Indian Water Week 2026

Urban Water Body Management and Environmental Issues

A Case Study of Kabul City in Afghanistan

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A child waits for water in Kabul — the daily reality behind the data.

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PRESENTATION OUTLINE

01 Introduction & Research Context

02 Study Area — Kabul City

03 Sanitation Challenges & Climate Change Impacts

04 Natural Drainage Issues

05 Water Resources Crisis

06 Results & Discussion

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INTRODUCTION

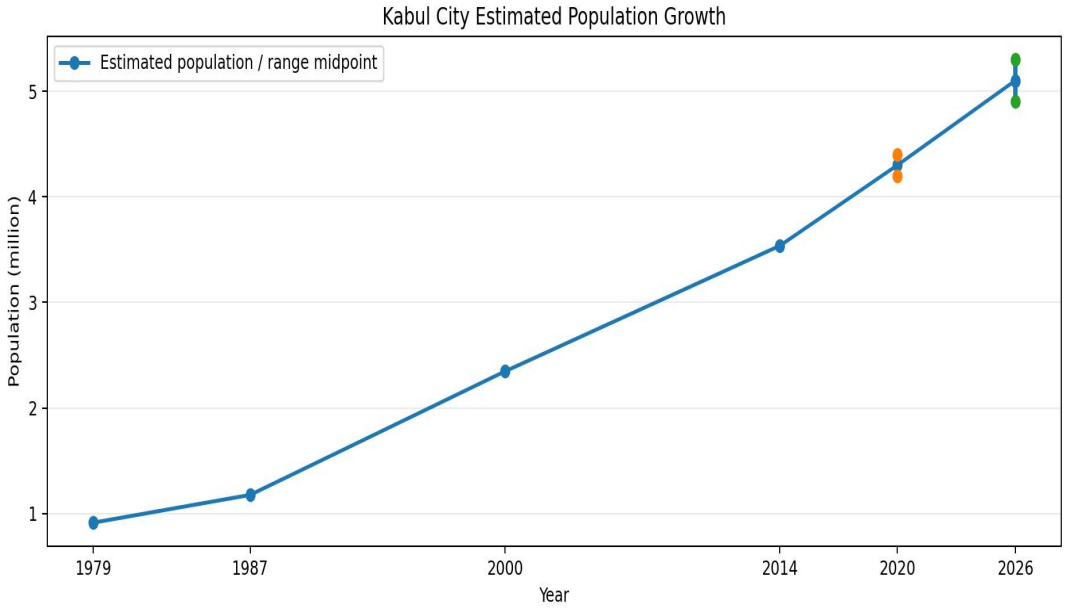
Research Context

Kabul City faces severe environmental pressures driven by:

- Fast-paced urbanization and prolonged conflict
- Poor infrastructure and weak governance
- Intensifying effects of climate change
- Groundwater supplies 85% of Kabul's population needs yet is severely depleted and polluted
- No centralized sewage network — reliance on septic tanks and pit latrines
- Rapid depletion rate of 2.1 m/year observed in multiple districts


Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development and Ganga Rejuvenation
9th
India International Water Week - 2026
THEME: CLIMATE RESILIENT WATER MANAGEMENT
September 22–26, 2026 | Convention Center & Hall No. 14, Bharat Mandapam, New Delhi

KABUL CITY POPULATION STATISTICS AND GROWTH



Estimated Population

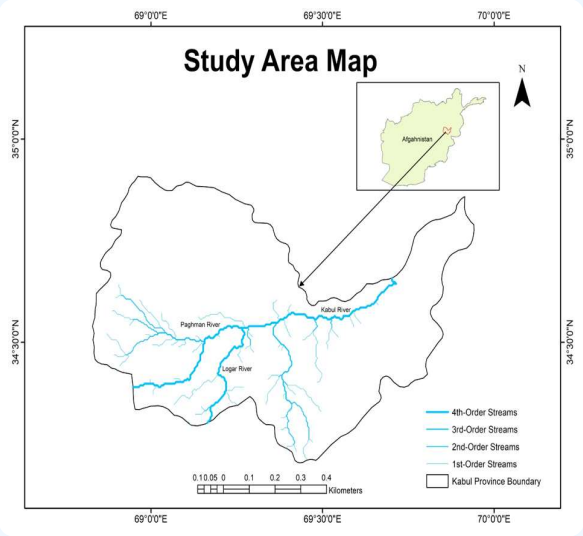
Year	Estimated Population
1979	≈ 913,000
1987	≈ 1,176,000
2000	≈ 2,347,000
2014	≈ 3,536,000
2020	≈ 4,200,000–4,400,000
2026	≈ 5- 6 million

Key implication: population growth increases urban water demand and pressure on limited water resources.

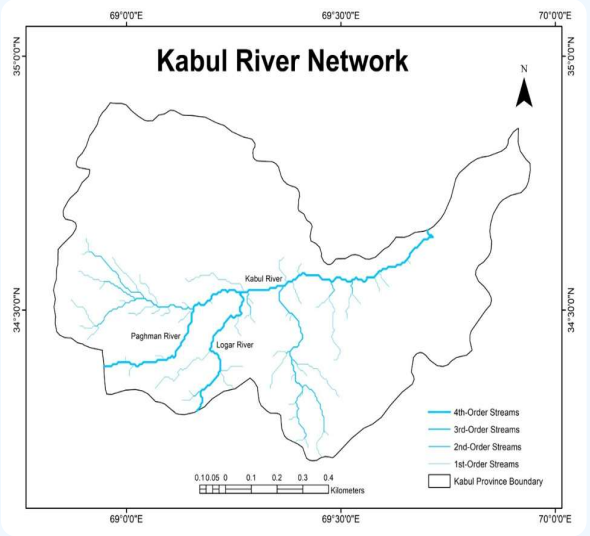
Source: Asian Development Bank

STUDY AREA — KABUL CITY, AFGHANISTAN

Elevation:	1,791 m (5,876 ft)
Total Area:	383.1 km² (KMA: ~1,763 km²)
Population:	~4.95 million (2025)
Districts:	22 Municipal Districts
Climate:	Cold Semi-Arid (BSk)
Primary Water:	Groundwater (85%)



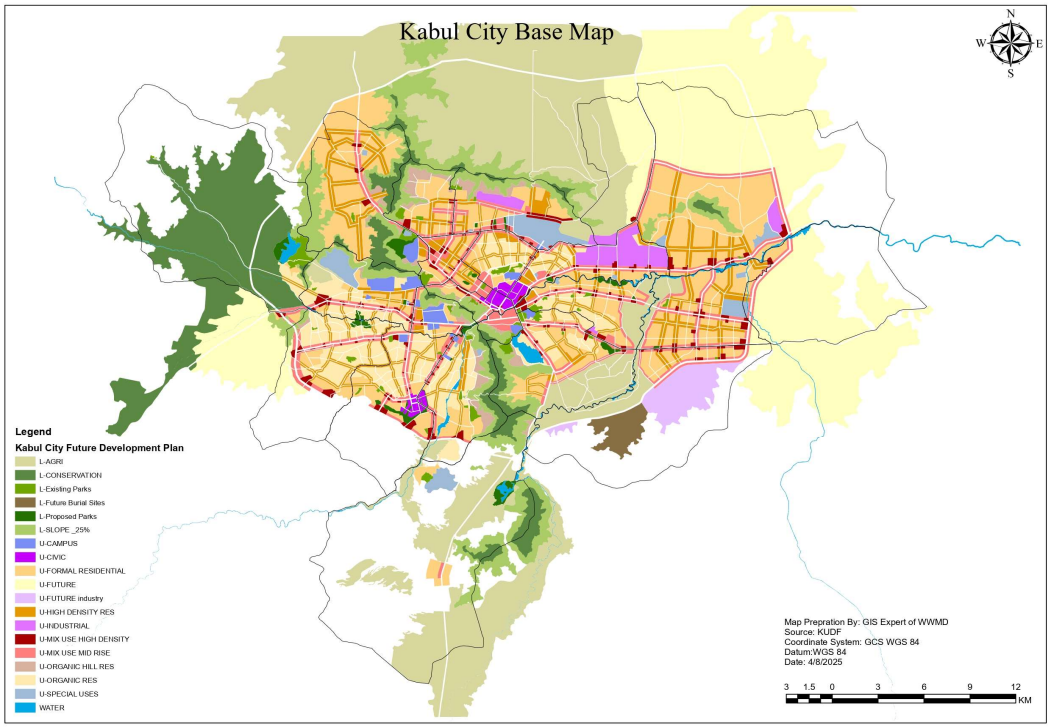
Study Area Map



Kabul River Network

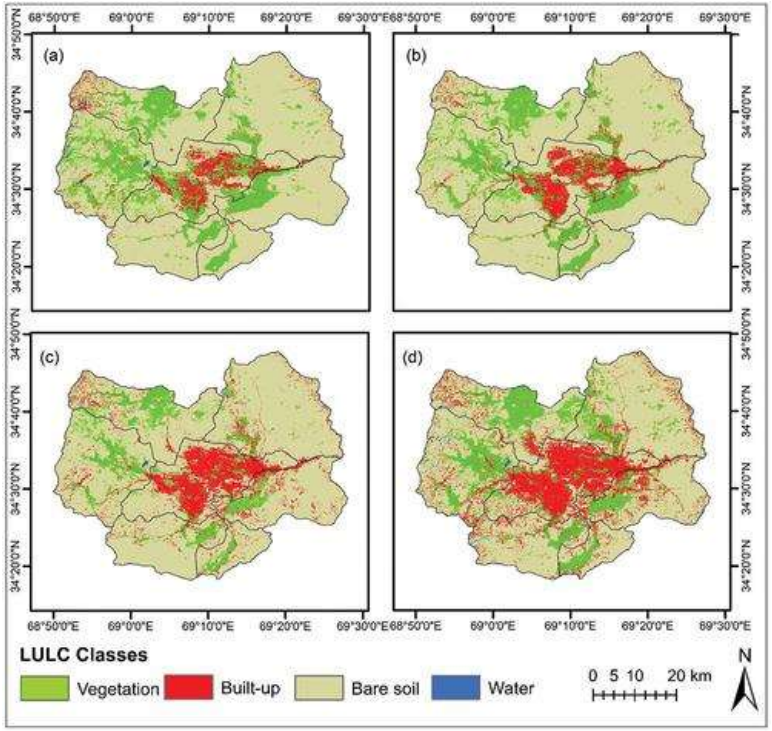
- Situated in a valley of the Hindu Kush mountains with the Kabul River at its center,
- Kabul is the nation's primate city — accounting for over 40% of Afghanistan's urban population.
- The Kabul River basin including Logar, Paghman and Panjshir tributaries forms the city's primary natural drainage system.
- Its mountainous location makes it inherently vulnerable to water shortages during dry spells and flash flooding during heavy rainfall.

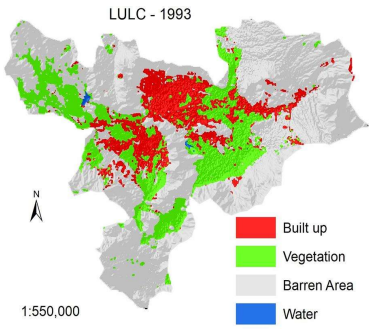
KABUL CITY BASE MAP

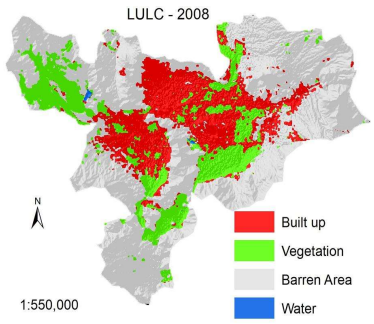


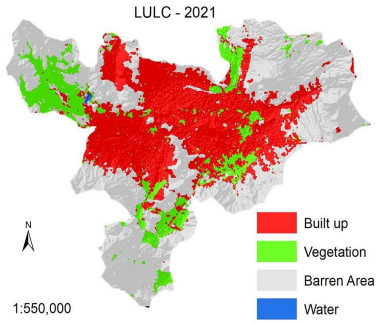
Source: Kabul Urban Development Framework (KUDF)

LAND USE / LAND COVER — MULTI-TEMPORAL CLASSIFICATION









Source: Compiled by the authors

Panels (a)–(d) show sequential LULC classifications for Kabul City, with built-up area (red) expanding progressively across the series while vegetation and bare soil recede — consistent with the sustained urban growth trend documented for the city.

LAND USE / LAND COVER CHANGE — KABUL CITY (1993–2021)

+165.0%
Built-up Area Growth
(1993 – 2021)

-34.5%
Vegetation / Agriculture
Area Lost

+227.2 km²
Net Built-up Area
Gained

LULC Class	1993 (km²)	2021 (km²)	Change (km²)	Change (%)
Built-up Area	137.7	364.8	+227.2	**+165.0%**
Vegetation / Agriculture	303.1	198.6	-104.5	**-34.5%**
Bare Land	177.2	132.0	-45.2	**-25.5%**
Water Body	10.6	11.3	+0.7	**+6.6%**
Others	21.4	23.3	+1.9	**+8.9%**
Total	**649.9**	**729.9**	—	—

Source: Ahmadi, S., & Sahak, H. (2022). Evaluation of urban sprawl and land use/cover variation patterns through remote sensing data: A case study in Kabul City, Afghanistan. *European Journal of Geography, 13*(1), 98–112.

OBJECTIVES & METHODOLOGY

Research Objectives

1. To assess the current state of Kabul's urban water resources and their management.

2. To investigate the environmental, socio-economic, and governance challenges affecting water management.

3. To develop IWRM-based recommendations for pollution control, decentralized treatment, and climate adaptation to improve sustainable urban water management.

Methodology

Comprehensive Literature Review

Secondary data analysis (2013–2025): govt. publications, NGO databases, academic papers. Focus: groundwater depletion trends, drainage impacts of urbanization, sanitation infrastructure gaps.

Field Observations & Site Surveys

Site inspections at hydrological nodes — Andrabi Road, Kabul riverbronts. Visual documentation using high-resolution photography of riverbed conditions, wastewater discharge points.

Observational Analysis

Documented the 'Jerrycan Economy' — manual water collection by women and children — as evidence of collapsed municipal piped water infrastructure.

SANITATION CHALLENGES UNDER CLIMATE CHANGE IMPACTS

~100%	>50%	80%	60%	~33%
Residential wastewater released untreated	Homes without upgraded toilets	Population using pit latrines	Without centralized water services	Without access to basic drinking water

Core Sanitation Problems

- No centralized sewage — dependence on septic tanks and pit latrines
- Groundwater pollution worsened by absence of sewerage in informal settlements
- Falling river levels accelerate contaminant accumulation in subsurface water
- Schools and health centers forced to close due to water shortage and pollution
- High water table and poorly constructed drainage causes severe sanitary issues

Social & Gender Dimensions

- Women and girls bear disproportionate burden of water collection — limiting education
- Children missing school due to water collection duties — perpetuating poverty cycle
- Water-borne diseases exacerbated by malnutrition from low agricultural productivity
- Conflict and scarcity drive unsafe coping strategies including early marriage
- Growing geopolitical tensions over shared transboundary water supplies

NATURAL DRAINAGE ISSUES IN KABUL CITY

The Kabul River, its tributaries, seasonal streams, and natural valleys historically managed storm runoff — but rapid urbanization, environmental degradation, and climate change have severely impaired these natural drainage functions.

Channel Encroachment

Rapid urban growth has blocked or narrowed natural drainage routes, diminishing capacity and causing overflow during downpours.

Kabul River Degradation

Sedimentation, solid waste dumping, and untreated wastewater discharge have reduced the river's hydraulic efficiency and flood transport capacity.

Loss of Infiltration Zones

Development has replaced permeable surfaces (green spaces, floodplains) with impervious areas, increasing peak flows during heavy rainfall.

Climate-Driven Extremes

Increased frequency of flash floods, prolonged droughts, and high-intensity rainfall events overwhelm natural channels and promote sediment accumulation.

Inadequate Stormwater Systems

Absence of designed stormwater systems in informal areas causes waterlogging, uncontrolled runoff, and mixing of stormwater with wastewater.

Lack of Legal Protection

Natural streams and floodplains are excluded from official urban planning frameworks, making them susceptible to encroachment and abuse.

83.5% of Kabul residents consider absence of sewage and drainage systems a HIGH-IMPACT urban environmental issue (Rezayee et al., 2019)

WATER RESOURCES CRISIS IN KABUL CITY

85%
Population dependent on groundwater

25–30 m
Groundwater level drop in last decade

2.1 m/yr
Average annual depletion rate

44 MCM/yr
Extraction exceeds natural recharge

80%
Groundwater contaminated (WHO)

~50%
Shallow bore wells already dried up

Critical Warning — UNICEF Projection

UNICEF predicts that Kabul's aquifers could run out entirely by 2030, potentially forcing up to 3 million people to relocate. Over 120,000 uncontrolled private bore wells drain groundwater at nearly double the natural replenishment rate. Pollutants include arsenic, nitrates, E. coli, and heavy metals — exceeding WHO standards across up to 80% of tested sources.

KABUL CITY WATER SUPPLY & PER CAPITA WATER AVAILABILITY

Reported average water availability

≈20 LPCD

ADB Kabul MAR assessment

Desirable minimum

80 LPCD

ADB reference level

Approximate gap

≈60 LPCD

20 LPCD versus 80 LPCD

- Kabul residents have historically been substantially undersupplied with water.
- The ADB reports average availability of about 20 litres per capita per day (LPCD), compared with a desirable minimum of 80 LPCD.
- This deficit reinforces dependence on groundwater, private wells and other alternative supplies.

Implication: increase water availability through recharge + rainwater harvesting + watershed management + improved urban supply planning.

Source: Asian Development Bank, Preparing the Kabul Managed Aquifer Recharge Project (PPTA 48440-002).

SITE VISIT DOCUMENTATION — KABUL RIVER (February 2026)



Location: Andrabi Road area & Kabul Riverfront, Kabul, Afghanistan | **Date:** 07/02/2026 & 11/02/2026 |
Coordinates: N 34°30.90770' / E 69°10.29392' | Altitude: 1,803 m

THE HUMAN FACE OF KABUL'S WATER CRISIS

★ Most Repesentative



A child rests while waiting for water — the daily toll of Kabul's water crisis falls hardest on children, who often wait hours or skip school to fetch water for their families.



Dozens queue around a single water tanker



Neighborhood queue at a public water point



An elderly resident hauls water home



Jerricans lined up for an hours-long wait

Field photography documenting daily water-collection conditions across Kabul neighborhoods, 2024–2025.

WATER SUPPLY & ENVIRONMENTAL DEGRADATION — FIELD EVIDENCE

★ Key Evidence



The Kabul River reduced to a polluted trickle through the city center — direct visual evidence of the untreated wastewater discharge and solid-waste dumping described in this study's drainage assessment.



Private tanker delivering water to hillside households



Tanker refilling a household rooftop tank



Hand-pump well — a primary source for many families (AP)



Untreated waste choking an urban drainage channel

Source: Field photography and news documentation ,Kabul water-supply and drainage sites.

RESULTS & DISCUSSION — WATER CRISIS IN HUMAN TERMS



The 'Jerrycan Economy' — Kabul City, Afghanistan | Field Documentation, 2026

THE JERRYCAN ECONOMY

- Children and women manually transport water daily in wheelbarrows and jerricans.
- Direct result of total collapse of Kabul's piped municipal water infrastructure.
- Lost school hours represent generational cost of the water crisis.
- Private water companies resell groundwater at exploitative prices.

DRINKING WATER CRISIS

- Toxic link: Kabul River pollution seeps into shallow aquifers → contaminates **85% of drinking water**
- Groundwater level dropped **25–30 m** in past decade; nearly half of shallow wells already dry
- Crisis is structural, caused by governance failure, not mere resource scarcity
- In 2008 Oxfam survey: **40% cited water as cause of community and tribal conflicts**

UNICEF projects Kabul's aquifers could run out entirely by 2030 if current trends continue

ANNUAL RAINFALL DATA, KABUL CITY (2006–2023)

Table 1. Annual Rainfall in Kabul City (2006–2023) [mm]

Sl. No.	Year	Kabul City Rainfall (mm)
1	2006	364.1
2	2007	264.8
3	2008	184.8
4	2009	385.6
5	2010	262
6	2011	325.8
7	2012	367.8
8	2013	369.1
9	2014	372.8
10	2015	319.9
11	2016	296
12	2017	240.7
13	2018	233.6
14	2019	367.8
15	2020	335.9
16	2021	229.67
17	2022	305.34
18	2023	297.9
	Total	**5523.61**

Source: Afghanistan Meteorological Department; compiled by Authors' Study.

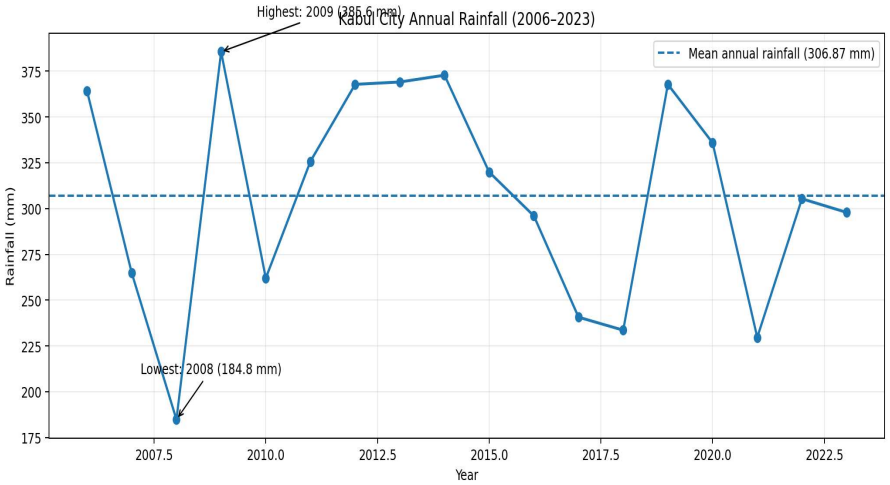
AVERAGE MONTHLY PRECIPITATION, KABUL CITY

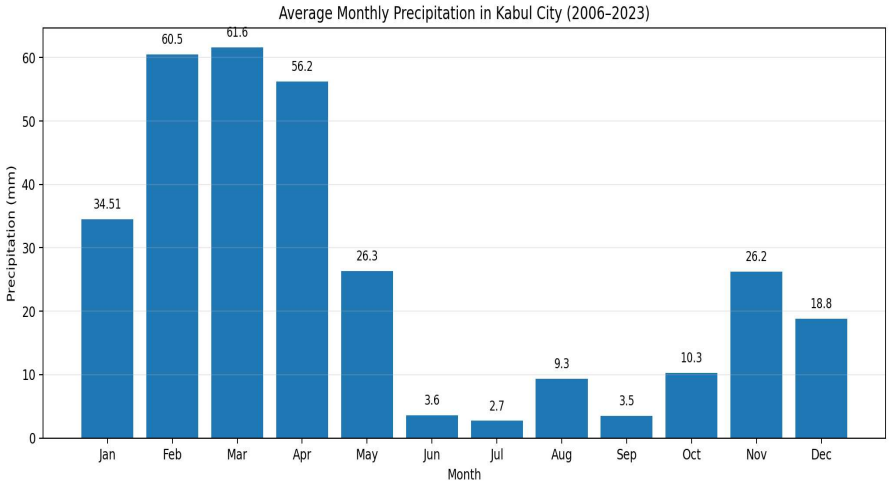
Table 2. Average Monthly Precipitation in Kabul City (2006–2023) [mm]

Month	Average Precipitation (mm)
Jan	34.51
Feb	60.5
Mar	61.6
Apr	56.2
May	26.3
Jun	3.6
Jul	2.7
Aug	9.3
Sep	3.5
Oct	10.3
Nov	26.2
Dec	18.8

Source: Afghanistan Meteorological Department; compiled by Authors' Study.

PRECIPITATION PATTERNS IN KABUL CITY (2006–2023)





01

Annual variability

Mean annual rainfall: 306.87 mm. Highest: 385.6 mm (2009); lowest: 184.8 mm (2008).

02

Strong seasonality

Rainfall is concentrated from January to April, while June–September receives very little precipitation.

03

Planning implication

Seasonal rainfall should be captured and retained through harvesting, check dams, recharge structures, and protected infiltration zones.

Source: Afghanistan Meteorological Department; compiled by Authors' Study

RECENT INTERNATIONAL & NGO EVIDENCE — KABUL WATER CRISIS

MERCY CORPS

09 MAY 2025

Kabul's Water Crisis

An Inflection Point for Action

Nearly half of Kabul's boreholes are reported dry; groundwater extraction dramatically exceeds natural recharge.

NGO / Humanitarian research

Source-page evidence panel

ICRC

22 MAR 2025

Afghanistan: Addressing the Water Crisis for Communities

Borewells in Kabul have dried and residents increasingly rely on commercial water tankers.

Groundwater decline and inadequate water infrastructure are increasing water insecurity.

International humanitarian organization

Source-page evidence panel

AL JAZEERA

05 JUL 2025

'End is near': Will Kabul become first big city without water by 2030?

Aquifer levels have fallen 25–30 m over the past decade, according to the Mercy Corps assessment.

The article links the crisis to over-extraction, climate change, governance failures and population growth.

International news

Source-page evidence panel

Source-page snapshot: headline/date + concise source-supported finding. Full article links are listed in the presentation notes/source list.

RECENT INTERNATIONAL & NGO EVIDENCE — KABUL WATER CRISIS

CNN

19 JUL 2025

Afghanistan's Kabul water crisis

CNN's report highlights the worsening shortage and household struggle to secure safe water.

The report draws on the Mercy Corps assessment and describes the crisis as a growing humanitarian concern.

International news

Source-page evidence panel

NDTV

20 JUL 2025

Half Of Kabul's Wells Are Dry, City Could Run Out Of Water In 5 Years

Nearly half of Kabul's boreholes are reported dry; extraction is about 44 million m³/year above recharge.

The report identifies over-extraction, rapid population growth, climate change and mismanagement as drivers.

International news / AFP

Source-page evidence panel

REUTERS

30 SEP 2025

Kabul's wells run dry, driving children out of class and into water queues

Families queue for hours for water; some wells that once reached 120 m have dried.

Reuters reports that poor households can spend up to 30% of income on tanker water.

International news / Reuters

Source-page evidence panel

Source-page snapshot: headline/date + concise source-supported finding. Full article links are listed in the presentation notes/source list.

INSTITUTIONAL & GOVERNANCE GAPS

Kabul's water crisis is fundamentally a governance crisis — not merely an infrastructure or resource problem. Overlapping responsibilities across multiple agencies with no coordinated framework have created systemic dysfunction.

Institutional Fragmentation

Water supply, sanitation, drainage, groundwater management, and environmental protection spread across multiple agencies with ill-defined coordination.

No Integrated Framework

Disjointed planning: land-use, solid waste, wastewater, and groundwater extraction function without systematic coordination.

Unregulated Bore Well Drilling

Absence of regulatory controls allows uncontrolled abstraction by 120,000+ private bore wells, exceeding natural recharge rates.

Weak Environmental Enforcement

Regulations on solid waste disposal and wastewater discharge are not stringently enforced, resulting in severe groundwater pollution.

Data & Technical Deficits

Lack of hydrogeological data, outdated monitoring systems, insufficient technical expertise, and financial constraints impede decisions.

Climate Change Not Integrated

Adaptation to climate change — long droughts and heavy rainfall events — has not been incorporated into urban water planning.

POLICY RECOMMENDATIONS FOR SUSTAINABLE WATER MANAGEMENT

01

Integrated Water Resources Management (IWRM)

Coordinate solid waste control, stormwater, wastewater treatment, and groundwater regulation under a unified management framework.

02

Decentralized Wastewater Treatment

Establish decentralized treatment facilities in high-density areas to prevent untreated sewage from reaching groundwater.

03

Riverbank & Drainage Protection

Legally protect and restore riverbanks and natural drainage courses to restore hydraulic capacity and reduce flood risk.

04

Artificial Groundwater Recharge

Implement infiltration zones along the Kabul River and controlled aquifer recharge basins to combat falling groundwater levels.

05

Rainwater Harvesting

Incorporate rooftop rainwater harvesting in building codes — especially for non-potable uses — to reduce groundwater dependency.

06

Improved Waste Management

Establish recycling systems and strictly enforce bans on improper waste dumping to prevent river and groundwater contamination.

07

GIS-Based Urban Planning

Use GIS tools for risk mapping, groundwater monitoring, and zoning to support evidence-based water infrastructure decisions.

08

Gender-Inclusive WASH Programs

Expand community awareness and gender-sensitive WASH initiatives to ensure equitable access to safe water and sanitation.

REGIONAL WATER RESOURCE STRATEGY

09

Regional Watershed Management & Water Resource Augmentation

Develop check dams, recharge structures, and rainwater-harvesting systems at the regional and upstream watershed scale to capture runoff, enhance groundwater recharge, reduce erosion and flood risks, and increase water availability for Kabul's urban areas. Integrate these measures into urban planning and infrastructure strategies to strengthen long-term urban water security.

Regional watershed

Manage upstream runoff and seasonal flows.

Check dams & harvesting

Retain water and reduce rapid downstream runoff.

Recharge & water storage

Increase infiltration and support groundwater recharge.

Urban water security

Improve water availability and strengthen resilient planning.

Planning mechanism: integrate regional watershed interventions with GIS-based urban planning, recharge zoning, drainage protection, and water-infrastructure investment.

CONCLUSION

- Kabul City's water crisis is multi-causal: urbanization, infrastructure gaps, groundwater over-exploitation, environmental degradation, and climate variability.
- Approximately 85% of the population depends on groundwater — now severely polluted and depleted faster than it is recharged.
- Untreated sewage, solid waste, and uncontrolled bore wells create a 'toxic link' threatening public health and urban stability.
- Water management challenges in Kabul are fundamentally governance and socioeconomic issues — not isolated technical failures.
- Rapid informal settlement growth, weak monitoring, lax enforcement, and fragmented institutions sustain the feedback loop of water shortage and environmental degradation.
- Without immediate action, Kabul risks a permanent hydrological breakdown — endangering millions of residents by 2030.

A new comprehensive urban water management strategy is urgently needed: integrating drainage restoration, wastewater treatment, groundwater control, waste management reform, and climate adaptation — underpinned by GIS surveillance, artificial aquifer recharge, and gender-inclusive WASH programs.

Thank You

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