# Chapter 9
# Legal Framework for the Urban Water Environment

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## 9.1 Introduction

The complexity of the legal framework for the urban water environment approaches the complexity of the scientific and technical aspects of urban water management addressed in other chapters, although for different reasons and with different possible solutions. Urban water resources are addressed, to varying and sometimes overlapping degrees, by private, local, state, regional, federal, and sometimes even international law. Some aspects of urban water resources management are governed by *common law* (legal principles derived from a series of decisions reached by judges in individual cases), while other requirements are dictated by statutes passed by federal, state, or local legislative bodies, or regulations issued by administrative agencies. Separate (although sometimes linked) legal regimes address aspects of water supply, water treatment and distribution, and the environmental and human health and safety aspects of wastewater, storm water, and drainage or flood control.

This chapter will outline the major legal doctrines and sources of law that govern or affect urban water management most directly. (Other legal principles, such as those governing contracts, affect urban water use and management more tangentially and largely in the same way as they affect other public and private activities.) Even this brief summary, however, covers a wide range of statutory, regulatory, common law and other legal aspects of the urban water environment. The chapter concludes with a critique of the manner in which the fragmentation of that law and policy impedes efforts to promote more sustainable and efficient uses of water in urban areas.

## 9.2 Governing Legal Principles and Doctrines

The legal regime governing the urban water environment could be organized in a number of ways. This analysis focuses on four primary governmental functions

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related to urban water use and management. First, especially in areas where demand approaches or exceeds supply, cities must secure adequate supplies of fresh water for their citizens (the "front end" of the urban water environment). Second, they must treat and convey water of acceptable quality to all necessary points of use. Third, they must deal with the "back end" of the urban water cycle by making sure that urban wastewater, in the form of sewage and storm water runoff, does not pose threats to human health and safety, property, and aquatic ecosystems. Fourth, they can take advantage of urban waterways as environmental and recreational assets rather than simply as resources to exploit (Chapters 6 and 8).

### *9.2.1 Water Supply*

Municipalities cannot simply stick a pipe in the ground or in a body of surface water and extract water for use by their citizens. All states (and most other countries) have legal systems governing allocation of water rights among competing users (Sax et al., 2000). Water law in most U.S. states has deep origins in common law, but all states now have statutes, regulations, and other administrative mechanisms to implement those principles. Although most states confer some degree of legal preference on municipalities to meet the basic, health-related needs of domestic users, attention to water law is increasingly important for growing cities to secure adequate water supplies. As outlined below, however, the nature of the legal systems governing water rights varies in different parts of the United States. Eastern states use modified versions of the riparian rights doctrine inherited from England. Arid western states adopted the prior appropriation doctrine in response to very different hydrological and geographic conditions.[1] Water law in some states in the intermediate zone along the 100th meridian, and along the west coast, reflects a hybrid of riparian and appropriative rights.

*Riparian rights doctrine*: The original riparian rights doctrine developed in England is a system of property rights in which only riparian (waterside) land owners had the right to withdraw and use water from a stream or other water body (Sax et al., 2000, pp. 20–97). The doctrine was based on a concept of "no harm", meaning that riparian landowners could use water so long as they did not substantially impair either the quantity or quality of water for downstream users. Although designed to protect the rights of downstream landowners rather than as a system for environmental protection, the system was inherently protective of aquatic ecosystems and ensured that neither upstream owners nor the earliest users could dominate water resources at the expense of others. This rights-based system also made sense in a country where most landowners had access to some supply of water, and at a time when water supply far exceeded demand. Courts reconsidered the pure riparian rights doctrine during early American history when mill users and others increased demand and competition for scarce water. As a result, American courts modified

[1] A few western states that were part of Mexico before the Treaty of Guadalupe Hidalgo still observe some remnants of Spanish water law.

the doctrine to allow more significant stream depletions when justified to promote industry, agriculture, and other development (*Snow v. Parsons*).

Under traditional riparian doctrine, domestic uses for culinary purposes, to cultivate gardens and other subsistence uses, enjoyed an absolute preference, but those uses typically were not large enough to cause significant depletions or harm. Other, more intensive uses, for example to run mills or other economic uses, are subject to the *reasonable use doctrine*, in which uses are permissible if reasonable relative to the rights of other riparian landowners for other reasonable uses. The reasonable use doctrine requires courts to balance the rights of competing users based on factors such as the purpose of the use, the suitability of the use to the water body, the economic and social value of the use, the harm caused, ways to avoid the harm, etc. (American Law Institute, 1979, Restatement (Second) of Torts, §850A).

Under the balancing principles of riparian rights, courts seek to allocate shortages fairly among all legitimate users, so no single user is likely to be shut off completely. However, this doctrine generate uncertainty for municipal and other users because no fixed quantity of water is assured, and some courts have limited the ability of cities to withdraw water even for general public uses in violation of strict riparian doctrine (Sax, et al., 2000, pp. 55–58). To address this problem, state legislatures have often intervened by enacting special legislative preferences or authorities for municipal water supply. For example, New York State's water supply law provides: "The acquisition, storage, diversion and use of water for domestic and municipal purposes shall have priority over all other purposes" (Sax et al., 2000, p. 58, *quoting* New York Environmental Conservation Law Title 15 – Water Supply). Many riparian doctrine states also now have statutes and regulations that establish somewhat clearer rules governing municipal water rights, often modeled after the Regulated Riparian Model Water Code (American Society of Civil Engineers, 1997). The exact status of municipalities with regard to riparian water rights, then, varies from state to state. The inherent uncertainty of riparian rights law—along with practical issues of storage and distribution—also prompted cities to build reservoirs to store water during wet periods as a hedge against later shortages.

Riparian rights also presented challenges for growing U.S. cities because of the original limitation that only riparian landowners could use water from a stream, and only on riparian lands. The riparian land limitation was environmentally protective because it kept water within watersheds, and worked reasonably well in the context of non-municipal water users. However, this limitation restricted the ability of cities to provide sufficient common water supplies for large bodies of citizens over a larger area. Courts first modified the limitation on place of use, so that riparian landowners could use their water supplies on non-riparian parcels, or sell it to non-riparian owners (*Connecticut v. Massachusetts*). With that change, a city could purchase—or acquire through eminent domain[2]—riparian parcels necessary to assure municipal

[2]Eminent domain, or "condemnation", is a legal process by which a government can obtain land from non-willing sellers for legitimate public purposes. Under both federal and state constitutions, the government must pay "just compensation," or fair market value, for the land, and provide a fair set of judicial or other procedures ("due process") to justify the public use, if challenged, and to determine fair compensation.

water supply. Later, as cities expanded and as demand for water for industrial, commercial, and other purposes on non-riparian lands grew, courts further loosened the requirement that water be used within the watershed of origin, allowing cities to import water from other watersheds. For example, New York City began to import water from the Croton River in Westchester County (*Hudson River Fisherman's Association v. Williams*), and later from more distant supplies in the Catskill and Adirondack Mountains.

*Prior appropriation doctrine*: By the mid-nineteenth century, riparian rights principles did not serve the needs of water users in the arid west. Water was needed for mining, irrigation and other uses on non-riparian lands; greater certainty of water supply was needed to justify investments; and demand often exceeded supply, especially during droughts. To address those needs, western states developed the prior appropriation doctrine (Sax et al., 2000, pp. 98–279). Under prior appropriation law, water rights are quantified specifically (x cubic feet per second (cfs) or y acre-feet (af)) and priority in times of shortage is determined in order of seniority ("first in time, first in right"). Priority dates are determined by the time at which water is first diverted and put to a legally "beneficial use", such as irrigation or municipal water supply, and during times of shortage senior water rights are honored in full before junior rights-holders receive any water at all. Prior appropriation law does not limit the place of use, meaning that large amounts of water can be—and are—transported out of the watershed of origin to distant locations where it is needed.

Unlike the riparian rights doctrine, in which water rights are attached to ownership in land and continue whether or not water is used, appropriative rights are "usufructory" in nature. The public, through the state, owns the water but individuals are given the right to use it, at certain times and for certain purposes, and subject to various conditions. Thus, under the "use it or lose it" tenet of prior appropriation law, rights to use water can be forfeited if not exercised. This ostensibly ensures that water is not "wasted" or that water rights are not held purely for speculation. Although in theory water must be used efficiently to prevent waste, the incentive is to use one's full water right so as not to lose it, and rules against inefficient waste are rarely enforced. Moreover, until relatively recently, traditional prior appropriation law has recognized as "beneficial uses" only off-stream uses for human economic purposes, at the expense of in-stream and other environmental "uses".

As was true in riparian rights states, western legislatures recognized that domestic uses of water to sustain basic human needs warranted some priority over other uses, and that concept translated to some degree of preference for municipal water supply as well. Nevertheless, the fact that so much western water is held for agricultural and other non-municipal purposes, with very early priority dates, has created problems for rapidly growing western cities, especially in areas with inadequate proximate supplies of fresh water. That led to infamous "water grabs" such as Southern California's raids on the water resources of Owen's Valley and Mono Lake (Reisner, 1986).

Growing western cities governed by prior appropriation law have tried to address water shortages in various ways (Adler, 2007; Chapter 12). Cities in urban Southern California have facilitated water transfers from agricultural areas with superior

water rights (such as the Imperial Valley) by paying those areas to implement more efficient water conveyance and use measures (Hadad, 2000), and are now beginning to use expensive desalination of ocean water. Las Vegas adopted very aggressive water conservation measures, and is trying to augment existing supplies through groundwater from nearby basins. Denver and other cities along Colorado's Front Range import Colorado River water through tunnels beneath the high peaks of the Rockies. Many cities are reclaiming urban waste water to re-use for irrigation water (Furumai, 2007). Despite all of those measures, each region faces shortages under the pressure of impending growth, and both legal and technological solutions will be required in response.

*Inter-jurisdictional conflicts*: Water supply needs for expanding cities in all parts of the country have led to inter-basin, interstate, and even international conflicts over supplies from major river basins. The stakes are high, as water supply can be one key factor in determining which cities will grow and which will face limits. One key example is the ongoing tension between Colorado's Front Range, Southern California, Phoenix, and Salt Lake City over water from the Colorado River Basin, a problem that is likely to exacerbate as those and other cities in the region continue to expand, and as global warming potentially reduces runoff in the basin (Adler, 2007). But cities have fought over rivers in the east as well, including the Connecticut, the Hudson, the Delaware, and most recently the Appalachacola-Chatahoochee-Flint basin in the southeast.

There are three main legal responses to interstate water conflicts. First, on a number of occasions the U.S. Supreme Court has issued decrees allocating water among states under a doctrine known as "equitable apportionment," in which the court balances a number of factors such as need, priority, and fairness to determine how to apportion scarce water resources among states (e.g., *Wyoming v. Colorado*). Second, under the Compact Clause of the U.S. Constitution (Art. I, §7, cl.3), states can negotiate settlements through interstate compacts, such as the Colorado River Compact, which require congressional ratification. Third, Congress can step in independently and pass laws allocating interstate water resources among states. The United States has also negotiated international treaties over allocation of water from international waters such as the Colorado and Rio Grande Rivers (Meyers and Noble, 1967).

*Groundwater allocation*: The law governing groundwater allocation is even more perplexing than it is for surface water for two reasons. First, five separate doctrines (and variations within those doctrines) apply to groundwater in various U.S. states, so water allocation law varies even more widely among states with respect to groundwater than it does for surface water (Sax et al., 2000, pp. 359–385). Groundwater law evolved initially during an era when groundwater was a mystery—when people knew nothing about where it came from and how much was there. Especially where groundwater seemed essentially unlimited, that led to doctrines such as the "rule of capture," in which landowners had the right to extract as much water as they needed from wells drilled on their own property, thus providing no protection to those whose wells may have been sucked dry as a result.

Few jurisdictions continue that simple doctrine now that groundwater demand often exceeds supply (Glennon, 2002). Other doctrines, therefore, modify the rule

of capture idea to varying degrees (Sax et al., 2000, pp. 364–365). The American Reasonable Use Doctrine, for example, recognizes a right of capture so long as the water is put to a reasonable use on the land from which it is withdrawn. The Correlative Rights doctrine is similar to the riparian rights doctrine for surface water, and requires a balancing of competing uses based on a series of equitable factors. Other states similarly modify the reasonable use principle borrowed from surface water law, and many western states apply the prior appropriation doctrine to groundwater as well as to surface water.

Second, applying separate legal regimes to surface and groundwater supplies, which again hales from a time when little was know about the source of groundwater supplies, makes little sense where those resources are interconnected. This problem has generated legal conflicts in which it is not entirely clear, for example, how a groundwater withdrawal relates to water rights from an adjacent surface water even when it is clear that the two are hydrologically connected, and that the groundwater pumping will reduce surface water supplies (or vice versa) (*City of Albuquerque v. Reynolds*). The result depends on variations in state law, including the precise relationship between a state's common law and statutory treatment of the two water sources, as well as variations in the relevant hydrogeology. As the modern science of hydrogeology evolves, and given our understanding of hydrological cycles that connect surface water, groundwater, and atmospheric water, it would make more sense to merge the doctrines and to treat water as a single resource.

*Regulatory overlays*: Cities planning projects to expand or to improve water supplies also face a maze of federal, state, and local regulatory requirements which are mixed blessings from the municipal perspective. Although those laws and regulations serve important roles in protecting water, aquatic, and other environmental resources, they also can complicate and delay water project planning and development. Only the most prevalent federal law examples are outlined below.

Any water project that involves a major federal action with potentially significant impacts on the human environment triggers compliance with the National Environmental Policy Act (NEPA). In many instances that requires an environmental impact statement to evaluate and disclose the environmental impacts of the proposed project, to identify feasible project alternatives and mitigation measures, and to solicit and integrate comments on those issues from other interested or affected agencies and the public (NEPA, § 102(2)(C)). A "major federal action" includes federal funding or other direct involvement in project planning, construction, or implementation, or a range of federal licenses or permits. Moreover, courts have interpreted the kinds of environmental impacts to be addressed quite broadly (Driesen and Adler, 2007, p. 330). However, NEPA is primarily an environmental full disclosure law that demands only analysis and public airing of impacts, alternatives, and mitigation measures. It does not dictate particular decisions or results once those procedural requirements for analysis, disclosure, and public discourse are met (*Robertson v. Methow Valley Citizen's Council*).

Other federal regulatory laws impose more direct substantive requirements on decisions regarding urban water supply. Projects that involve the discharge of fill material into the "waters of the United States", for example, require permits under

Section 404 of the federal Clean Water Act (CWA). Permits may not be issued if they would have unacceptable adverse impacts on the aquatic environment, or if there are less damaging practicable alternatives that would meet project goals without causing the same level of impacts. Similarly, any project involving major federal actions that would jeopardize the continued existence of any species listed as threatened and endangered under the federal Endangered Species Act (ESA) requires consultation with the U.S. Fish and Wildlife Service (for inland species) or National Marine Fisheries Service (for marine mammal, anadromous fish, and marine species). Approval of such projects must prevent jeopardy to the species, and require implementation of all reasonable and prudent measures to protect the species.

### *9.2.2 Water Treatment and Distribution*

Securing adequate water supplies and building the dams, well-fields, conveyances, and other projects necessary to transport water to cities is only the first step in providing water that is fit for various urban end uses. Cities also must treat water to appropriate standards for distribution and sale to public and other users, and administer a system for the sale of water in ways that balance affordability, equity and efficiency.

*Water treatment*: Public water supply systems are regulated by the federal Safe Drinking Water Act (SDWA), under which the U.S. Environmental Protection Agency (EPA) establishes drinking water standards known as maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) (U.S. EPA, 2003). MCLs are mandatory and enforceable standards that balance public health and safety against treatment costs, while MCLGs are stricter but unenforceable goals for optimum water safety independent of cost. The appropriate balance to strike between treatment costs and health benefits is the subject of considerable controversy between EPA and cities, for example, when EPA established new treatment standards for arsenic and for disinfection byproducts (U.S. EPA, 2001). Congress provided states with primary enforcement authority for public water systems, so long as EPA approves the state program as complying with federal law and regulations. Specific requirements can vary depending on the size of the public water supply system, the source of water used, and other factors.

The SDWA also authorizes cities to adopt and implement measures to protect "sole source aquifers". This allows communities to establish a "critical aquifer protection area" and to adopt comprehensive plans to protect a particularly important water supply at its source ("wellhead protection") rather than simply providing treatment after water is collected for use. This provision is notable for its focus on the relationship between land use and drinking water quality, as opposed to a purely treatment-based approach.

*Distribution and sales*: As a purveyor of water to industrial, commercial, and residential customers, cities also stand in a position similar to that of a public utility selling a good (water) and service (distribution and delivery) to those end users

(Tarlock, 2005). In addition to the full range of business transactions necessary to run this kind of complex operation, municipal water entities also may be subject to legislative or regulatory requirements governing rate structures and other aspects of serving residential, commercial, and industrial end users.

Regulations governing prices and sales implicate important policy considerations regarding the pricing of public urban water supplies. Because clean water is so fundamental to basic public health and welfare, cities have a responsibility to provide water at affordable prices to all urban residents, who range widely in income and prosperity. Excessively cheap water, however, which was the mainstay in U.S. cities for generations, can encourage profligate use. In the absence of economic incentives to use water efficiently, many consumers will waste it. Public water can be subsidized in a number of ways, meaning that even the full direct costs of providing public water are not passed on to consumers, leading to inefficient use. Nor do most cities include in consumer water rates the external costs of water supply, such as the environmental damage caused by dams or dewatered rivers and streams.

Cities can balance the competing goals of providing adequate, safe water to all urban users while encouraging more efficient use in several ways. They can adopt a "least cost first" approach to water supply and demand, under which cities may purchase water-saving devices for end users (such as water-saving toilets or shower heads) if it is cheaper to do so per unit of water supplied than to build and operate new water supplies. Water efficiency can also be encouraged through increasing block prices, in which all consumers purchase up to a fixed amount of water deemed appropriate for basic purposes (indoor drinking, bathing, etc.) at very affordable prices, but additional "blocks" are incrementally more expensive. Those who wish to use more water to irrigate lawns, fill swimming pools, or for other less essential uses must pay for that privilege. Cities can also adopt building code regulations designed to encourage or to require water efficiency in new homes and other structures. In the Energy Policy and Conservation Act of 1992, Congress adopted national efficiency standards for plumbing fixtures and fittings.

Growing cities face additional policy choices, again guided by various legal principles, regarding the extension of water distribution and supply systems to newly-developing areas (Tarlock, 2005). New developments and increasing sources of water demand can impose significant capital costs on already strained institutions, or stretch limited water supplies to the point where reliability for all consumers is jeopardized. Under one view, municipalities or the related legal institutions responsible for water supplies have an obligation to provide safe water supplies to all of the public, whether they live or operate businesses in existing or new areas. This might require cities to implement stricter conservation measures on existing users, to use pricing structures to allocate limited supplies efficiently, or to take extraordinary steps to import water from beyond their traditional supply areas.

Another perspective, however, is that sustainable communities should not grow beyond their natural resource limits with respect to water supply (and other resources) (Nolan, 2001). This could result in effective or overt growth limits, and legal conflicts between developers and local governments who either impose bans on new development or simply decline to expand service areas (effectively

preventing new hookups) (Thompson, 2005; Tarlock and Van de Weterling, 2006). Courts have sustained such moratoria based on limited water supplies, but political pressure can cause cities to abandon those policies to accommodate growth (Arnold, 2005). A related issue is whether new developers should bear the full marginal costs of providing new water infrastructure and supplies, or whether those costs should be spread among existing and new users.

### *9.2.3 Wastewater, Stormwater, and Drainage*

The "back end" of the urban water environment is governed by a separate (but in some respects overlapping) legal regime designed to protect aquatic and other resources from the impacts of water pollution. That body of law is driven primarily by the CWA and complementary state and local laws and regulations governing water pollution control. It is also affected by state common law rules and local ordinances and regulations regarding drainage, as well as state and local land use and planning laws and regulations that affect the location, timing, intensity, and other attributes of development in ways that can affect water quality and aquatic ecosystem health dramatically, as described in other chapters.

*The Clean Water Act*: Since 1972, when Congress adopted major amendments to the Federal Water Pollution Control Act (known more typically by its short title as the CWA), water pollution control has been governed under a system of cooperative federalism involving some combination of the federal, state, and local governments. In the CWA, Congress established minimum principles and requirements that apply nationwide, supported by the federal government's authority over navigable waters under the commerce clause of the U.S. Constitution (U.S. Const. Art I, Section 8, cl. 3). The U.S. Supreme Court identified control over navigability as part of the federal government's commerce clause powers in an early case (*Gibbons v. Ogden*). Those minimum federal requirements also preempt non-complying state and local laws under the Supremacy Clause of the Constitution (U.S. Const. Art. VI, Section 2). However, Congress left considerable latitude to state and local governments to implement the CWA according to local conditions and priorities, so long as those minimum requirements are met. (CWA §101).

The 1972 CWA transformed U.S. water pollution control law by flatly prohibiting discharges of pollutants without permits that assure application of minimum treatment requirements (end-of-pipe obligations of individual dischargers) and compliance with ambient water quality standards (standards that establish goals for whole bodies of water in the face of pollution from multiple sources) (Adler et al. 1993). Previously, discharges were allowed presumptively so long as no harm could be proven. Beyond that simple principle, however, the confines of the law become more complex. More precisely, the CWA prohibits any person from discharging any pollutant into any navigable water from any point source (CWA §301). Efforts by dischargers to narrow the scope of the statute have led to series of legal cases regarding the meaning of the terms "discharge of a pollutant", "point source",

and "navigable waters" (*Miccosukee Tribe v. South Florida Water Management District*; *Concerned Area Residents for the Environment v. Southview Farm; Rapanos v. United States*). As explained further below, the battle over the latter term ("navigable waters") involves at a minimum the nature of water bodies that Congress intended to cover in the federal law, but also suggests questions about the kinds of waters over which the federal government has authority under the Commerce Clause.

Dischargers covered by the CWA must obtain a National Pollutant Discharge Elimination System (NPDES) permit from either EPA or from a state water quality agency with an EPA-approved program (CWA §402). Those permits impose effluent limitations that reflect the stricter of two kinds of controls. First, all dischargers must meet *technology-based standards* at least as stringent as those that can be met using what EPA has determined reflects the best technology available to treat that kind of waste from that category of facility. The best technology findings vary with the type of discharger, kinds of pollutants, and other factors, but aspire to a statutory goal of zero discharge, that is, the complete elimination of pollutant discharges into the navigable waters.

Second, dischargers must meet stricter "water quality-based" limits where necessary to assure attainment of in-stream water quality standards (CWA §303). Those standards consist of designated uses for all waters (such as contact recreation, drinking water, or protection of various kinds of fish and aquatic life), and water quality criteria deemed necessary and sufficient to protect those uses. Water quality standards are established by individual states, but require EPA review and approval, and EPA must adopt federal standards where the state standards are not sufficient.

*Sewage treatment regulation*: The CWA imposes several legal responsibilities on municipalities. Most notably, much of the fresh water that cities supply during the front end of the municipal water process becomes polluted sewage when it exits homes and businesses. Because nearly all U.S. communities do not separate "gray water"—mildly contaminated water from sinks—from the wastes generated in toilets and other more heavily contaminated waste, this generates millions of gallons a day of contaminated sewage that must be conveyed to treatment plants and properly treated and discharged (Tang et al., 2007). That requires the construction, operation and maintenance of both an extensive system of sewers and treatment facilities to meet applicable discharge requirements (Heany, 2007).

Through the CWA, beginning in 1948 and then expanded significantly in 1972, Congress provided large amounts of federal funding to assist states and cities in designing and building the sewerage infrastructure necessary to comply with those collection and treatment obligations (Adler, et al. 1993). Along with that funding, however, came legal responsibilities to adopt comprehensive wastewater treatment plans, in large part to prevent communities from growing without adequate sewerage capacity to treat the resulting wastewater to acceptable levels as prescribed in the CWA. The program was controversial in part because critics claimed that the resulting infusion of sewerage infrastructure did as much to fuel urban sprawl and related environmental problems as it did to control water pollution. In 1987, Congress replaced this system of outright federal grants with state revolving loan funds to continue to finance municipal sewerage systems.

Along with all other dischargers of pollutants into navigable waters, municipal sewage treatment plants must meet the minimum requirements of the CWA. They must obtain and comply with an NPDES permit for each treatment plant and outfall into navigable waters, and those permits must ensure compliance with both technology-based and water quality-based effluent limitations. The minimum technology-based requirement for municipal sewage is known as secondary treatment, the numeric limits for which are set forth in EPA regulations (40 C.F.R. Part 133). Strict limits to meet state water quality standards vary depending on the stringency of the applicable standards and the size of the receiving water relative to discharge volume (i.e., dilution or assimilative capacity), but often result in imposition of tertiary or other advanced treatment requirements.

Another way to comply with the CWA's presumptive discharge prohibition is not to discharge sewage waste into waters at all, but to reuse it beneficially to irrigate city parks and other green spaces, so that both the water and nutrients contained in properly treated sewage are not wasted (Furumai, 2007). Arid western cities increasingly are relying on beneficial reuse of sewage to augment their water supplies (or more precisely, to make better use of existing supplies by using available water multiple times). Doing so, however, still requires appropriate standards to ensure that contaminants do not interfere with beneficial reuse or create health or other hazards in the process. Beneficial reuse also involves environmental tradeoffs for western cities, because that effluent no longer returns to downstream waters which often have been significantly dewatered due to human diversions for agricultural, municipal, and other uses.

Municipalities also must comply with at least two other significant federal regulatory requirements in connection with sewage treatment plant operation. First, they must protect their own facilities (sewers and treatment plants) and receiving waters from toxics and other pollutants discharged into the sewer system at homes, commercial businesses, and industries within their service areas (CWA §307(b)). Most modern sewage treatment plants use a process of biological treatment in which live bacteria are critical to break down organic pollutants. Toxic pollutants can kill those "bugs" and thus impair treatment plant effectiveness. Some pollutants (such as heavy metals) are not effectively removed by sewage treatment processes designed to deal mainly with municipal sewage. Those substances can pass through the plant into receiving waters (and the plant operators are legally responsible for those releases), contaminate the sludge (also known as biosolids) produced as a byproduct of treatment, and even endanger the health or lives of treatment plant workers.

The CWA and EPA regulations require discharge limitations on these commercial and industrial "indirect dischargers" into sewers (to distinguish them from direct dischargers of the same pollutants into surface waters) through the "pretreatment" program. Indirect dischargers must pre-treat their sewage discharges so that the combination of pretreatment and treatment at the sewage treatment plant is at least as effective as requirements that would be imposed on the same facility discharging directly into a water body. Pretreatment also must be sufficient to prevent pass-through of toxic pollutants in unacceptable amounts, to prevent sludge

contamination, and to protect sewage treatment plant workers and infrastructure. Most notably for municipal sewage treatment program managers, the primary responsibility for ensuring that indirect dischargers comply with pretreatment requirements falls on the municipal sewage treatment plant, rather than EPA or the state water quality agency. Thus, although there is considerable state and federal oversight, the municipality itself must develop, implement, and enforce a pretreatment program that complies with federal statutory and regulatory requirements. Somewhat unusually, then, municipal sewerage programs are both regulators and regulated entities in the CWA process.

Second, a related requirement is to comply with EPA's sludge contamination regulations issued under Section 405 of the CWA (40 C.F.R. Part 503). The solids generated during the sewage treatment process can be viewed either as a valuable resource for recycling and reuse ("bio-solids"), or as a problematic, high-volume waste ("sludge") which must be disposed of properly. For either purpose, EPA regulations ensure that excess contamination by heavy metals and toxic organic contaminants do not either increase waste disposal hazards or interfere with valuable reuses of that material as fertilizer. For example, by minimizing contaminants and maximizing the nutrient content of its sewage by-products, the City of Milwaukee markets a soil conditioner for home gardening called Milorganite.

*Stormwater runoff ("nonpoint source") pollution control, and urban land use*: Although flooding occurs as a natural process even in undeveloped environments, those areas consist largely of permeable surface in which precipitation can infiltrate into soils and discharge more slowly into aquatic systems. Natural features such as wetlands and vegetated riparian flood plains further buffer the impacts of storms on streams and other aquatic systems. Urbanization changes regional hydrology in ways that have significant implications for city environments, and that must be addressed by legal rules (Brown et al., 2005). The increase in impervious surface areas (roads, buildings, parking lots) and the decrease in wetlands, vegetated flood plain habitats, and other natural features dramatically increases peak flows following storm events, causing erosion and damage to local stream morphology and aquatic habitats (Bledsoe and Booth, Chapter 6 of this volume). The resulting runoff water can also be contaminated badly by a range of chemical and other pollutants in the urban environment (U.S. Department. of the Interior, 2002).

Common law principles govern drainage problems between private landowners, with the usual variations among jurisdictions (Sax et al., 2000, pp. 92–93). In fact, two competing traditional common law rules of drainage produced entirely opposite presumptions. In one, the so-called "civil law" approach, landowners are liable for damages from any diversion of surface water from its natural flow, thus limiting the ability of property owners to protect development on their own properties from flooding or other drainage problems without potentially compensating other affected owners. Some states modified this approach to allow small diversions for which there is no reasonable alternative and where damage to others is minor. The opposite "common enemy" doctrine allows landowners to alter surface water flow on their properties in any way, regardless of harm to others, so long as they do not harm others through negligence. Many states, however, now adopt a "reasonable

use" approach in which a range of factors are considered in weighing the rights of landowners affected by drainage problems.

More wide-reaching drainage-related issues, such as runoff pollution in urban environments, however, must be addressed by public law. In addition to the point source control system discussed above, the CWA regulates pollution from diffuse sources, including runoff of contaminated precipitation from various land disturbances, artificial modification of stream channels and banks, and similar impairments of physical and biological characteristics of water bodies (Adler et al., 1993). Outside of the municipal context, those forms of pollution are not subject to the same kind of mandatory permitting, treatment, and control requirements as are point sources. Instead, the CWA requires states to adopt statewide nonpoint source pollution control plans with significant discretion to the states to determine how to address runoff pollution from agriculture, other land uses, and hydrological modifications (CWA §319).

Because of flooding and related hazards to property, human health and safety, municipalities cannot simply allow precipitation water to course through city streets. Cities construct and maintain networks of storm sewers to channel runoff water away from property (or roads) and into nearby rivers and streams during storm events. This water is contaminated by a range of pollutants from motor vehicles, building materials, lawn chemicals, organic matter, and other sources. Those discharges of pollutants into navigable waters from point sources (municipal storm sewers and outfalls), therefore, require NPDES permits like any other point source discharge. However, because of the multiple and diverse sources of pollutants in storm water discharges, the potentially massive volumes of storm water releases during heavy storm events, and the existence of large numbers of storm water outfalls in large municipal areas, use of concentrated treatment plant strategies similar to that used for municipal sewage is not viable. In essence, municipal storm water can be viewed as a hybrid because contaminants from nonpoint sources are channeled into storm sewers and then treated as a point source for legal purposes.

To address this hybrid nature of municipal storm water, in 1987 Congress enacted a separate storm water control provision within the NPDES program (CWA §402(p)). Because of delays in implementing that program, only recently have most cities been required to obtain discharge permits from EPA or delegated states (with deadlines for those permits dictated by city size). By regulation, EPA established requirements for cities to mitigate the impacts of storm water pollution through pollution prevention, land use and other control efforts (40 C.F.R. Part 122). As with the pretreatment program for sanitary sewer systems, this places cities in the position of implementing regulatory or quasi-regulatory programs to reduce storm water contamination from other property owners, while simultaneously operating the regulated discharge system and being responsible to reduce contamination from road systems and other public sources.

Many older cities initially built combined sewer systems, in which sanitary and storm sewers are combined (Chapter 1). Those cities face particularly serious water pollution episodes when storm intensity causes flows that exceed the capacity of the storm sewers, and when the combined flows from the storm and regular sewage

exceed sewage treatment plant capacity, causing combined sewer overflows (CSOs). After years of controversy regarding the extreme cost of addressing this set of issues, EPA adopted a CSO permitting strategy based on a combination of sewer system retrofitting and maintenance, treatment, and storm water management strategies as appropriate to individual cities (U.S. EPA, 1994).

Water pollution caused by land development is also addressed to some degree by a separate CWA provision governing discharges of dredge and fill material into waters covered by the Act, including most notably wetlands (CWA §404). Under this statutory program, such discharges require permits from the U.S. Army Corps of Engineers, which may be issued only after a finding that there is no less damaging practicable alternative, no unacceptable adverse impacts to the aquatic environment, and other requirements (40 C.F.R. Part 230; 33 C.F.R. Part 330). Wetlands and undeveloped floodplains are critical resources in urban and other environments, because they can help to buffer the hydrologic impacts of storms, filter pollutants, and provide open space and important habitats (National Research Council, 1995). Thus, regulatory and other strategies to preserve those areas can help cities to meet storm water management and other regulatory requirements discussed above.

At the same time, many wetlands are on private property, and denying applications to fill (and therefore to develop) those areas often generate claims by those landowners that the government has taken their property without due process or without just compensation (Sax, 1993). Although those claims are likely to fail in most circumstances (as discussed below), they generate pressure to minimize impacts of the program on private property, for example by narrowing the scope of waters covered by the CWA Section 404 program (*Rapanos v. United States*).

While water pollution and other forms of aquatic ecosystem impairment caused by land use and development are governed by all of these federal laws and regulations, state and local planning, zoning, and other land use controls also play significant roles in minimizing the effects of development on urban aquatic environments (Arnold, 2005; Nolan, 2001). For example, cities may impose setback requirements that prohibit or limit development within prescribed distances from streams and other aquatic resources. They can zone sensitive areas for lower densities, mandate open space and riparian area protection within large developments, or prohibit developments from exceeding a specific percentage of impervious surface.

Just as the federal government must take care to avoid unconstitutional takings of property in administration of the CWA and other federal statutes, states and cities must negotiate the appropriate balance between regulations that serve legitimate public purposes and those that arguably result in takings of private property without due process or just compensation. Although the law of "takings" is complex and sometimes confused, however, municipal land use programs and regulations will probably pass constitutional scrutiny if they are reasonably proportionate to the public purpose to be protected, do not result in a complete diminution of private property value, and are adopted and implemented with notice and opportunity for affected parties to participate (Martinez, 2006). Under these principles, the U.S. Supreme Court has invalidated some local requirements designed to protect water resources where they were not shown to be proportionate to the goals to be served,

but has also upheld broad government regulations designed to protect water quality and aquatic ecosystem health (*Nollan v. California Coastal Comm'n*; *Palazzolo v. Rhode Island*; *Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Commission*).

Some cities and regions are using comprehensive plans and taking other more comprehensive steps to protect their aquatic resources using state and local legal authority, alone or in combination with relevant federal programs (Arnold, 2005). As discussed in Chapter 11, a large number of collaborative watershed management programs around the country are considering more comprehensive approaches to protect urban ecosystems, especially in rapidly developing areas.

*Groundwater pollution*: Municipal programs and activities can also affect ground water quality in ways that are addressed both by the common law of nuisance and by a wide range of federal statutes and regulations, in addition to the SDWA wellhead protection programs discussed above. Cities can use some of these tools to protect the quality of their ground water resources (quantity issues are addressed above) and the health and welfare of their citizens, but they are also subject to those requirements with respect to municipal activities such as solid waste disposal. Groundwater pollution can pose particular challenges because once an aquifer is contaminated, it is not likely to have the same flushing capacity as a river or other surface water. If polluted seriously, the resource might be lost for human consumption without expensive and lengthy remediation.

Urban areas generate tremendous volumes of solid waste. This waste burden can be reduced through aggressive recycling and reuse efforts, but significant amounts of waste are unavoidable. When disposed of improperly, solid waste disposal can cause serious groundwater and surface water pollution as well as public health risks from disease vectors and other problems. Under the federal Resource Conservation and Recovery Act (RCRA, an amendment to the SWDA), individual states operate non-hazardous solid waste programs according to general EPA regulations and standards, while EPA promulgates more specific waste treatment, transportation and disposal requirements for more dangerous hazardous wastes. Municipal groundwater and other resources can be protected through compliance with landfill siting, permitting, design and operation standards adopted under RCRA, and cities can affirmatively use this statute, either directly or through EPA and a state environmental agency, to require other parties to protect groundwater supplies or to clean up contaminated groundwater.

The federal "Superfund" statute (more formally the Comprehensive Environmental Response, Compensation and Liability Act, or CERCLA) also serves as a two-edged sword for municipalities. Under Superfund, several broad categories of "responsible parties" (current property owners, past owners at the time of disposal, some kinds of transporters, and persons who arrange for hazardous substance disposal) are liable for releases of hazardous substances into the environment. Superfund is a particularly potent legal tool because any responsible party can be held liable for releases regardless of fault (e.g., merely by virtue of current property ownership even if they were not responsible for the wastes), and because individual parties can be held "jointly and severally liable" for releases, meaning that one

party can bear full liability for an entire cleanup even if many parties contributed to the problem. These seemingly unfair provisions, however, are tempered by several somewhat complicated exceptions, and the fact that private landowners can sue other potentially responsible parties to clean up contaminated sites, or to seek contribution from other responsible parties to offset joint and several liability.

Municipalities can be responsible parties under Superfund, although they enjoy some narrow exceptions in addition to those available to private landowners. For example, cities are not liable for hazardous substance releases on properties acquired through tax sales, unless the municipality is responsible or partially responsible for the release. Thus, municipal governments must take the same care with hazardous substance disposal and management as do other parties, in part to avoid potentially significant Superfund liability and, more importantly, to protect their groundwater and other resources. However, like other parties, municipalities can also use Superfund affirmatively to require other property owners to clean up contaminated sites, or to bear their fair chare of the costs of doing so.

### *9.2.4 Benefits of Urban Aquatic Ecosystems*

Thus far, we have discussed laws and regulations designed to address *problems* in the urban water environment. Although a full discussion of legal principles governing the use of public land as an amenity is beyond the scope of this text, it is a mistake to ignore the fact that urban aquatic environments can and should also be viewed as tremendous resources to enhance quality of life in a community. Many cities are taking steps to restore urban rivers and streams, to promote recreational and environmental "greenways" using riparian corridors as assets rather than liabilities, and to preserve and protect green spaces in and around riparian zones to enhance and protect water resources and habitats for fish, wildlife, and other ecological communities (Chapter 7). Those efforts can benefit landowners by increasing property values, and aquatic ecosystem restoration can be part of urban renewal efforts in previously undesirable areas.

## 9.3 Legal Barriers to a Sustainable Urban Water Environment

This brief (and only partially complete) survey of the law relevant to the urban water environment suggests that a very wide range of laws, regulations, judicial decisions and other sources of law can influence the ways in which cities manage their water resources and aquatic environments. Some of the law provides useful tools that cities can use to achieve the objectives of providing safe and sufficient water supplies, and protecting urban waterways and aquatic ecosystems for the benefit of their citizens. While serving those needs, the same set of legal doctrines present a maze of compliance challenges for city water managers, sewerage officials, planners, zoning officials, and others.

### 9.3.1 Common Law Versus Statutory Approaches

One famous, early twentieth century case in the U.S. Supreme Court (*Missouri v. Illinois*) illustrates a number of these issues simultaneously: the interactions between the "front end" and the "back end" of the urban water environment, resulting conflicts among jurisdictions, and the need for innovative, holistic legal approaches to those problems. At the end of the nineteenth century, the City of Chicago realized that its water supply was being polluted by its own sewage discharges to Lake Michigan, which were close to the city's water intake structure, thus causing serious public health epidemics. To solve this problem, Chicago literally reversed the course of the Chicago River by means of an artificial channel that diverted the city's sewage into the Desplaines River, which empties into the Illinois River and then the Mississippi River upstream of St. Louis. When St. Louis experienced an increase in the incidence of typhoid fever, it alleged that Chicago had eliminated a public nuisance that affected Chicago's citizens at the expense of other communities downstream. The Supreme Court rejected this famous public nuisance lawsuit in the face of conflicting scientific evidence about the presence and residence time of the typhoid bacillus in the river, other possible sources of contamination from cities much closer to St. Louis, and ambiguous epidemiological data.

The *Missouri v. Illinois* saga illustrates the difficulties that lawyers and judges face when dealing with new, rapidly evolving and conflicting science and technology. After all, the case was brought only a matter of decades after Louis Pasteur demonstrated the role of bacteria in human disease. At the same time, however, it highlighted the need for legal solutions designed to prevent unsound urban water management practices rather than relying on the uncertainties of proof in isolated common law nuisance lawsuits. Although Justice Oliver Wendell Holmes in *Missouri v. Illinois* suggested that might come in the form of filters on the St. Louis public water supply to protect against pollution from multiple sources, in the CWA Congress ultimately intervened to require all cities to treat sewage to appropriate standards at the source, so that public health impacts would not turn on the location and fate of any particular discharge.

Although discrete legal challenges are pervasive, as they are in most aspects of municipal affairs, this survey suggests that two significant kinds of legal barriers may impede efforts to attain a more sustainable urban water environment. Unfortunately, neither will be easy to "solve" within the confines of the current legal regime governing urban water issues.

### 9.3.2 Fragmentation in Water Law

The first major barrier is fragmentation. As described above, urban water management is governed to varying degrees by common law, statutory law, and administrative regulation; and by federal, state, and local law. In part to summarize some of the contents of this chapter, Table 9.1 illustrates in a highly simplified fashion the

**Table 9.1** The legal landscape for the urban water environment (simplified)

| | Supply | Storage and Conveyance (dams and distribution systems) | Water treatment | Distribution and sale | Waste treatment (sewage and stormwater); drainage control |
|---|---|---|---|---|---|
| Goals | Water rights; water source protection | Adequate supply; minimize environmental impacts | Safe community drinking water | Affordability, efficiency, equity | Water quality, aquatic ecosystem protection, flood control |
| Problems | Competing users; growing demand; pollution and land use | Environmental conflicts | Contaminants | Increasing costs of acquisition, storage, treatment, distribution | Pollution sources; precipitation intensity; urbanization |
| Legal tools | State water law (riparian rights, prior appropriation, groundwater); planning and watershed protection; tort law; pollution laws (RCRA, CERCLA, CWA, SDWA); local building codes, plumbing and efficiency standards, water pricing | Federal, state and local environmental laws and regulations (NEPA, ESA, CWA) | Source protection (planning and zoning, land use, pollution prevention); SDWA standards | Public utility and rate regulation, pricing methods | Water quality laws (CWA and state); wetland and floodplain protection; land use planning and zoning; flood control laws; drainage law |

complex relationship between legal sources and water sources and uses in the United States. Taken together, the legal regime distinguishes in various ways between water quantity and water quality; between water supply, distribution, treatment and discharge; and between surface water and groundwater (from both supply and pollution perspectives). Likewise, distinct sets of laws and regulations designed to provide water to direct land use through planning and zoning and to minimize water quality impacts from urbanization serve different functions which are not always well coordinated (Arnold, 2005). Urban water managers and other officials must navigate a maze of different laws, regulations, procedures, and agencies to address various parts of their missions, and those different sources of authority are not necessarily consistent. No wonder the urban water environment itself is fragmented and often poorly coordinated, as discussed in Chapters 11 and 12.

It is highly unrealistic to think that this problem of fragmentation will be solved with any magic bullet, that is, with some kind of "superlaw" governing all aspects of the urban water environment. Indeed, there are some very good reasons for dealing with various aspects of water law and management in different ways. For example, local governments may be best suited to making land use decisions that affect water quality and quantity based on a range of local conditions, preferences, and other factors. However, establishing minimum national requirements for water quality (for example, through the CWA), ensures that all citizens receive certain basic protections against water pollution, and prevents some communities from simply exporting their wastes to others downstream.

It is realistic, and probably essential if we are to achieve greater sustainability in urban water resources and management, to take incremental steps to better coordinate various components of the laws and regulations that apply to these issues, even at the cost of some short-term disruptions and conflicts. For example, some administrative disruption would occur if states merged their systems for allocating surface water and groundwater rights, and some water rights would likely be affected during the transition. In the long run, however, addressing all water sources within hydrologically-connected basins and aquifers would make more sense than the current separate regimes.[3] Likewise, a formal merging of water quality and water quantity law—the absence of which Supreme Court Justice Sandra Day O'Connor referred to as "an artificial distinction"(PUD No. 1 of *Jefferson County v. Washington Department Ecology*)—would likely create a significant number of difficult transitional issues. It would be easier for municipalities and others to engage in comprehensive, integrated water resource planning and management, if the two systems were merged or at least better integrated. Finally, the linkages between water, land use, and growth are far too profound to continue to deal with them through entirely disconnected legal regimes. Sustainable urban water use and healthy urban aquatic environments require a more holistic consideration of the relationships between land use, water use and disposal, and aquatic ecosystem health.

[3]Not all aquifers are geographically coextensive with surface water basins, but in most cases hydrological connections predominate over discontinuities.

### 9.3.3 Public Versus Private Rights

The second major legal barrier to a more sustainable urban water environment, and one that may be even more challenging to address, is the traditional conflict between public welfare and private property rights, especially at the land–water interface ("the water's edge") (Adler, 2005). As noted above, the Supreme Court has accepted a range of legitimate government regulatory and other programs designed to protect water and aquatic resources in the face of challenges that unlawful takings have occurred. (*Palazzolo v. Rhode Island*; *Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Commission*). In others, it has rejected those controls as insufficiently proportionate to the public objectives sought (*Nollan v. California Coastal Commission*), or has ruled that the regulation would constitute an unlawful taking without just compensation (*Lucas v. South Carolina Coastal Council*). Even if most formal takings challenges to governmental regulation fail, the prospect of those lawsuits and the very effective political advocacy to protect private property rights against perceived or real governmental abuse can have a chilling effect on public measures to ensure sustainable water resources and healthy aquatic ecosystems in urban areas and elsewhere.

### 9.3.4 The Public Trust Doctrine

The common law public trust doctrine, however, illustrates that private property rights are not always paramount, and that single legal doctrines cannot necessarily be viewed in isolation (Adler, 2005). The public trust doctrine has ancient origins in Roman law, was adopted in many European countries during the middle ages and later was embedded in modified form in English common law. As adopted in England, the trust doctrine entailed ownership by the sovereign on behalf of the people in common, and restricted the ability of the Crown to alienate those trust resources in favor of private individuals. As such, the trust concept imposed on the government a duty to manage and protect those resources for the common purposes of commerce, navigation, and fishing.

In the United States, the colonies and then the states inherited both public trust ownership and responsibility. In a seminal public trust doctrine case, the U.S. Supreme Court held that the Illinois legislature and other government trustees have only limited discretion to dispose of public trust resources, and may not make a disposition that is fundamentally inconsistent with the purposes of the trust (*Illinois Central R.R. Co. v. Illinois*). However, the doctrine was limited to the common law triad of commerce, navigation, and fisheries. Born in a time when ecological awareness and understanding was virtually nonexistent, and when population pressures had not yet generated the magnitude of environmental harm that is occurring and understood today, ecological values were not included in the original doctrine.

Beginning in the early 1970s, in parallel with the Nation's growing interest in and understanding of water pollution, loss of species and habitat, and other forms of environmental harm, the public trust doctrine was revitalized in an effort to provide a common law basis for broader protection. In a now-famous article, Professor Joseph

Sax argued for the renovation and later expansion of the doctrine as a means of providing a legal right, vested in the public, and enforceable against the government, to vindicate commonly-held expectations in environmental values (Sax, 1970). The courts soon took up the banner, most notably in the famous "Mono Lake" decision, and expanded the doctrine in terms of both geographic reach and the scope of common values to be protected (*National Audubon Society v. Superior Court*; *Marks v. Whitney*; *Just v. Marinette County*).

While some courts have viewed the trust duty expansively, one key critic argues that on a national scale, the doctrine remains limited to issues of public access and navigability, rather than broader issues of environmental protection (Lazarus, 1986). Moreover, as with the statutory applications and solutions discussed above, those proposed expansions will be met with heavy opposition from those who argue that expanding the doctrine beyond its traditional reach violates private property rights and other constitutional limitations (Huffman, 1987). These and more pragmatic barriers to case-by-case litigation brought on behalf of public resources historically has rendered common law approaches to environmental protection potentially effective for specific cases, but less so on a national scale.

### *9.3.5 Beyond the Public Trust?*

More fundamentally, despite its recent expansion in some jurisdictions to address environmental as well as commercial resources, the public trust doctrine remains rooted in anthropocentric notions of property law in which the trust assets are held by the government for the common benefit of human users. This foundation, along with the legal nature of the trust analogy itself, poses a serious impediment to the doctrine's effectiveness as a means of environmental protection.

Just as we distinguish artificially between water quality and water quantity, in some ways we draw an artificial boundary between private property rights on riparian and other waterside lands, and public rights in the water itself and in the beds and banks of navigable water bodies. In reality, also as recognized by the Supreme Court, the dividing line between land and water is often far from clear (*United States v. Riverside Bayview Homes*). A more fine-tuned concept of public and private property rights (and responsibilities) in these transition zones, in which the government's ability to protect public aquatic resources increases with the aquatic nature of public resources, would more realistically account for the shifting nature and benefits of those resources. Likewise, it would allow federal, state, and local governments to implement legitimate programs to manage and protect public water and aquatic resources, and to do a better job of promoting sustainability in the urban water environment.

## References

Adler, R.W. (2007). *Restoring Colorado River Ecosystems: A Troubled Sense of Immensity*, Washington, D.C.: Island Press.

Adler, R.W. (2005). The law at the water's edge: Limits to "ownership" of aquatic ecosystems. In Arnold, C.A., ed. *Wet Growth: Should Water Law Control Land Use*? Washington, D.C.: Environmental Law Institute.

Adler, R.W., Landman, J.C., and Cameron, D.M. (1993). *The Clean Water Act 20 Years Later*, Washington, D.C.: Island Press.

Arnold, C.A. (2005). Introduction: Integrating water controls and land use controls: New ideas and old obstacles. In Arnold, C.A., ed. *Wet Growth: Should Water Law Control Land Use*? Washington, D.C.: Environmental Law Institute.

Brown, L.R., Gray, R.H., Hughes, R.M., and Meador, M.R. (2005). Introduction to effects of urbanization on stream ecosystems, 47 *American Fisheries Society Symposium* 1.

American Law Institute. (1979). *Restatement (Second) of Torts*.

American Society of Civil Engineers, Water Laws Committee, Water Resources Planning and Management Division. (1997). *Regulated Riparian Model Water Code*.

City of Albuquerque v. Reynolds, 379 P.2d 73 (N.M. 1962).

Clean Water Act, 33 U.S.C. §1251 et seq.

Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §9601 et seq.

Concerned are Residents for the Environment v. Southview Farm, 34 F.3d 114 (2d Cir. 1994).

Connecticut v. Massachusetts, 282 U.S. 660 (1931).

Driesen, D.M., and Adler, R.W. (2007). *Environmental Law: A Conceptual and Pragmatic Approach*, New York: Aspen Publishers.

Endangered Species Act, 16 U.S.C. §1531 et seq.

Energy Policy and Conservation Act of 1992. Public Law 102–486, October 24, 1992. 102nd Congress. Washington, D.C.

Furumai, H. (2007). Reclaimed stormwater and wastewater and factors affecting their reuse. In Novotny, V. and Brown, P. eds. *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management*, London: IWA Publishing.

Gibbons v. Ogden, 22 U.S. (9 Wheat) 1 (1824).

Glennon, R.L. (2002). *Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters*, Washington, D.C.: Island Press.

Hadad, B.M. (2000). *Rivers of Gold: Designing markets to Allocate Water in California*, Washington, D.C.: Island Press.

Heany, J.P. (2007). Centralized and decentralized urban water, wastewater & storm water systems. In Novotny, V. and Brown, P. eds. *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management*, London: IWA Publishing.

Hudson River Fisherman's Association v. Williams, 139 A.D.2d 234 (N.Y. S.Ct App. Div. 1988).

Huffman, J.L. (1987). Avoiding the takings clause through the Myth of public rights, 3 *Journal of Land Use and Environmental Law* 171.

Illinois Central RR. Co, v. Illinois, 146 U.S. 387 (1892).

Just v. Marinette County, 201 N.W.2d 761 (Wis. 1972).

Lazarus, R.J. (1986). Changing Conceptions of Property and Sovereignty in Natural Resources: Questioning the Public Trust Doctrine, 71 *Iowa Law Review* 631.

Lucas v. South Carolina Coastal Council, 505 U.S. 1003 (1992).

Marks v. Whitney, 491 P.2d 374 (Cal. 1971).

Martinez, J. (2006). *Government Takings*, St. Paul, Minn: Thompson-West Publishing.

Meyers, C. and Noble, R. (1967). The Colorado River: The Treaty with Mexico, 19 *Stanford Law Review* 367.

Missouri v. Illinois, 200 U.S. 496 (1906).

National Audubon Society v. Superior Court, 658 P.2d 709 (Cal. 1983).

National Environmental Policy Act, 42 U.S.C. §4321 et seq.

National Research Council. (1995). *Wetlands: Characteristics and Boundaries*, Washington, D.C.: National Academy Press.

Nolan, J.R. (2001). *Well Grounded: Using Local Land Use Authority to Achieve Smart Growth*, Washington, D.C.: Environmental Law Institute.

Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987).
Palazzolo v. Rhode Island, 553 U.S. 606 (2001).
Phillips Petroleum Co. v. Mississippi, 484 U.S. 469, 475–476 (1988).
PUD No. 1 of Jefferson County v. Washington Department Ecology, 511 U.S. 700 (1994).
Rapanos v. United States, 126 S.Ct. 2208 (2006).
Reisner, M. (1986). *Cadillac Desert: The American West and its Disappearing Water*, 2d ed., New York: Viking.
Resource Conservation and Recovery Act, 42 U.S.C. §6901 et seq.
Robertson v. Methow Valley Citizen's Council, 490 U.S. 332 (1989).
Safe Drinking Water Act, 42 U.S.C. §300f et seq.
Sax, J.L., Thompson, B.H., Jr., Leshy, J.D., and Abrams, R.H. (2000). *Legal Control of Water Resources*, 3d ed. St. Paul, Minn.: West Group.
Sax, J.L. (1993). Property Rights and the Economy of Nature: Understanding *Lucas v. South Carolina Conservation Council*, 45 *Stanford Law Review* 1433.
Sax, J.L. (1970). The public trust doctrine in natural resources law: Effective judicial intervention, 68 *Michigan Law Review* 471.
Snow v. Parsons, 28 Vt. 459 (Vermont, 1856).
South Florida Water Management District v. Miccosukee Tribe, 541 U.S. 95 (2005).
Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Comm'n, 122 S. Ct. 1465 (2002).
Tang, S.L., Yue, D.P.T., and Ku, D.C.C. (2007). *Engineering and Costs of Dual Water Supply Systems*, London: IWA Publishing.
Tarlock, A.D. (2005). We are all water lawyers now: Water law's potential but limited impact on urban growth management. In Arnold, C.A., ed. *Wet Growth: Should Water Law Control Land Use*? Washington, D.C.: Environmental Law Institute.
Tarlock, A.D. and Van de Weterling, S.B. (2006). Western growth and sustainable water use: If there are no "natural limits," should we worry about water supplies? 27 *Public Land and Resources Law Review*33.
Thompson, B.H., Jr. (2005). Water management and land use planning: Is it time for close coordination? In Arnold, C.A., ed. *Wet Growth: Should Water Law Control Land Use*? Washington, D.C.: Environmental Law Institute.
United States v. Riverside Bayview Homes, 474 U.S. 121 (1985).
U.S. Department of the Interior, U.S. Geological Survey (2002). Fact Sheet FS-042-02, Effects of Urbanization on Stream Ecosystems.
U.S. Environmental Protection Agency, Office of Water (2001). National Primary Drinking Water Standards, EPA 816-F-03-016, available at http://www.epa.gov/safewater.
U.S. Environmental Protection Agency (2001). National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Monitoring, 66 Fed. Reg. 6975 et seq. (January 22, 2001) (codified at 40 C.F.R. Parts 9, 141, and 142).
U.S. Environmental Protection Agency (1994). Combined Sewer Overflow (CSO) Control Policy, EPA 830Z94001.
Wyoming v. Colorado, 259 U.S. 419 (1922).