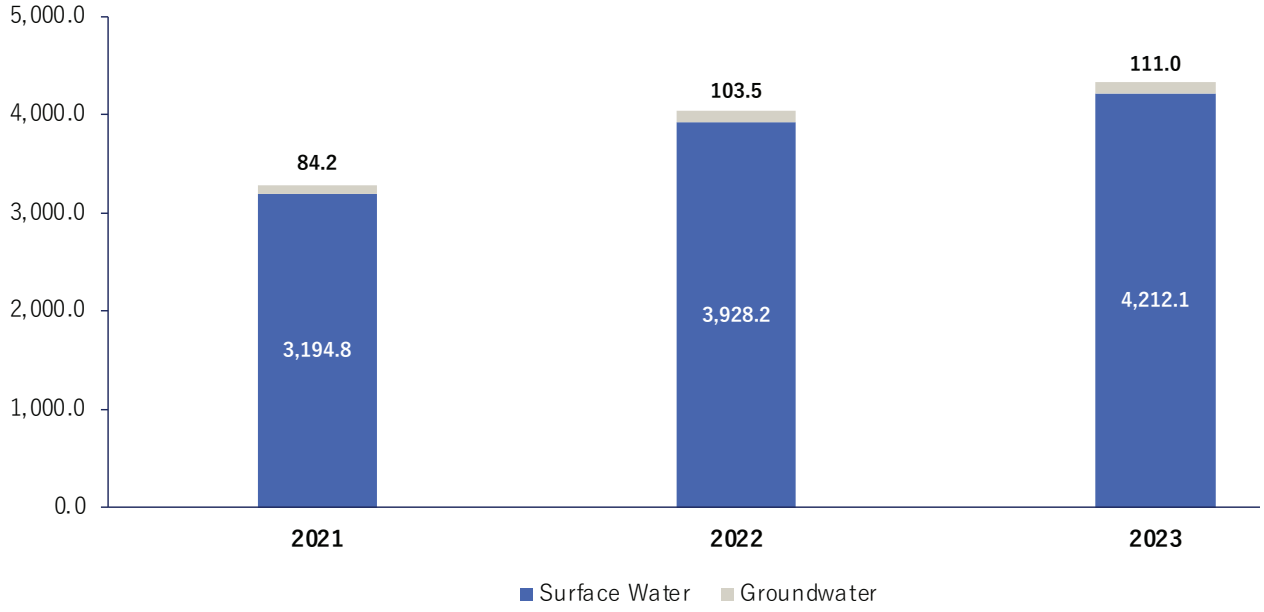
Figure 4. Source of water used by agriculture water use by source, 2021–2023 (million cubic meters)



Total irrigated water use grew from 3,279 million cubic meters in 2021 to 4,323.1 million cubic meters in 2023, a steady increase of 31.8 percent. Surface water provided 97.4 percent of irrigation supply across the period. The contribution of groundwater, while minor in absolute terms, grew from 84.2 million cubic meters to 111 million cubic meters, signalling growing reliance on sub-surface sources for irrigation. The steady year-on-year growth in both sources warrants active monitoring against basin-level sustainable yield thresholds.

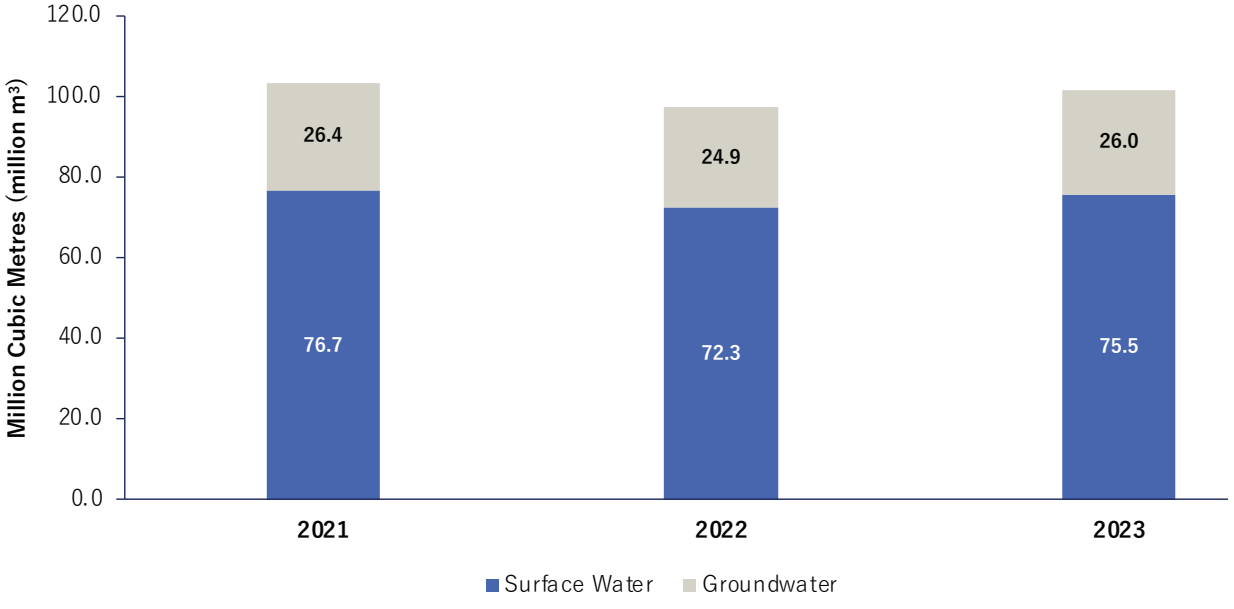


Figure 5. Irrigated agriculture water use by source, 2021–2023 (million cubic meters)



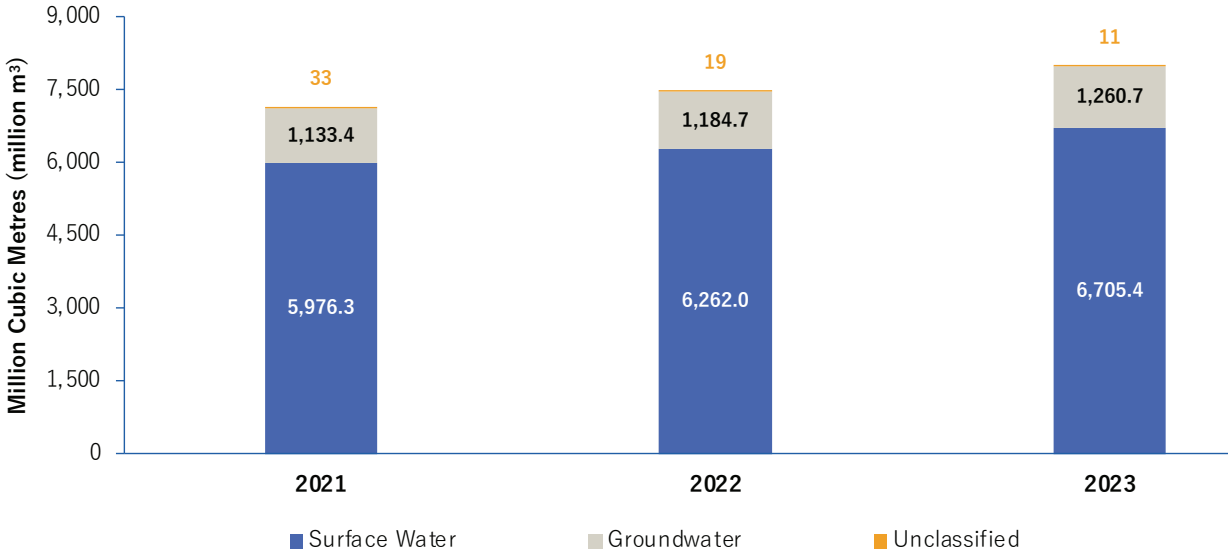
Livestock water use declined marginally from 103.1 million cubic meters in 2021 to 101.5 million cubic meters in 2023, sourced almost exclusively from surface water, consistent with pastoralist and agro-pastoralist practices drawing from rivers, dams, and water pans. Groundwater abstraction for livestock similarly declined slightly from 26.4 million cubic meters in 2021 to 26 million cubic meters in 2023. Aquaculture water use grew from 116.1 million cubic meters in 2021 to 248.4 million cubic meters in 2023, consistent with national food security strategies promoting inland aquaculture expansion.

Figure 6. Livestock water use by source, 2021–2023



Construction is the largest consumer of managed water across all three years, growing from 7,142.6 million cubic meters in 2021 to 7,977.1 million cubic meters in 2023, a cumulative increase of 11.7 percent. Surface water dominates at 84.1 percent of the sector's total in 2023, with groundwater growing from 1,133.4 to 1,260.7 million cubic meters, reflecting increased borehole use at remote construction sites.

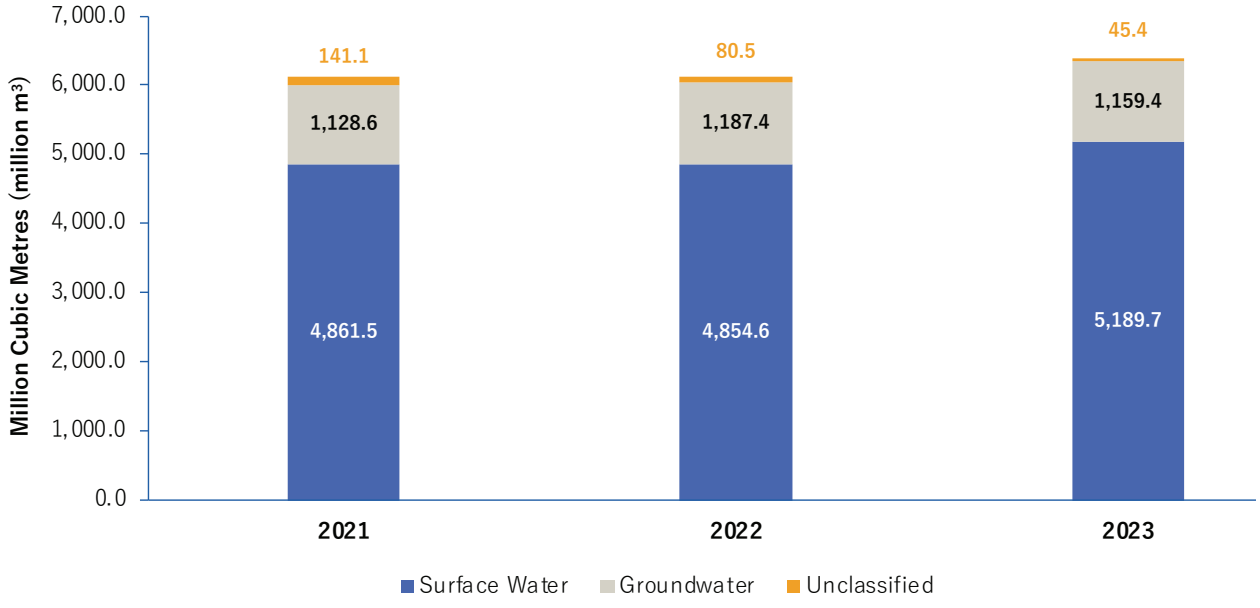
Figure 7. Construction water use by source, 2021–2023





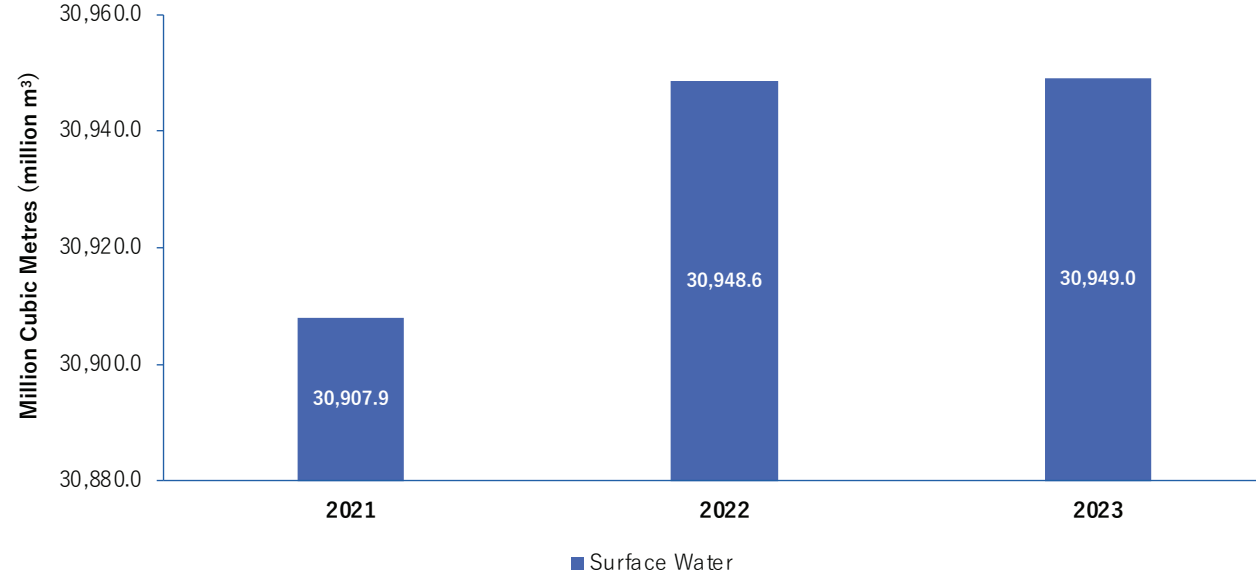
The health and social work sector recorded water use of 6,131.2 million cubic meters in 2021, 6,122.5 million cubic meters in 2022, and 6,394.5 million cubic meters in 2023, a cumulative increase of 4.3 percent. Surface water accounts for 81.2 percent of sector supply in 2023, with groundwater supplementing supply in facilities outside urban utility coverage. Growth reflects the expansion of healthcare infrastructure under the Universal Health Coverage program and the water intensity of clinical operations. Health sector figures were estimated from available facility data, and actual volumes may be higher as coverage improves.

Figure 8. Health and social work water use by source, 2021–2023



The hydropower sector recorded virtually unchanged water use across all three years: 30,907.9 million cubic meters in 2021, 30,948.6 million cubic meters in 2022, and 30,949 million cubic meters in 2023. All water use in this sector is sourced from surface water. Hydropower is a *non-consumptive user* in accounting terms, returning virtually all water to river systems after passing through turbines. However, it is acutely sensitive to upstream flow changes: any reduction in river flows caused by climate variability, land use change, or increased upstream abstraction would translate directly into reduced generation capacity.

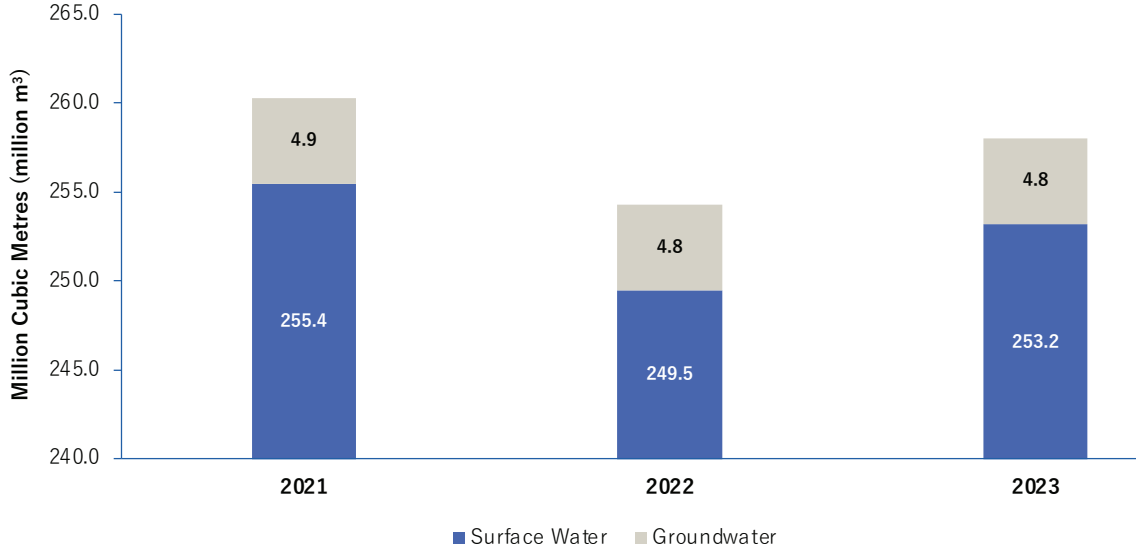
Figure 9. Electricity and gas water use by source, 2021–2023





The water supply utilities sector recorded abstraction of 260.3 million cubic meters in 2021, 254.3 million cubic meters in 2022, and 258 million cubic meters in 2023. These figures reflect abstraction for treatment and distribution rather than end use, and nearly all supply is sourced from surface water. Wastewater volumes directed to formal treatment facilities grew consistently from 118.2 million cubic meters in 2021 to 154.7 million cubic meters in 2023, a cumulative increase of 30.9 percent. Untreated wastewater discharge declined from 237.3 million cubic meters in 2021 to 185.4 million cubic meters in 2023, a reduction of 21.9 percent. While the direction is encouraging, 185.4 million cubic meters of untreated effluent entering Kenya's water bodies annually remains a significant environmental and public health liability, and the treatment rate of 45.5 percent in 2023 remains well below adequate levels.

Figure 10. Water supply utilities water use by source, 2021–2023



Education sector water use grew from 91.6 million cubic meters in 2021 to 96.6 million cubic meters in 2023. Industrial and commercial services grew from 58.8 million cubic meters in 2021 to 82.1 million cubic meters (39.6 percent) in 2023, with diversified sourcing across surface water, groundwater, and unclassified sources.

> **The water supply utilities sector recorded abstraction of 260.3 million cubic meters in 2021, 254.3 million cubic meters in 2022, and 258 million cubic meters in 2023. These figures reflect abstraction for treatment and distribution rather than end use, and nearly all supply is sourced from surface water.**

Figure 11. Education water use by source, 2021–2023

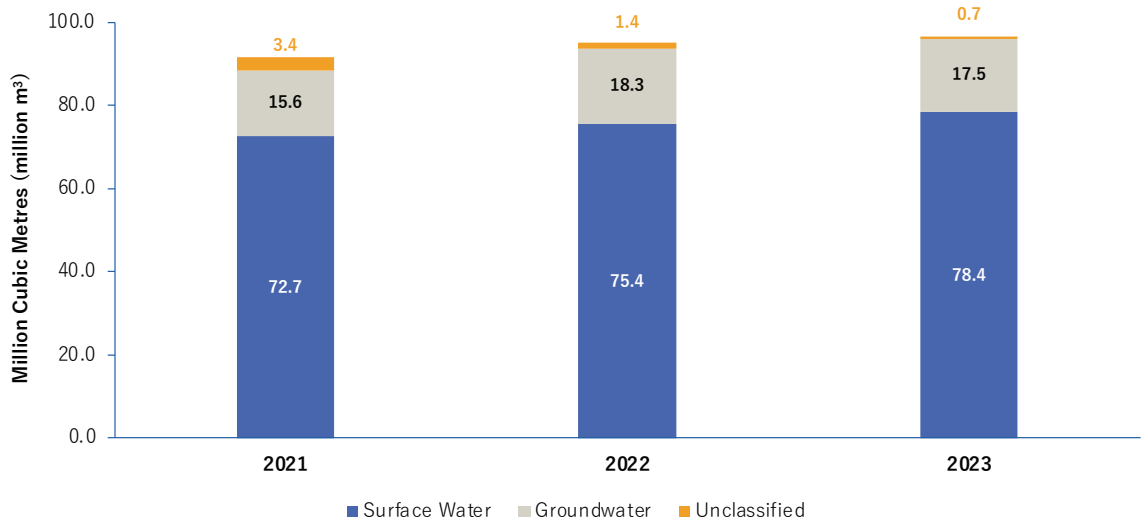
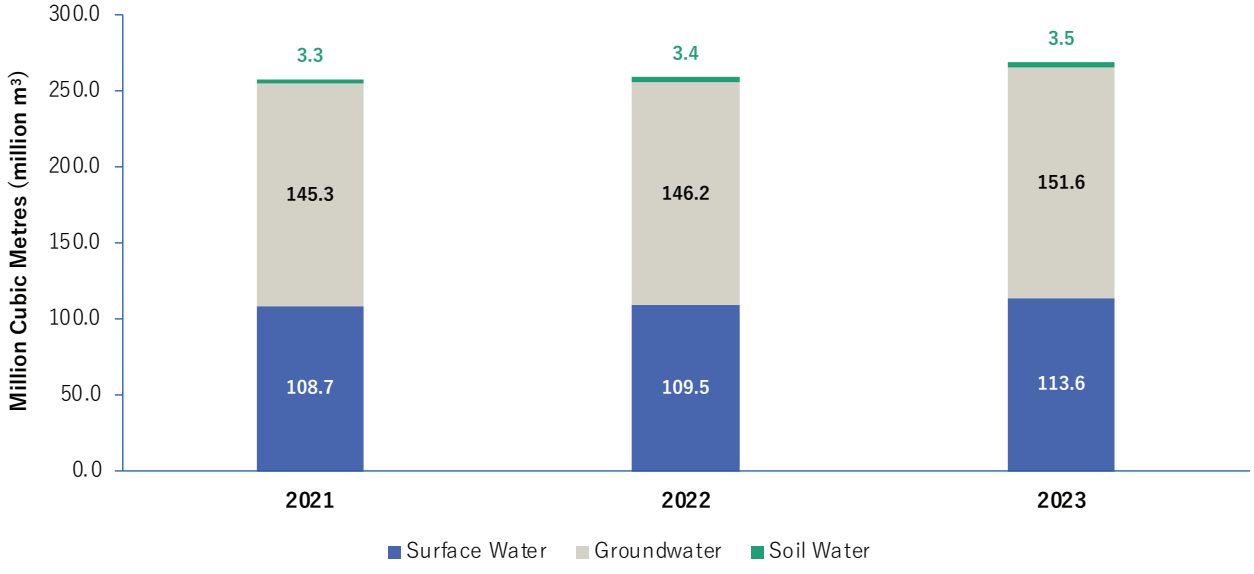


Figure 12 shows household water use by source for 2021 to 2023. Total household water use grew from 257.3 million cubic meters in 2021 to 268.7 million cubic meters in 2023, an increase of 4.4 percent, consistent with population growth and ongoing urbanization.

Figure 12. Households' water use by source, 2021–2023



Groundwater is the dominant supply source throughout the period, accounting for 56.4 percent of household supply in 2023, sourced from private boreholes and shallow wells. Surface water, representing households connected to formal utility networks, contributed 42.3 percent. Both sources grew modestly and in broadly equal proportion over the three years, with surface water rising from 108.7 million cubic meters in 2021 to 113.6 million cubic meters in 2023 and ground-

water from 145.3 million cubic meters in 2021 to 151.6 million cubic meters in 2023. Soil water use for own-account household production of agricultural products contributed a small but consistent share of 3.3 million cubic meters in 2021 to 3.5 million cubic meters in 2023.

The sustained groundwater dominance at the household level reflects the large proportion of Kenya's population, particularly in peri-urban and rural areas, that remains outside the reach of the formal piped utility network. Extending piped infrastructure to secondary towns and rural growth centres is a prerequisite for shifting this balance over successive editions of the accounts.

3.2.1.2 Year-on-Year Observations

Between 2021 and 2022, most managed sectors recorded only modest changes. Construction and irrigation both grew, while the health sector use declined marginally before recovering in 2023. The overall managed water economy contracted slightly in 2022, consistent with drought conditions that also suppressed rainfed agricultural volumes. The 2023 picture is more pronounced, with construction, irrigation, health, aquaculture, and industrial services all recording their highest volumes in the three-year period. This broad-based growth across managed sectors, coinciding with the El Niño rainfall event, suggests that improved water availability in 2023 supported increased abstraction across productive sectors.

3.2.2 Return Flows and Environmental Outputs

This section presents the environmental outflows recorded in the accounts: return flows to inland water resources, groundwater recharge, evapotranspiration, non-revenue water, and water incorporated into products. Together, these flows complete the water balance and confirm the internal structure of the PSUTs under the SEEA-Water framework. Table 4 below presents the full breakdown of environmental output flows for 2021 to 2023.

Table 4. Return flows, evapotranspiration, non-revenue water and net consumption, 2021–2023

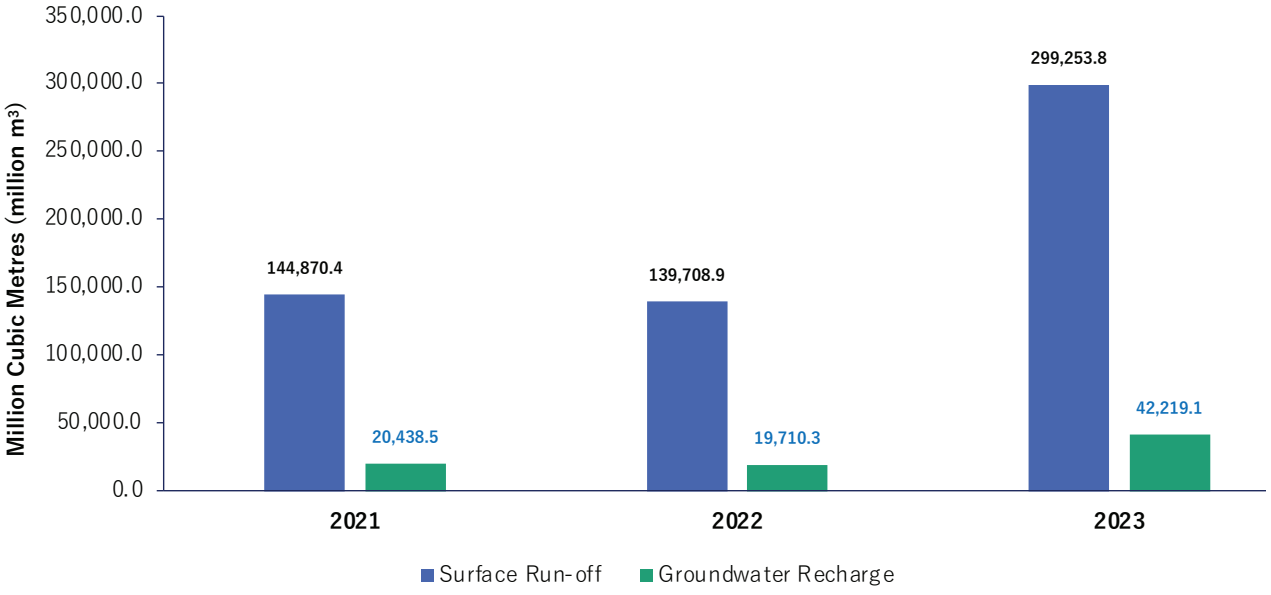
FLOW CATEGORY	2021 (m^3)	2022 (m^3)	2023 (m^3)	Δ 21 → 22	Δ 22 → 23	% Chg 21 → 23
Total Return Flow to Inland Waters	203,363,194,675	198,041,962,950	380,564,062,813	-5,321,231,725	182,522,099,863	87.1%
Surface Runoff	144,870,392,160	139,708,919,389	299,253,790,852	-5,161,472,771	159,544,871,463	106.6%
Groundwater Recharge (Infiltration)	20,438,500,000	19,710,312,828	42,219,107,115	-728,187,172	22,508,794,287	106.6%
Evapotranspiration	80,387,947,971	80,387,947,971	80,669,024,712	0	281,076,741	0.3%
Non-Revenue Water / Distribution Losses	213,746,531	205,104,751	195,517,726	-8,641,780	-9,587,025	-8.5%
Water Incorporated into Products (Net)	20,742,221,970	18,160,851,248	118,579,155,500	-2,581,370,723	100,418,304,253	471.7%

Source: Kenya Water Accounts PSUTs 2021–2023.

Note: Return flows and groundwater recharge surge in 2023 with El Niño rainfall. Evapotranspiration remains stable.

Figure 13 shows total surface runoff and groundwater recharge components of return flows to inland water resources for 2021 to 2023, as related to rainfed agriculture.

Figure 13. Surface runoff and groundwater recharge components of return flows to inland water resources, 2021–2023



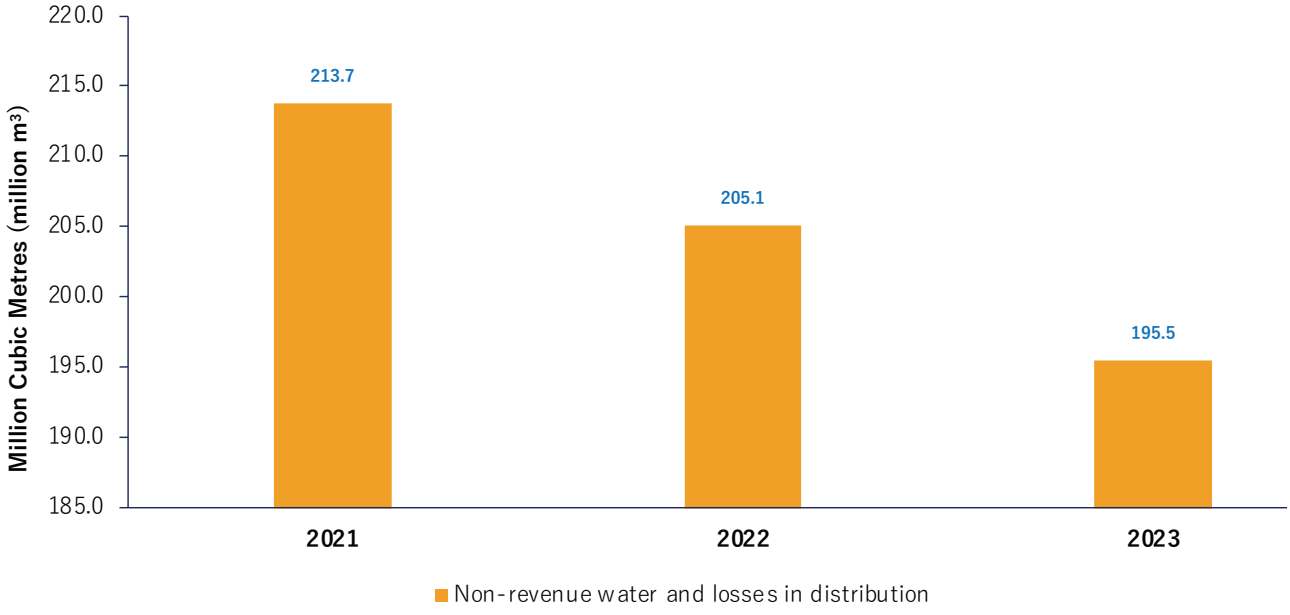
Total return flows to inland water resources were 203,384.4 million cubic meters in 2021, 198,042 million cubic meters in 2022, and 380,564.1 million cubic meters in 2023. The 2023 year-on-year increase of 92.2 percent mirrors the precipitation (soil water) expansion, as above-normal rainfall generated substantially greater surface runoff and groundwater recharge. This is a normal hydrological response to above-normal rainfall. Figure 13 shows only the surface run-off and groundwater recharge components of these flows, which relate to rainfed agriculture. Return flows from the other sectors are recorded in aggregate in Table 4 and are not disaggregated by pathway.

Groundwater recharge was 20,438.5 million cubic meters in 2021, declining slightly to 19,710.3 million cubic meters in 2022, before expanding to 42,219.1 million cubic meters in 2023, an increase of 114.2 percent. The 2023 recharge windfall directly replenished aquifer storage, but it should not be treated as a reliable baseline. Recharge is directly dependent on rainfall, and future dry years will reduce it while abstraction demand continues to grow.

Evapotranspiration remained stable across the three years at 80,388 million cubic meters in both 2021 and 2022, with a marginal increase to 80,669 million cubic meters in 2023 (0.3 percent). This reflects consistent land use and vegetation patterns across Kenya's agro-ecological zones. Figure 14 shows non-revenue water and distribution losses for 2021 to 2023.



Figure 14. Non-revenue water and distribution losses, 2021–2023



Non-revenue water declined consistently from 213.7 million cubic meters in 2021 to 205.1 million cubic meters in 2022 (4 percent) and 195.5 million cubic meters in 2023 (4.7 percent). The cumulative reduction of 8.5 percent reflects genuine infrastructure management improvement by water service providers, attributable to pipe rehabilitation, pressure zone management, and District Metered Area implementation. Each million cubic meters of non-revenue water eliminated avoids equivalent abstraction, treatment, and distribution costs.

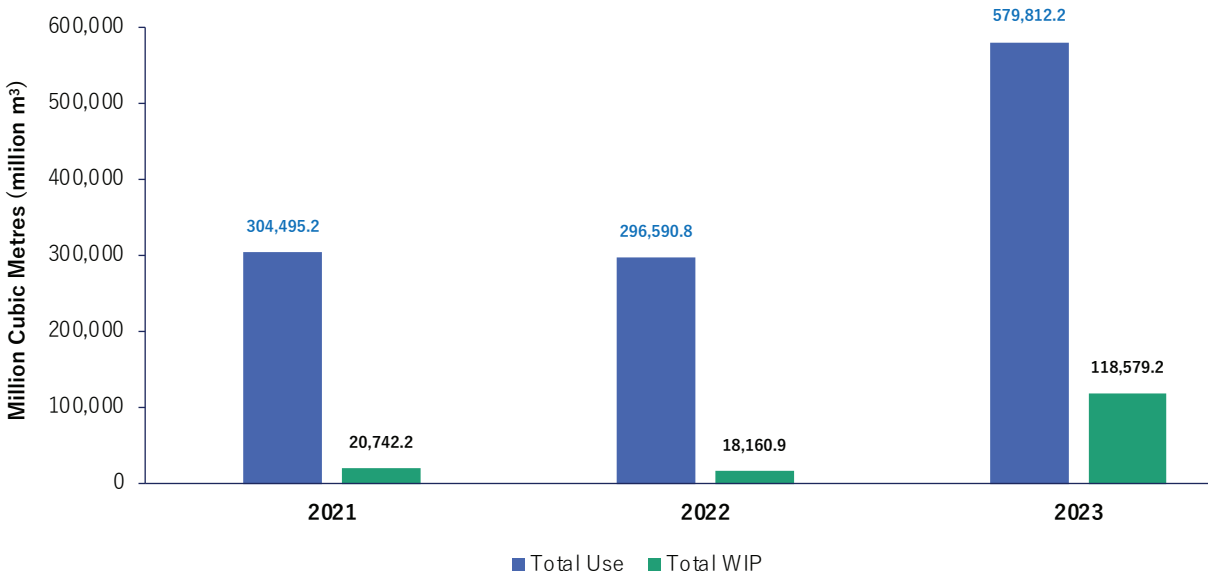
Water incorporated into products (WIP) is the most precise measure of net water consumption in the accounts. Unlike gross abstraction figures, which count water that is later returned to the environment, WIP records only the volume physically embedded in outputs such as crops, manufactured goods, and processed water that does not re-enter the water cycle within the accounting period.

WIP stood at 20,742.2 million cubic meters in 2021, declining to 18,160.9 million cubic meters in 2022, before surging to 118,579.2 million cubic meters in 2023. As with total water use, the 2023 figure is driven almost entirely by rainfed agriculture and the use of soil water, which embedded 106,966.8 million cubic meters of water directly in crop outputs, a direct consequence of the El Niño rainfall event. Excluding the soil water used in rainfed agriculture, the trend in managed-sector WIP is consistently upward across all three years, with construction, irrigation, and health accounting for the bulk of growth. This upward trend in managed-sector net consumption is the more policy-relevant signal: it indicates that the economy's draw on rivers and aquifers is increasing in ways that are not offset by return flows.

3.3 Total Water Use vs Total Water Incorporated into Products

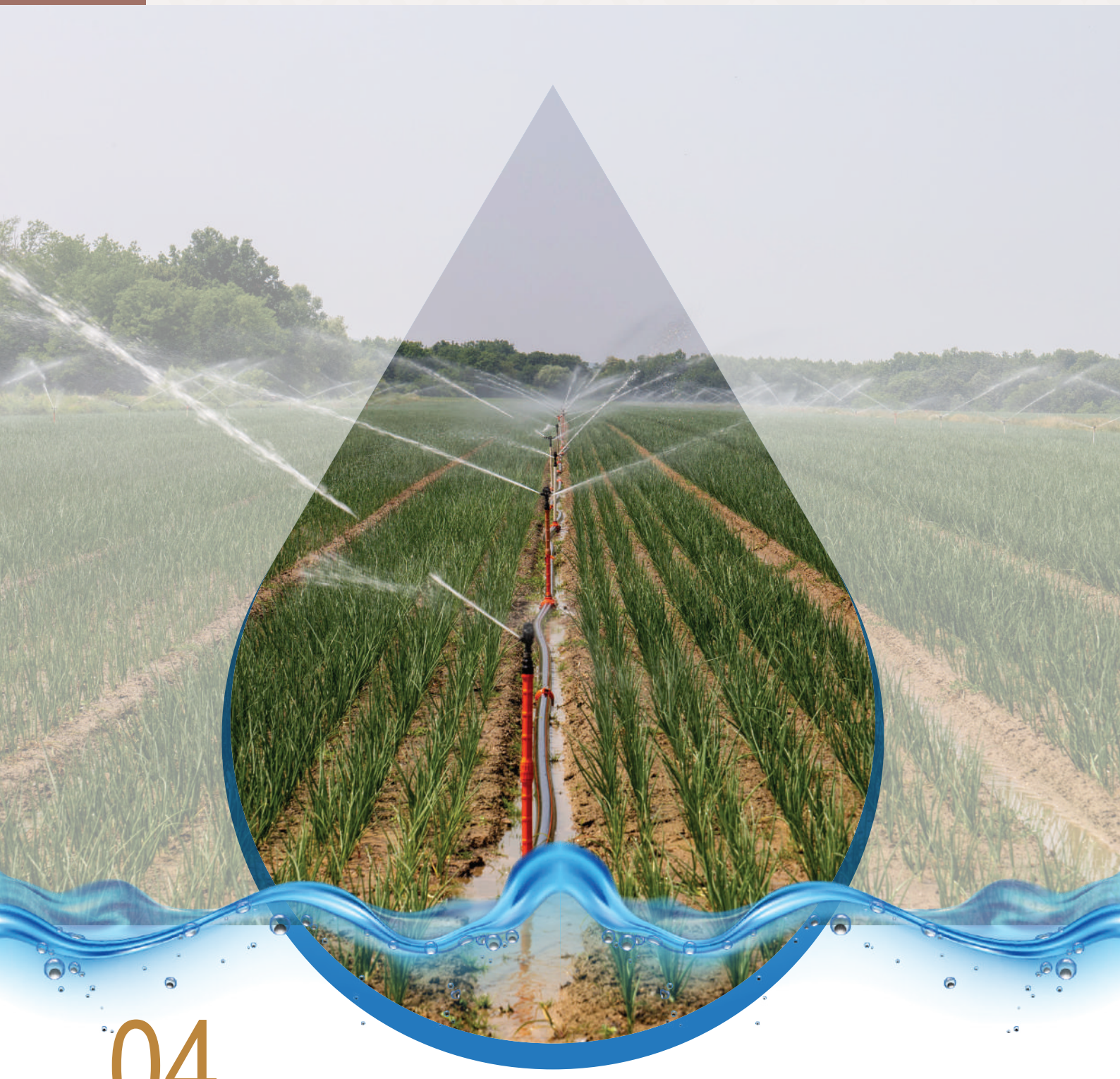
Figure 15 presents total water use alongside total water incorporated into products (WIP) for each year from 2021 to 2023.

Figure 15. Total water use vs total WIP, 2021–2023



Across all three years, total water use substantially exceeded water incorporated into products, reflecting the large volume of water that passes through the economy and returns to the environment without being consumptively used, mostly through hydroelectric returns. Total water use stood at 304,495.2 million cubic meters in 2021, declining modestly to 296,590.8 million cubic meters in 2022, before nearly doubling to 579,812.2 million cubic meters in 2023. Water incorporated into products, representing the net consumptive portion of that use, was considerably smaller: 20,742.2 million cubic meters in 2021, 18,160.9 million cubic meters in 2022, and 118,579.2 million cubic meters in 2023.

The consumptive use ratio, computed as WIP as a share of total use, was 6.8 percent in 2021, 6.1 percent in 2022, and 20.4 percent in 2023. Both the total use and WIP figures for 2023 are heavily influenced by the El Nino rainfall event, which drove a near-doubling of rainfed agricultural volumes. When soil water use by rainfed agriculture is excluded, the consumptive use ratio across managed sectors is considerably higher and more stable across the three years, reflecting the water intensity of construction, irrigation, and health and social work activities.



04 Recommendations

The findings from Kenya's Physical Water Accounts for 2021 to 2023 point to several specific areas where policy intervention, institutional reform, and investment would improve the sustainability and governance of water resources. The recommendations below are drawn directly from the evidence in the accounts.

Accelerate Irrigation Permitting and Enforce Abstraction Limits

Irrigated agriculture is the fastest growing consumer of managed water by absolute volume, with abstraction rising from 3,279 million cubic meters to 4,323.1 million cubic meters between 2021 and 2023, an increase of 31.8 percent. Over the same period, the compliance level for abstraction permits declined from 66.9 percent to 64 percent, with irrigation's share of unpermitted abstraction volumes growing from approximately 20.5 percent in 2021 to 23.7 percent in 2023. The Water Resources Authority should prioritize the regularization of existing unlicensed irrigation abstractions and strengthen enforcement mechanisms to ensure that new irrigation expansion does not proceed ahead of permitting. Adoption of water-efficient irrigation technologies, including drip and sprinkler systems, should be promoted in parallel to moderate the rate of demand growth.

The Water Resources Authority should prioritize the regularization of existing unlicensed irrigation abstractions and strengthen enforcement mechanisms to ensure that new irrigation expansion does not proceed ahead of permitting. Adoption of water-efficient irrigation technologies, including drip and sprinkler systems, should be promoted in parallel to moderate the rate of demand growth.

Invest in Wastewater Treatment Infrastructure

The accounts show that the wastewater treatment rate improved from 33.3 percent in 2021 to 45.5 percent in 2023, which is a positive trend. However, 185.4 million cubic meters of untreated wastewater were discharged in 2023, falling well short of the universal access to reasonable standards of sanitation guaranteed under Article 43(1)(b) of the Constitution of Kenya, 2010. Investment should be directed at expanding sewerage network coverage and treatment plant capacity in secondary towns and peri-urban areas, where untreated discharge poses the greatest risk to downstream water quality and public health.

Sustain and Scale Up Non-Revenue Water Reduction Programs

Non-revenue water declined from 213.7 to 195.5 million cubic meters between 2021 and 2023, a reduction of 8.5 percent, demonstrating that infrastructure rehabilitation and pressure zone management are delivering measurable results. This trajectory should be maintained and extended. Each million cubic meters of non-revenue water eliminated avoids equivalent abstraction, treatment, and distribution costs, making continued investment in leak detection, pipe rehabilitation, and district metered area implementation one of the most cost-effective water security interventions available.

Develop a Basin-Level Water Allocation Framework

The current accounts present water supply and use at the national level. The data on construction sector growth (up 11.7 percent over the period);



groundwater abstraction increases across irrigation, construction, health, and households; and the dominance of surface water in hydropower and utility supply all point to growing pressure on specific river basins that national totals cannot adequately capture. A basin-level water allocation framework, drawing on the six drainage basins described in Annex B, would allow the Water Resources Authority to identify where sustainable yield thresholds are most at risk and to prioritize monitoring accordingly.

Establish a Systematic Groundwater Monitoring Program

Groundwater abstraction grew across every productive sector between 2021 and 2023, including irrigated agriculture (up to 111 million cubic meters), construction (up to 1,260.7 million cubic meters), health facilities, and households, where groundwater accounts for 56.4 percent of supply. The 2023 groundwater recharge windfall of 42,219.1 million cubic meters should not be treated as a reliable baseline: recharge is directly dependent on rainfall, and future dry years will reduce it while abstraction demand continues to grow. A national aquifer monitoring program is needed to establish sustainable yield thresholds before abstraction trends in arid and semi-arid areas become irreversible.

Institutionalize Annual Water Accounts Production

This report represents the first edition of Kenya's Physical Water Accounts, covering 2021 to 2023. For the accounts to serve their intended purpose as a planning and governance tool, they must be produced annually and consistently. KNBS, in collaboration with the Water Statistics Technical

Working Committee, should formalize the compilation process, document the methodology and estimation approaches used in this edition, and establish data sharing arrangements aligned with ISIC Rev.4 between WRA, WASREB, NIA, KMD, and other contributing agencies to ensure that future editions can be produced without the data gaps and estimation uncertainties that constrained this first compilation. This is consistent with Kenya's commitments under the NP-AEEA 2025–2028 and with SDG 6.4 monitoring obligations.

Develop Water Asset Accounts in Subsequent Editions

The Physical Supply and Use Tables compiled in this report are flow accounts: they record how water moved through the economy during 2021, 2022, and 2023, but they do not record whether Kenya's total water stocks are increasing or decreasing over time. The report identifies growing groundwater abstraction across every productive sector and flags aquifer sustainability as a concern, but without opening and closing stock data for surface water bodies and aquifer systems, it is not possible to determine whether current abstraction rates are within sustainable yield thresholds. Compiling water asset accounts that record water stocks at the start and end of each accounting period should be incorporated into the scope of a future edition under the NP-AEEA 2025–2028 framework.

Develop Monetary Supply and Use Tables in Subsequent Additions

Future editions of the water accounts should include Monetary Supply and Use Tables. Physical Supply and Use Tables show how much water moves through the economy but they do not show the value of that water. Monetary Supply and Use Tables record the payments, costs, and value added associated with each water flow, completing the link between the water accounts and the System of National Accounts. Several policy questions cannot be answered from physical tables alone. Water-use efficiency by sector (SDG indicator 6.4.1) is defined as value added per cubic meter and cannot be computed without monetary value added. The gap between the price paid for water and the value that water generates in production (including the implicit value of soil water used in rainfed agriculture, where no price is paid) is invisible in physical accounts.

Producing Monetary Supply and Use Tables in future editions would build directly on the physical PSUTs already and is technically tractable for KNBS. Even partial coverage of water supply (ISIC 36), agriculture (ISIC 01–03), and electricity generation (hydropower under ISIC 35) would deliver a national estimate of water value added, sector-level water productivity, and SDG indicator 6.4.1.

Annex A: List of Tables

Supply Table 2023

Million cubic meters per annum

	Rainfed	Irrigation	Aquaculture	Livestock	Industrial/ Commercial	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Sewerage	Construction	Education	Human health and social work activities	Other Service Activities	Total Industry	Households	Flows from the Rest of the World (Imports)	Flows from the Environment	Total Supply
1. Sources of Abstracted Water:																	
Surface Water																47,848.9	**47,848.9**
Groundwater																2,793.8	**2,793.8**
Soil Water																529,112.2	**529,112.2**
Unclassified																57.3	**57.3**
Total Supply Abstracted Water																*579,812.2*	**579,812.2**
2. Water:																	
Distribution of abstracted water							453.5						453.5				**453.5**
Own use of abstracted water	106,966.8	4,323.1	248.4	101.5	82.1	30,949.0			7,977.1	96.6	6,394.5	4.5	157,143.6	268.7			**157,412.3**
From other sources (Cross-Border)													-		0.0		**0.0**
3. Wastewater and re-used water:																	
Wastewater to treatment								154.7					154.7				**154.7**
Wastewater (untreated)								185.4					185.4				**185.4**
Own treatment of wastewater													-				**-**
Re-used water produced (for distribution)													-				**-**
4. Return flows of water:																	
To inland water resources	**341,472.9**	**1,513.1**	**121.0**		**65.6**	**30,949.0**			**3,545.4**	**41.4**	**2,740.5**		**380,448.9**	**115.2**			**380,564.1**
~ Surface runoff	299,253.8																**-**
~ Groundwater recharge	42,219.1																**-**
Non-revenue water and losses in distribution							195.5						195.5				**195.5**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Evapotranspiration	80,669.0												80,669.0				**80,669.0**
Total water incorporated into products	106,966.8	2,810.0	127.4	101.5	16.4	-	258.0		4,431.7	55.2	3,654.0	4.5	118,425.6	153.5			**118,579.2**

Use Table 2023

Million cubic meters per annum

	Rainfed	Irrigation	Aquaculture	Livestock	Industrial/ Commercial	Electricity, gas, steam and air conditioning	Water collection, treatment and supply	Sewerage	Construction	Education	Human health and social work activities	Other Service Activities	Total Industry	Households	Flows to the Rest of the World (Exports)	Flows to the Environment	Total Use
1. Sources of Abstracted Water:																	
Surface Water		4,212.1	198.5	75.5	69.0	30,949.0	253.2		6,705.4	78.4	5,189.7	4.5	47,735.3	113.6			**47,848.9**
Ground Water		111.0	50.0	26.0	12.9		4.8		1,260.7	17.5	1,159.4		2,642.2	151.6			**2,793.8**
Soil Water	529,108.8												529,108.8	3.5			**529,112.2**
Unclassified Source					0.2		-		11.0	0.7	45.4		57.3				**57.3**
Total Use Abstracted Water	**529,108.8**	**4,323.1**	**248.4**	**101.5**	**82.1**	**30,949.0**	**258.0**	**-**	**7,977.1**	**96.6**	**6,394.5**	**4.5**	**579,543.6**	**268.7**			**579,812.2**
2. Water:																	
Use of distributed water					64.3					7.0		3.7	74.9	183.1			**258.0**
Non-revenue water and losses in distribution							195.5						195.5				**195.5**
Total water incorporated into products	106,966.8	2,810.0	127.4	101.5	16.4	-	258.0	-	4,431.7	55.2	3,654.0	4.5	118,425.6	153.5			**118,579.2**
3. Wastewater and re-used water:																	
Wastewater received from other units								154.7					154.7				**154.7**
Own treatment of waste-water							-	185.4					185.4				**185.4**
Re-used water (distributed reuse)																	**-**
4. Return flows of water:																	
To inland water resources																380,564.1	**380,564.1**
To other sources																80,669.0	**80,669.0**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Total water evaporated, transpired and incorporated into products																	
Non-revenue water and losses in distribution							195.5						195.5				**195.5**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Evapotranspiration	80,669.0												80,669.0				**80,669.0**
Total water incorporated into products	106,966.8	2,810.0	127.4	101.5	16.4	-	258.0		4,431.7	55.2	3,654.0	4.5	118,425.6	153.5			**118,579.2**

Supply Table 2022

Million cubic meters per annum

	Rainfed	Irrigation	Aquaculture	Livestock	Industrial/ Commercial	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Sewerage	Construction	Education	Human health and social work activities	Other Service Activities	Total Industry	Households	Flows from the Rest of the World (Imports)	Flows from the Environment	Total Supply
1. Sources of Abstracted Water:																	
Surface Water																46,743.8	**46,743.8**
Groundwater																2,725.3	**2,725.3**
Precipitation																247,020.1	**247,020.1**
Unclassified																101.5	**101.5**
Total Supply Abstracted Water															**-**	**296,590.8**	**296,590.8**
2. Water:																	
Distribution of abstracted water							459.4						**459.4**				**459.4**
Own use of abstracted water	7,209.5	4,031.7	214.4	97.2	81.0	30,948.6			7,465.8	95.1	6,122.5	4.6	**56,270.3**	259.0			**56,529.3**
From other sources (Cross-Border)													-				-
3. Wastewater and re-used water:																	
Wastewater to treatment								135.2				-	**135.2**				**135.2**
Wastewater (untreated)								209.3					**209.3**				**209.3**
Own treatment of waste-water													-				-
Re-used water produced (for distribution)													-				-
4. Return flows of water:																	
To inland water resources	**159,419.2**	**1,411.1**	**104.4**		**64.8**	**30,948.6**			**3,318.1**	**40.7**	**2,623.9**	**-**	197,931.0	**111.0**			**198,042.0**
~ Surface runoff	139,708.9																**-**
~ Groundwater recharge	19,710.3																-
Non-revenue water and losses in distribution							205.1						**205.1**				**205.1**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Evapotranspiration	80,387.9												**80,387.9**				**80,387.9**
Total water incorporated into products	7,209.5	2,620.6	109.9	97.2	16.2	-	254.3		4,147.6	54.3	3,498.6	4.6	**18,012.8**	148.0			**18,160.9**

Use Table 2022

Million cubic meters per annum

	Rainfed	Irrigation	Aqua-culture	Live-stock	Indus-trial/ Com-mer-cial	Electric-ity, gas, steam and air condi-tioning	Water collection, treatment and supply	Sew-erage	Con-struction	Edu-cation	Human health and so-cial work activities	Other Ser-vice Activi-ties	Total Industry	House-holds	Flows to the Rest of the World (Exports)	Flows to the Environ-ment	Total Use
1. Sources of Abstracted Water:																	
Surface Water		3,928.2	171.3	72.3	68.1	30,948.6	249.5		6,262.0	75.4	4,854.6	4.5	**46,634.3**	109.5			**46,743.8**
Ground Water		103.5	43.1	24.9	12.5		4.8		1,184.7	18.3	1,187.4		**2,579.2**	146.2			**2,725.3**
Soil Water	247,016.7												**247,016.7**	3.4			**247,020.1**
Unclassified Source					0.4				19.1	1.4	80.5	0.1	**101.5**				**101.5**
Total Use Abstracted Water	**247,016.7**	**4,031.7**	**214.4**	**97.2**	**81.0**	**30,948.6**	**254.3**	**-**	**7,465.8**	**95.1**	**6,122.5**	**4.6**	**296,331.8**	**259.0**			**296,590.8**
2. Water:																	
Use of distributed water					59.6				36.9	9.6	31.1		**137.2**	117.0			**254.3**
Non-revenue water and losses in distribution							205.1						**205.1**				**205.1**
Total water incorporated into products	7,209.5	2,620.6	109.9	97.2	16.2	-	254.3	-	4,147.6	54.3	3,498.6	4.6	**18,012.8**	148.0			**18,160.9**
3. Wastewater and re-used water:																	
Wastewater received from other units								135.2					**135.2**				**135.2**
Wastewater (untreated)								209.3					**209.3**				**209.3**
Own treatment of waste-water													**-**				**-**
Re-used water (distributed reuse)													-				**-**
4. Return flows of water:																	
To inland water resources																198,042.0	**198,042.0**
To other sources																80,387.9	**80,387.9**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Total water evaporated, transpired and incorporated into products													-				-

Supply Table 2021

Million cubic meters per annum

	Rainfed	Irrigation	Aquaculture	Livestock	Industrial/ Commercial	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Sewerage	Construction	Education	Human health and social work activities	Other Service Activities	Total Industry	Households	Flows from the Rest of the World (Imports)	Flows from the Environment	Total Supply
1. Sources of Abstracted Water:																	
Surface Water																45,600.5	**45,600.5**
Ground Water																2,570.8	**2,570.8**
Soil Water																256,146.1	**256,146.1**
Unclassified Source																177.8	**177.8**
Total Supply Abstracted Water																304,495.2	**304,495.2**
2. Water:																	
Distribution of abstracted water							474.0						**474.0**				**474.0**
Own use of abstracted water	10,446.0	3,279.0	103.1	226.3	58.8	30,907.9			7,142.6	91.6	6,131.2	4.4	**58,280.7**	257.3			**58,534.8**
From other sources (Cross-Border)													**-**		0.0		**0.0**
3. Wastewater and re-used water:																	
Wastewater to treatment								118.2					**118.2**				**118.2**
Wastewater (untreated)								237.3					**237.3**				**237.3**
Own treatment of waste-water													**-**				**-**
Re-used water produced (for distribution)													**-**				**-**
4. Return flows of water:																	
To inland water resources	**165,218.7**	**1,147.0**		**110.2**	**47.0**	**30,907.9**	**-**		**3,174.5**	**39.3**	**2,627.7**		**203,272.3**	**112.2**			**203,384.4**
~ Surface runoff	144,791.3												**144,870.4**				
~ Groundwater recharge	20,427.3												**20,438.5**				
Non-revenue water and losses in distribution							213.7						**213.7**				**213.7**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Evapotranspiration	80,387.9												**80,387.9**				**80,387.9**
Total water incorporated into products	10,446.0	2,131.3	103.1	116.1	11.8	-	260.3		3,968.1	52.4	3,503.6	4.4	**20,597.1**	145.2			**20,742.2**

Use Table 2021

Million cubic meters per annum

	Rainfed	Irrigation	Live-stock	Aqua-cul-ture	Indus-trial/ Com-mer-cial	Electric-ity, gas, steam and air condi-tioning	Water collection, treatment and supply	Sew-erage	Con-struc-tion	Edu-cation	Human health and so-cial work activities	Other Ser-vice Activi-ties	Total Industry	House-holds	Flows to the Rest of the World (Exports)	Flows to the Environ-ment	Total Use
1. Sources of Abstracted Water:																	
Surface Water		3,194.8	76.7	92.8	49.4	30,907.9	255.4		5,976.3	72.7	4,861.5	4.3	**45,491.7**	108.7			**45,600.5**
Ground Water		84.2	26.4	23.3	9.1		4.9		1,133.4	15.6	1,128.6		**2,425.5**	145.3			**2,570.8**
Soil Water	256,142.9								-	-	-		**256,142.9**	3.3			**256,146.1**
Unclassified Source					0.3				32.9	3.4	141.1	0.1	**177.8**				**177.8**
Total Use Abstracted Water	256,142.9	3,279.0	103.1	116.1	58.8	30,907.9	260.3	-	7,142.6	91.6	6,131.2	4.4	**304,237.9**	257.3	-		**304,495.2**
2. Water:																	
Use of distributed water					66.3				30.6	10.0	27.0		**133.9**	126.4			**260.3**
Non-revenue water and losses in distribution							213.7						**213.7**				**213.7**
Total water incorporated into products	10,446.0	2,131.3	103.1	116.1	11.8	-	260.3	-	3,968.1	52.4	3,503.6	4.4	**20,597.1**	145.2			**20,742.2**
3. Wastewater and re-used water:																	
Wastewater received from other units								118.2					**118.2**				**118.2**
Wastewater (untreated)								237.3			-	-	**237.3**				**237.3**
Own treatment of waste-water													**-**				**-**
Re-used water (distributed reuse)													**-**				**-**
4. Return flows of water:																	
To inland water resources																203,384.4	**203,384.4**
To other sources																80,387.9	**80,387.9**
5. Evaporation of abstracted water, transpiration and water incorporated into products:																	
Total water evaporated, transpired and incorporated into products																	-

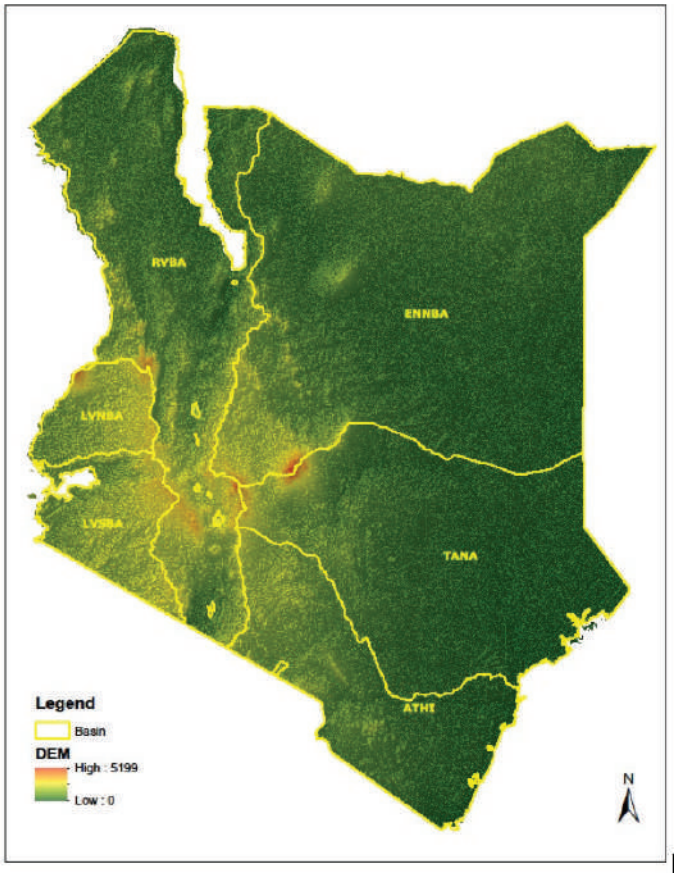
Annex B: Kenya's Water Resources

Kenya's water resources are shaped by highly variable rainfall, complex topography, and significant regional disparities in availability. Mean annual rainfall across the country is approximately 680 mm, ranging from about 200 mm in the arid and semi-arid lands to approximately 1,800 mm in the humid highland zones (Ministry of Environment, Water and Natural Resources and Water Resources Management Authority, 2013).[1] This unevenness has direct consequences for how much water different regions can access, how reliable river flows are from season to season, and how heavily communities depend on groundwater. Kenya's water resources are organized across three broad categories: drainage basins and their river and lake systems, groundwater aquifers, and precipitation.

Drainage Basins

Surface water is divided across six drainage basins[2]: Athi, Tana, Lake Victoria South, Lake Victoria North, Rift Valley, and Ewaso Ng'iro North. Figure A1 shows the spatial extent of each basin overlaid on a Digital Elevation Model, illustrating the relationship between Kenya's topography and drainage patterns.

Figure A1. Kenya's six drainage basins



Source: Water Resources Authority (WRA)/Kenya National Bureau of Statistics (KNBS)

[1] Ministry of Environment, Water and Natural Resources and Water Resources Management Authority (2013). The Project on the Development of the National Water Master Plan 2030: Final Report, Volume I, Executive Summary. Nairobi: Republic of Kenya/Japan International Cooperation Agency (JICA)

[2] Water Resources Authority (WRA). Basin Areas. Nairobi: Water Resources Authority.

The Athi Basin covers 66,559 km² and is the most densely populated, encompassing Nairobi and Mombasa. The Tana Basin at 126,208 km² drains the Mount Kenya highlands and feeds the country's longest river system before reaching the Indian Ocean. The Lake Victoria South and North basins together support a substantial share of Kenya's western population and drain into Lake Victoria, the country's largest freshwater resource and a shared transboundary lake managed under the Lake Victoria Basin Commission. The Rift Valley Basin at 131,423 km² is centred on a series of significant rift lakes including Turkana, Naivasha, Baringo, Bogoria, Nakuru, and Elementaita. The Ewaso Ng'iro North Basin at 210,000 km² is the largest basin and the least populated, covering the arid north and northeast.

The major river systems include the Athi, which drains 57 percent of its basin and is joined by the Nairobi River downstream of the capital; the Tana, which originates on Mount Kenya and flows to the coast via Garissa; the Nzoia, which drains approximately 70 percent of the Lake Victoria North basin; and the Ewaso Ng'iro, which originates near Mount Kenya and terminates in the Lorian Swamp in the northeast. Most rivers in the northern basins are seasonal.

Kenya's wetlands form an important but often overlooked component of the water system. The Tana River Delta, the Yala Swamp, and the Lorian Swamp all perform significant water regulation functions including flood attenuation, groundwater recharge, and sediment retention. Their degradation reduces the natural buffering capacity of river systems and affects downstream water availability.

Groundwater Aquifers

Kenya's groundwater resources are distributed across five major geological formations: Archaean, Proterozoic, Palaeozoic and Mesozoic sediments, Tertiary and Quaternary volcanics, and Tertiary and Quaternary sediments. The eastern parts of the country, underlain by sedimentary rocks, hold the most significant aquifer systems and provide critical supply in areas where surface water is seasonal or absent. Groundwater abstraction grew across every productive sector between 2021 and 2023, underscoring the importance of systematic aquifer monitoring to establish sustainable yield thresholds before abstraction in arid and semi-arid areas becomes irreversible.

Precipitation

Precipitation is the ultimate source of all water entering Kenya's water system. The country experiences two main rainfall seasons: the long rains between March and May, and the short rains between October and December. A third rainfall season occurs between June and August in the coastal region, the highlands west of the Rift Valley, and the Lake Victoria Basin.[3] The highland water towers, including the Aberdare Range, Mount Kenya, and the Mau Forest Complex, generate the river flows that sustain downstream basins and are the most critical recharge zones in the country. The sensitivity of Kenya's water system to inter-annual rainfall variability is clearly demonstrated in the accounts: the El Niño rainfall event of 2023 drove a near-doubling of total recorded national water use, almost entirely through the use of soil water by rainfed agriculture.

[3] Kenya Meteorological Department (2022). State of the Climate Kenya, 2022. Nairobi: Republic of Kenya.



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