Mainstreaming ILLBM: Introduction to Lentic–Lotic Integration for Resilient Basin Governance

ILEC Scientific Committee, August 2025

Preface

This document introduces the concept of Integrated Lentic–Lotic Basin Management (ILLBM), an evolution of Integrated Lake Basin Management (ILBM). ILLBM offers a governance-focused, continuum-based perspective that recognizes the interconnected nature of lakes, rivers, wetlands, and their associated ecosystems.

What follows is not a speculative idea or a quick policy suggestion. ILLBM is the result of *nearly a year of structured, in-depth discussions and refinements* by the ILEC Scientific Committee and collaborators. It has been informed by **analyses of multiple real-world basin cases** — from highland lake–river systems to deltaic wetlands — where existing governance frameworks could not fully address the hydrological, ecological, and socio-cultural realities at play.

These studies revealed recurring patterns that had **not been systematically recognized** before:

- Lakes behaving as dynamic hydrological nodes rather than static endpoints.
- Governance disconnects at river–lake and lake–coast interfaces.
- Groundwater–surface water linkages influencing seasonal stability and resilience.

The ILLBM framework is designed to make such realities visible and manageable, providing a structured way to align lentic–lotic governance without replacing existing integrative frameworks such as IWRM, IRBM, DRR, or Source-to-Sea (S2S).

1. From Fragmentation to Continuum Thinking

Over the past several decades, frameworks such as **Integrated Water Resources Management (IWRM)**, **Integrated River Basin Management (IRBM)**, **Integrated Coastal Zone Management (ICZM)**, **Disaster Risk Reduction (DRR)**, and **Source-to-Sea (S2S)** have broadened environmental governance. They have improved cross-sector coordination, strengthened upstream–downstream linkages, and promoted multi-jurisdictional cooperation.

Yet, despite these advances, operational misalignments persist. Lakes, wetlands, and other lentic systems remain underrepresented in flow-centric governance regimes. Their distinct hydrological patterns, ecological functions, and cultural roles — including long recovery periods, nutrient retention, and community traditions — often fall outside mainstream planning priorities.

The 2020 Global Call to Action recognized these shortcomings and reaffirmed the importance of elevating lakes within the international water agenda. This momentum built on ILBM — the only internationally recognized governance framework focused on lentic systems — which structures management around six foundational pillars: policy, institutions, participation, technology, information, and finance.

However, conventional "hydrostatic–hydrodynamic" thinking — emphasizing engineered flow control and resource extraction — tends to obscure the vulnerabilities of lentic waters, especially when they are interconnected with lotic systems. ILLBM emerged to address these governance blind spots, extending ILBM's logic into systems where lentic–lotic interdependencies define both ecological function and management reality.

2. Evolving from ILBM to ILLBM

ILBM has served for over two decades as a governance-centered platform for managing lake basins, enabling diagnostic assessment, multi-stakeholder dialogue, and capacity building. It remains essential in basins with clear lake mandates or limited river–lake–coast interactions.

But in highly interconnected systems, lake sustainability hinges on upstream nutrient and sediment control, downstream flow and salinity regulation, and lateral habitat connectivity. Conversely, rivers and wetlands depend on lakes' buffering, retention, and flow-stabilizing functions.

ILLBM makes these linkages explicit. It positions itself at the intersection of ILBM and integrated river basin governance, within the broader framework for basin-wide water resources planning, ensuring that lakes are not treated in isolation from their inflows and outflows — and that rivers are not managed without regard to their lentic counterparts.

A distinctive contribution of ILLBM is its flow-behavioral perspective: lakes, rivers, wetlands, and reservoirs can exhibit varying lentic or lotic characteristics depending on geography, seasonality, and infrastructure. These variations affect pollutant retention, flood propagation, and habitat dynamics, and must be incorporated into governance design.

ILLBM's scope extends beyond surface water to vertical linkages: groundwater recharge from rivers, aquifer–lake exchanges, and groundwater-fed springs that sustain seasonal flow and water quality. This integration of surface and subsurface water management is critical for both ecological resilience and community livelihoods. It aligns closely with the principles of **Integrated Groundwater Management (IGM)** — an established approach that promotes conjunctive use, recharge protection, and pollution control within basin-scale governance.

Experience from local-scale applications also supports recognizing a seventh governance pillar — Culture, History, and Tradition (Water Culture) — as a cross-cutting foundation that interacts with and strengthens all six existing pillars, embedding governance in identity, legitimacy, and community stewardship.

3. Why ILLBM, Why Now?

Global policy agendas — the SDGs, disaster risk reduction strategies, climate adaptation frameworks, and biodiversity conservation goals — increasingly emphasize the need for system-wide governance reform. Yet in practice, integration efforts remain under-resourced, and policies and projects are siloed.

Early exploratory applications of ILLBM — based on literature reviews and desk studies of real-world basins — revealed consistent challenges:

- Disconnects between upstream and downstream actors, and between science and governance.
- Legacy perceptions of lakes as static endpoints rather than active system nodes.
- Siloed initiatives that fail to build institutional continuity or learning.
- Unrecognized de facto ILLBM practices that remain unsupported.
- Stakeholder fatigue from repetitive, non-implementable planning cycles.

These findings confirm that ILLBM is not a theoretical invention, but a structured synthesis of patterns already emerging in practice — a tool to recognize them, align them, and make them actionable.

4. Signposts from Early ILLBM Explorations

Desktop-based reviews of interconnected lake–river–coast systems — such as highland glacial basins, large transboundary lakes with multiple inflows and outflows, and urbanizing delta systems — revealed that many already operate under ILLBM-like conditions, though without formal recognition.

Examples include:

- **Sediment–nutrient linkages** from upstream catchments affecting lake trophic status, with downstream implications for estuaries.
- **Seasonal groundwater–surface water exchanges** that stabilize dry-season flows and influence flood risk.

- **Cultural heritage practices** such as traditional irrigation channels and spring festivals are directly tied to hydrological patterns.
- **Flood/drought buffering** as lakes absorb peak flows during extreme rains, reducing downstream damage, while excessive withdrawals lower lake levels and reduce flows during droughts.
- **Urban–rural interactions** where cities often discharge wastewater into rivers feeding lakes, while lakes in turn supply raw water for urban populations.
- **Tourism–recreational linkages** as lake-based tourism depends on river inflows and also can impact downstream ecotourism through increased nutrients and sediments.
- **Invasive species spread across continua** where aquatic weeds often proliferate in lakes but spread via rivers and canals, and degrade water quality, navigation, and resource use downstream.
- **Wetland–lake biodiversity linkages** since migratory bird flyways and fish spawning routes rely on lentic wetlands and lotic corridors.
- **Reservoir cascades with mixed behavior** as hydropower reservoirs act as lentic nodes for sediment trapping, altering downstream nutrient and sediment balances.

These signposts show that even a light-touch ILLBM application can make hidden linkages visible, strengthen basin-wide collaboration, and validate local innovations within a broader governance framework.

5. Charting the Path Forward: Building the ILLBM Platform Process

Mainstreaming ILLBM calls for flexibility. The ILLBM Platform Process is not a rigid template but a governance interface architecture that can be adapted to different contexts:

- Stakeholder mapping to identify coordination and knowledge gaps.
- Joint framing sessions to co-define cross-cutting challenges.
- Scenario exercises to explore trade-offs under changing conditions.
- Parallel planning processes to bridge institutional timing mismatches.

Local experiences have demonstrated how ILLBM can:

- Integrate upstream–downstream reciprocity into legal ordinances.
- Combine groundwater recharge techniques with adaptive irrigation management.
- Link citizen-led cultural heritage preservation to basin governance.
- Diversify funding through public, private, and community-based sources.

Such measures treat groundwater and surface water as a single system, reflecting the principle of conjunctive management promoted by established groundwater governance approaches, embed risk reduction measures for natural disasters into routine governance, and reinforce cultural continuity alongside technical management.

6. Conclusion: Toward a Flexible, Interface-Oriented Future

ILLBM is best understood as a bridging logic, complementing ILBM and other broader integrative approaches by aligning governance across lentic–lotic domains. Its strength lies in combining governance awareness, hydrological realism, and adaptability to varied institutional settings.

Its development — grounded in a year of intensive expert deliberation and analysis of real-world cases — marks a unique advance in water governance thinking. Future demonstration projects should tackle diverse complexities, from groundwater–lake dynamics to glacial hazards, proving that ILLBM is both conceptually robust and practically grounded.

In its most promising form, ILLBM shifts water governance from managing isolated parts to governing interconnected relationships, with the seventh pillar of Culture, History, and Tradition ensuring that solutions remain socially legitimate and enduring.

Notes

Glossary of Related Frameworks Referenced in this Document

- **Integrated Water Resources Management (IWRM)** – Coordinated development and management of water, land, and related resources to maximize welfare without compromising ecosystem sustainability.
- **Integrated River Basin Management (IRBM)** – Management of rivers and their basins as interconnected systems, balancing ecological, social, and economic objectives.
- **Integrated Coastal Zone Management (ICZM)** – Integrated approach to managing coastal resources and development sustainably.
- **Disaster Risk Reduction (DRR)** – Systematic efforts to reduce disaster risks and vulnerabilities.
- **Source-to-Sea (S2S)** – Managing land, freshwater, coastal, and marine systems as a connected continuum from headwaters to ocean.
- **Integrated Groundwater Management (IGM)** – Coordinated management of groundwater and surface water, land use, and ecosystems to ensure sustainable and equitable use of groundwater resources.

Evolution of the ILLBM Concept

Integrated Lentic–Lotic Basin Management (ILLBM) emerged from the recognition that sustainable lake management cannot be achieved without strong linkages to rivers, wetlands, and coastal systems. While broader frameworks such as **IWRM**, **IRBM**, and **ICZM** have promoted integration, they have not fully addressed the distinct behavioral and governance requirements of lentic waters, which were first emphasized through

ILBM.

Key Milestones in ILLBM Development

- 2008–2016: Initial discussions on ILLBM were conducted under the ILEC–Shiga University research collaboration on ILBM.
- 2016: The Bali Declaration at the 16th World Lake Conference formally recognized the importance of lentic–lotic integration.
- 2018–2024: The ILEC–JICA Knowledge Co-Creation Program, "Integrated Lake, River, and Coastal Basin Management for Sustainable Use and Preservation of Water Resources," has contributed to advancing the concept of ILLBM.
- 2020–2025: The ILEC Scientific Committee undertook a series of intermittent ILLBM conceptualization studies, reviewing and reflecting on the past ILBM study project outputs, including the review of GEF-LBMI Lake Briefs and their updated versions.
- June 2025: The ILEC Mid-Term Plan (2025–2030) identified ILLBM as a priority focus for the Scientific Committee, aiming to contribute to global water discussions in the post-SDG context.

This progression, participated by numerous practitioners, scientists, government officials, and lake community members, positions ILLBM as a bridging framework between ILBM and broader integrative approaches such as IWRM, IRBM, DRR, ICZM, and Source-to-Sea.

Major Contributors and Endorsers

The ILEC Scientific Committee prepared this document with significant contributions made by:

M. Nakamura, W. Rast, M. Finlayson, A. Santos-Borja, A. Pattnaik, A. Juarez. P. M'Mayi (UNEP-EWAD, Nairobi) also participated in many discussion sessions.

Other members of the ILEC Scientific Committee are in the process of contributing to and endorsing the evolving versions of this document.