Urban Watersheds: Geology, Contamination, and Sustainable Development


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The locations of industrial and urban centers are often closely linked to the movement of contaminated water to nearby water bodies. The occurrence and distribution of contaminants are likewise in part influenced by the geology and flow of water in urban watersheds. Other contributors to contaminant sources, and hence their occurrence and fate in urban watersheds, include decisions by a diverse group of players (citizens), historical development patterns, industrial sites or history, and the variety and types of land cover. Due to these multiple reasons, assessing the risks of environmental contamination in urban environments requires an interdisciplinary approach. The objective of Urban Watersheds: Geology, Contamination, and Sustainable Development is to link content from the disciplines of geology, hydrology, contaminant chemistry, urban planning, and risk analysis in the context of assessing contaminants and achieving sustainability in urban watersheds.

The book is divided into three parts. The first part addresses the geology of urban areas. In addition to a notable discussion of the principles of groundwater flow and groundwater–surface water interactions, the geology part of the book includes a discussion of sedimentary environments, which is important as many urban areas are in geological settings dominated by sedimentary deposits. Later discussions in the book include how specific sedimentary environments affect the movement of contaminants and water and the consequent vulnerability of a given urban area to environmental risks. The authors also discuss challenges associated with geologic mapping in urban areas and offer suggestions for overcoming those challenges. They further provide an example case study for developing an urban geologic vulnerability map by including a multitude of factors that contribute to environmental risk, such as the direction of groundwater flow, potential sources of contamination, and the locations of supply wells and surface water in specific urban areas.

The second part of the book closely examines common contaminants in urban watersheds. It begins with a brief introduction to toxicity, followed by discussion about the chemistry and environmental behavior of contaminants such as organic compounds, metals, pesticides, pathogens, emerging contaminants, and radioactive compounds. This section offers insights on how the integration of geology, hydrology, and contaminant chemistry can help improve watershed management practices in urban areas. This section of the book concludes with a discussion of contaminant risk factors and remedial actions for soil, groundwater, and air and includes a cost analysis for remediating common urban contaminants.

The third part of the book is dedicated to sustainability and analyzes the disruptions of matter and energy flows brought on by urbanization. Of particular interest in this section is a discussion of the ecosystem impacts of major engineered systems in urban watersheds, such as sanitary sewers, stormwater infrastructure, and structures for navigation and flood control. The section also includes a chapter dedicated to the prevention of both point and nonpoint source pollution. It provides timely examples of pollution prevention practices and presents insights on how to assess the results of such practices. Urban Watersheds concludes with a series of case studies from urban areas in which both environmentally successful and unsuccessful development practices have been implemented. The authors make a strong case for narrowing the gap between science and policy in urbanized watersheds so that future efforts to attain sustainability can be more successful.