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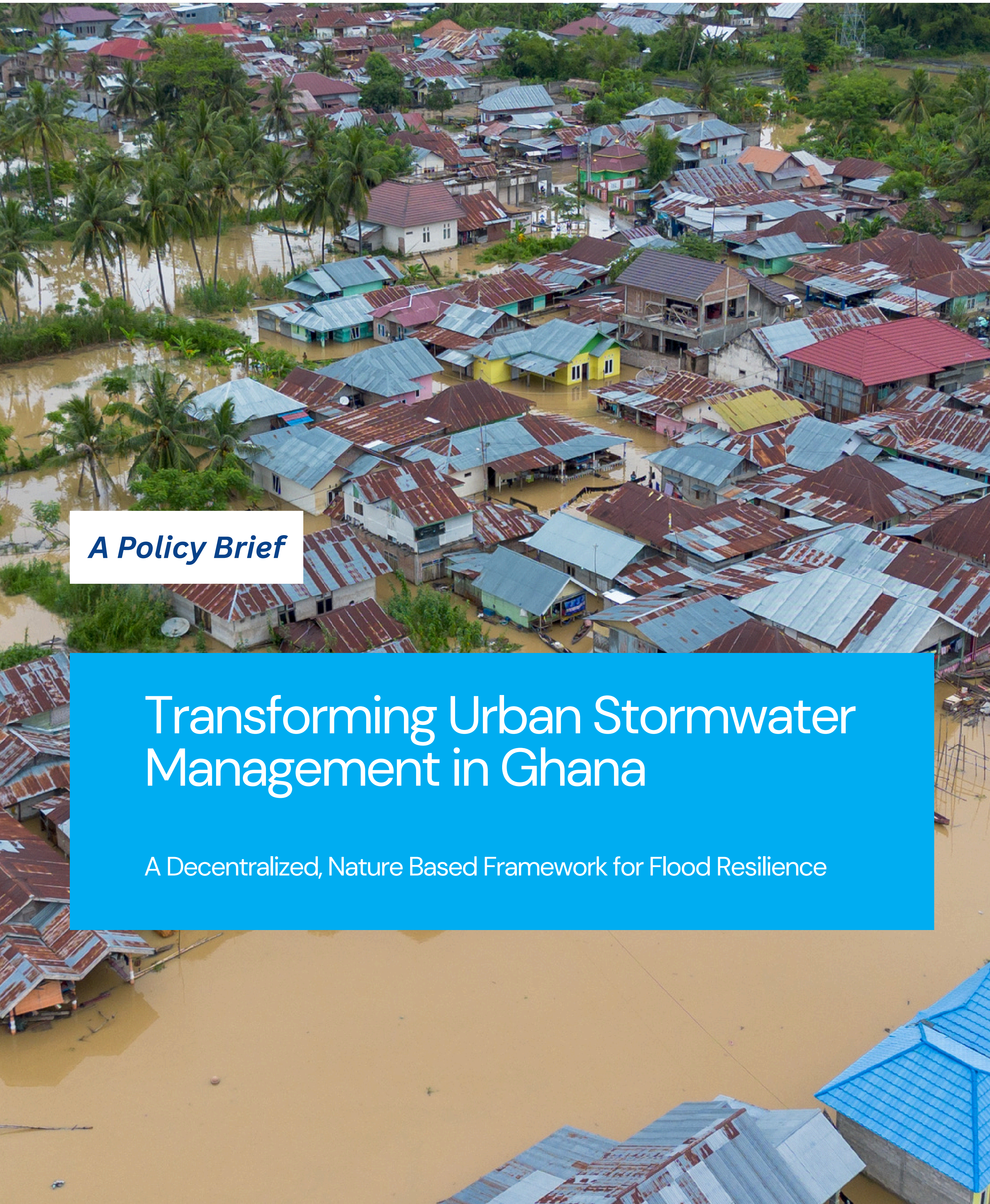

A Policy Brief

Transforming Urban Stormwater Management in Ghana

A Decentralized, Nature Based Framework for Flood Resilience

A Policy Brief Document

Issued By The Ghana Institution of Engineering

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Executive Summary

Ghana's rapidly urbanizing cities—especially Accra—are experiencing worsening flooding due to outdated, downstream-focused drainage systems, weak institutional coordination, and accelerating land-use change. Evidence from Andoh & Ocansey (2016) and the 12 January 2026 GhIE presentation by Professor Robert Andoh shows that traditional conveyance-based stormwater systems are no longer fit for purpose. . As the document notes, Accra "cannot continue relying on traditional, centralized, conveyance-based stormwater systems" because urbanization, weak waste management, and climate variability have outpaced system capacity.

A shift toward decentralized, nature-based, catchment-wide stormwater management is urgently required.

The Problem

1. Conventional Drainage Systems Are Failing

Accra's drainage model focuses on moving peak flows downstream as fast as possible.

This approach:

- Overloads downstream channels
- Requires high capital and maintenance costs
- Ignores upstream hydrology and land-use change
- Cannot keep pace with rapid, unplanned urbanization

Professor Andoh's presentation highlights that drains increasingly act as "solid-waste conduits, reducing hydraulic capacity," further undermining performance.

2. Flooding Frequency and Severity Are Increasing

Flooding in Accra has intensified since 2010, occurring even in dry seasons—evidence of structural rather than climatic drivers. The presentation notes that the Korle Lagoon Ecological Restoration Project "may have introduced hydraulic bottlenecks at the Odaw outfall," worsening backwater effects.

3. Institutional Fragmentation Prevents Integrated Action

Stormwater responsibilities are split across MWRWH, WRC, EPA, GWCL, MMDAs, and the Hydrological Authority. As the document states, "administrative boundaries do not align with drainage basins," preventing catchment-scale planning.

4. Ghana Has Not Adopted Decentralized Stormwater Management at Scale

Despite global best practice (GI, SUDS, WSUD), Ghana still relies heavily on:

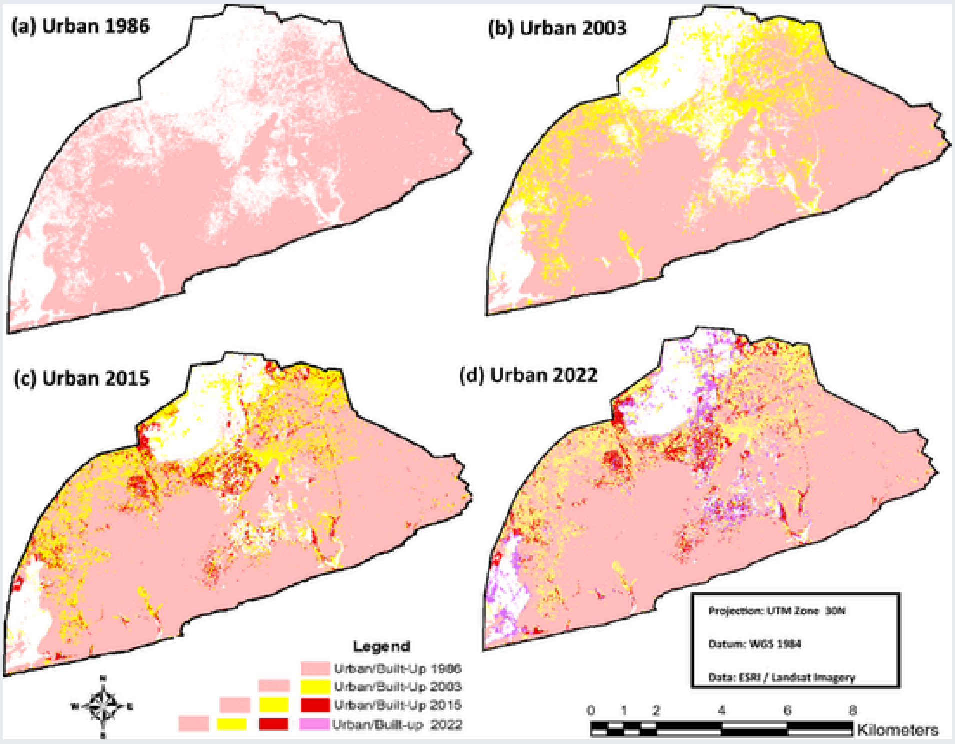
- Large drains
- Dredging
- Desilting
- Downstream engineering

Nature-based solutions remain underutilized.

Why Change Is Urgent

- Urbanization is accelerating in Ga East, Ga West, Adenta, and Kasoa.
- Impervious surfaces continue to expand.
- Waste management remains weak.
- Climate variability is increasing rainfall intensity.
- Hydraulic constraints at the Odaw–Korle system persist.

The document concludes that the shift to decentralized, nature-mimicking systems is "even more urgent today."



Policy Recommendations

01

Adopt a Decentralized, Nature-Based Stormwater Management Framework

- Implement upstream, distributed controls that mimic natural hydrology:
- Permeable pavements
- Bioswales and rain gardens
- Green roofs
- Distributed detention and infiltration systems
- Riparian buffers and green corridors
- Upstream interventions are “cheaper, more scalable, and more effective than downstream engineering.”

02

Introduce a National Post-Development Runoff Control Policy

Mandate that post-development peak runoff rates and volumes do not exceed pre-development levels.

Key components:

- Mandatory hydrological modelling for development approvals
- On-site detention, infiltration, and retention requirements
- Penalties for non-compliance; incentives for exceeding standards

The document notes this is “one of the most effective tools globally for reducing urban flood risk.”

03

Establish a National Rainwater Harvesting Policy

- Require rainwater harvesting in all new residential, commercial, and institutional buildings.
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- Policy elements:
- Integration into non-potable uses (irrigation, cleaning, flushing)
- Incentives for retrofitting existing buildings
- Recognition of rainwater harvesting as a stormwater volume-reduction tool, not just a water-supply measure

04

Introduce a National Post-Development Runoff Control Policy

Shift National Practice from Peak-Flow Conveyance to Volume Reduction

05

Establish Catchment-Based Planning Units

Align stormwater planning with hydrological boundaries and empower units to coordinate across MMDAs.

06

Strengthen Regulatory Enforcement

- Mandate permeable surfaces
- Prohibit full-plot paving
- Enforce buffer zones along waterways
- Require sediment and erosion control during construction

07

Mobilize Private Sector and Community Participation

Support local enterprises in green infrastructure installation and maintenance. Promote community stewardship of decentralized systems.

08

Retrofit Existing Infrastructure

Optimize existing drains using:

- Flow controls
- Detention cells
- Infiltration systems

Rather than replacing drains, enhance their performance through distributed controls.

Expected Outcomes

- Reduced flood frequency and severity
- Lower long-term infrastructure costs
- Improved water quality in rivers and lagoons
- Enhanced climate resilience
- Job creation in green infrastructure
- Alignment with SDG 6 and SDG 11

Conclusion

The evidence is clear: Ghana's current stormwater management model is structurally inadequate for today's urbanization and climate realities. A decentralized, nature-based, catchment-wide framework offers a cost-effective, resilient, and globally aligned pathway forward. As the document emphasizes, Accra must "shift from downstream, conveyance-based engineering to upstream, decentralized, nature-mimicking stormwater management." The time for policy reform is now.

Annex 1

Policy Justification

01

Hydrological Failure Mechanisms in Accra's Current System

1.1 Dominance of Peak-Flow Conveyance

Accra's drainage network is engineered primarily for rapid conveyance of peak flows, not for runoff volume reduction. As the document states, the system "focus[es] on peak flow conveyance rather than runoff volume reduction."

This creates three hydrological problems:

- Downstream surcharge: Concentrated flows exceed channel capacity.
- Shortened time of concentration: Faster runoff arrival increases peak discharge.
- No attenuation: Lack of upstream storage eliminates natural buffering.

1.2 Expansion of Impervious Surfaces

The document notes "full-plot paving of residential properties" and rapid urbanization. Imperviousness increases:

- Runoff coefficient (C)
- Peak discharge (Qp)
- Runoff volume (V)
- Pollutant wash-off

This shifts hydrographs upward and forward, overwhelming downstream drains.

1.3 Loss of Infiltration and Baseflow Regulation

Traditional systems ignore infiltration. Without infiltration:

- Soil moisture recharge declines
- Baseflow to streams becomes erratic
- Flashiness increases
- Flood peaks rise sharply

The document emphasizes the need for “source control (intercept, detain, infiltrate runoff near where it falls).”

1.4 Hydraulic Bottlenecks at the Odaw Outfall

The document states that KLERP “may have introduced hydraulic bottlenecks at the Odaw outfall.”

Hydrologically, this creates:

- Backwater effects
- Reduced discharge capacity during high tide or blockage
- Increased flood frequency upstream

This explains why floods now occur “even in the dry season.”

02

Why Decentralized, Nature-Based Systems Work Hydrologically

2.1 Restoring the Natural Water Balance

Nature-based systems (GI, SUDS, WSUD) restore the four components of the urban water balance:

1. Infiltration
2. Evapotranspiration
3. Interception
4. Detention

The document aligns with this by calling for "distributed storage across the catchment" and "infiltration systems."

2.2 Hydrograph Flattening and Peak Reduction

Upstream detention and infiltration:

- Increase lag time
- Reduce peak discharge
- Reduce runoff volume
- Lower downstream hydraulic stress

This is why the document states upstream interventions are "cheaper, more scalable, and more effective."

2.3 Volume-Based Control vs. Peak-Flow Control

Peak-flow control alone fails because:

- Developers can meet peak limits while still increasing total runoff volume
- Downstream channels remain overloaded
- Hydrographs become longer and higher

Volume-based control (recommended in the document) ensures:

- Total runoff volume is capped at pre-development levels
- Peak flows naturally reduce
- Drainage networks operate within design limits

3. Hydrological Basis for a Post-Development Runoff Control Policy

The document recommends that "post-development peak runoff rates and volumes must not exceed pre-development levels."

Hydrologically, this requires:

3.1 Pre-Development Baseline

- Soil infiltration capacity
- Vegetation interception
- Natural depression storage
- Lower runoff coefficients ($C \approx 0.1–0.3$)

3.2 Post-Development Controls

To match pre-development conditions, developments must incorporate:

- On-site detention
- Infiltration trenches
- Permeable pavements
- Green roofs
- Rainwater harvesting

These reduce Qp, V, and Tlag.

3.3 Why This Policy Is Globally Effective

Because it:

- Forces hydrological neutrality
- Eliminates cumulative downstream overload
- Makes developers responsible for their hydrological footprint
- Reduces long-term public expenditure on drains

4. Hydrological Rationale for Rainwater Harvesting as Stormwater Control

The document emphasizes that rainwater harvesting should be treated as a stormwater volume-reduction tool, not just a water-supply measure.

Hydrologically, rainwater harvesting:

- Removes a portion of rainfall from the runoff pathway
- Reduces effective imperviousness
- Provides detention storage
- Delays discharge
- Reduces peak flows and volumes

In dense urban areas like Accra, this is one of the few scalable upstream interventions.

5. Catchment-Based Planning: Hydrological Justification

The document notes that “administrative boundaries do not align with drainage basins.”

Hydrologically:

- Water flows by topography, not political boundaries
- Effective stormwater management requires catchment-scale modelling
- Upstream actions directly affect downstream flooding
- Fragmented governance leads to contradictory interventions
-

Catchment-based planning ensures:

- Coordinated detention and infiltration
- Consistent design standards
- Integrated modelling of flows, storage, and conveyance
- Efficient allocation of resources

Annex 2

Implementation Roadmap for Decentralised, Nature-Based Stormwater Management

Phase 1: Policy and Institutional Alignment (0-6 months)

- Finalize and adopt national policies on post-development runoff control and rainwater harvesting
- Establish catchment-based planning units within MWRWH and align mandates across WRC, EPA, GWCL, MMDAs, and the Hydrological Authority
- Issue regulatory directives on permeable surfaces, buffer zones, and erosion control.

Phase 2: Pilot Projects and Capacity Building (6-18 months)

- Launch pilot decentralized stormwater projects in Ga East, Adenta, and Kasoa
- Train MMDA engineers and planners on green infrastructure design and maintenance
- Develop national guidelines for bioswales, green roofs, and infiltration systems.

Phase 3: Scaling and Enforcement (18-36 months)

- Roll out national compliance framework for runoff control and rainwater harvesting
- Provide incentives for private sector participation and building retrofits
- Monitor and evaluate performance of pilot sites and scale successful models.

Phase 4: Long-Term Integration (3-5 years)

- Integrate stormwater planning into urban development approvals and land-use plans
- Institutionalize community stewardship programs for decentralized systems
- Embed stormwater resilience into national climate adaptation and SDG strategies.

Conclusion

The hydrological rationale is unequivocal: Accra's flooding is driven by structural, not climatic, factors. The document clearly states that Accra "must shift from downstream, conveyance-based engineering to upstream, decentralized, nature-mimicking stormwater management." The proposed framework aligns with global best practice and addresses the core hydrological drivers of urban flooding in Ghana.

Get in touch

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