

A Workshop Report on

***Research Frontiers and their Applications for Water Resources
Infrastructure in Urban Watersheds: Making the connection
between human and hydro-ecological interactions***

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Executive Summary

A workshop was organized by the Baltimore Ecosystem Study (BES) in June 1999 to explore the role of water resources infrastructure on rural-urban ecosystem function. This report summarizes and extends the main outcomes of that meeting. The BES is an NSF funded Long Term Ecological Research (LTER) site, focussing on the structure and function of urban and urbanizing ecosystems in the Baltimore Metropolitan area (<http://www.ecostudies.org/bes>). Many of the critical interactions between human society and ecosystems are mediated by the form, extent and function of water related infrastructure that develops over decades to centuries as part of the evolution of urban space. The term 'infrastructure' was broadly defined to include more than structural interventions of the natural system and encompasses the physical, ecological and societal aspects of water resource management system. The development and functioning of urban water resources infrastructure includes feedback loops between watershed and ecosystem conditions, economic demand, human perception of the environment, and the regulatory and management response to individual, community and institutional needs.

The main goals of the workshop were to:

- Identify key areas of interest defined by ecosystem-infrastructure interactions from different disciplinary perspectives and the advantages of studying them with multidisciplinary approaches.
- Discuss the development of a conceptual model that articulates the interaction of water resources infrastructure among the social, economic, hydrologic and ecological components of an urban ecosystem.
- Outline a set of primary issues for future collaborative research in this area.

Workshop presentations and group discussions identified a broad range of issues pertaining to site specific health concerns of contaminants and pathogens within streams and sewers to larger scale statewide policy and regulations. Participants acknowledged the temporal sensitivity of infrastructure function and quality to environmental and social conditions within urban watersheds. While it was recognized that there is integral connectivity amongst the component parts of the water resources infrastructure-ecosystem framework, a number of barriers to an integrated conceptual framework were identified. Such barriers include an incomplete knowledge of the interactions and feedback between the water resources infrastructure systems and the urban ecosystem, and the existence of distinct paradigms in specific component fields of research. A systems-based approach was advocated in the development of the conceptual model as an initial framework, understanding that this approach may be more natural to some disciplines but not others. Our discussions illustrated the limits of this approach, and suggested a new paradigm needs to be hybridized from existing disciplinary perspectives.

The formalization of an integrated framework was identified as a critical need. Recommendations for future research address three key areas:

1. *Identification, measurement and modeling of the dynamic connectivity between engineered and natural drainage pathways as well as the social and institutional processes affecting these dynamics.*
2. *Development of methods to study and quantify the impacts of water resources infrastructure on urban ecosystems that incorporate the varying spatial and temporal scale of both human and biophysical processes.*
3. *Definition of an interdisciplinary paradigm to formalize the feedback and interactions among the biophysical and social components of infrastructure within urban ecosystems.*

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