

**MAINTAINING INSTREAM FLOW AND PROTECTING AQUATIC HABITAT: PROMISE AND PERILS  
ON THE PATH TO REGULATED RIPARIANISM**

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**Introduction**

Increasing urbanization and growing demands for water supplies are among the factors that have led many eastern states to face the need for changes to their common law systems of water rights allocation. This article considers some issues raised by efforts at statutory reform when human demands for water imperil instream flows and the survival of aquatic organisms. The article focuses on the recent history of water rights legislation in Massachusetts to illustrate some promising approaches as well as some key pitfalls in the path toward a resource allocation system that provides adequate protection of instream flows while encouraging efficient use of water for offstream uses.

Of the New England states, Massachusetts and Connecticut made significant shifts toward statutory control of water resources in the 1980's, following difficult experiences with drought conditions.<sup>1</sup> These two states adopted statutory schemes that have many features in common. Both states established administrative frameworks for expert planning and increased government oversight of water resources allocations in the name of serving the public interest. While the legislation has not incorporated the full array of provisions set forth in the recommendations of the American Society of Civil Engineers' Regulated Riparian Model Water Code,<sup>2</sup> or in the extensive multi-layered regime of a state such as Florida,<sup>3</sup> the enactments do reflect efforts at

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<sup>1</sup> Massachusetts Water Management Act, MASS. GEN. LAWS ch. 21G, §§ 1 to 19 (2002); Massachusetts Interbasin Transfer Act, MASS. GEN. LAWS ch. 21, §§ 8B-8D (2002); Connecticut Water Diversion Policy Act, CONN. GEN. STAT. §§ 22a-365 to 22a-378.

<sup>2</sup> AM. SOC'Y OF CIVIL ENG'RS, THE REGULATED RIPARIAN MODEL WATER CODE: FINAL REPORT OF THE WATER LAWS COMMITTEE OF THE WATER RESOURCES PLANNING AND MANAGEMENT DIVISION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS (Joseph W. Dellapenna ed., 1997) [hereinafter MODEL CODE].

<sup>3</sup> FLA. STAT. ch. 373. Some key aspects of the Florida system are discussed in Joseph W. Dellapenna, *The Law of Water Allocation in the Southeastern States at the Opening of the Twenty-First Century*, 25 U. ARK. LITTLE ROCK L. REV. 9, 58-64 (2002). See also Richard C. Ausness, *Water Rights Legislation in the East: A Program for Reform*, 24 WM. & MARY L. REV. 547, 557-559 (1983).

broad statutory reform in the face of competition over water supplies in increasingly urbanized landscapes.

In Massachusetts, the Water Management Act of 1985 displaced key aspects of the common law in establishing a statewide management program for water withdrawals. The legislature envisioned the beginnings of a "comprehensive" regulatory regime.<sup>4</sup> The scope of the administrative permit program was limited, however, to large, new consumptive withdrawals of water.<sup>5</sup> Smaller and existing withdrawals of water, as well as "nonconsumptive" uses, have remained outside the close supervision of the state Department of Environmental Protection (DEP). With its exemptions, thresholds and definitional ambiguities, the legislation left a range of unsettled questions to be resolved through administrative proceedings, judicial decisionmaking, or further legislation. In recent years, continuing controversies over how to manage competing demands for water resources<sup>6</sup> reflect the fact that the Massachusetts regulatory system is still a work-in-progress, even though the state has adopted more far-reaching statutory reforms than many eastern states.

The transitional character of Massachusetts' shift to administrative oversight is typical of regulated riparian jurisdictions.<sup>7</sup> Authors who distinguish the emerging regulatory systems in riparian jurisdictions from the hard-edged definitions of prior appropriation jurisdictions have at times voiced the view that the incremental and evolving nature of eastern permit systems, as well as the differences among the states, may be success stories of local experimentation and adaptation rather than incomplete or defective implementations of western style systems.<sup>8</sup> The argument implies that the hybrid and varying aspects of regulated riparian systems offer the promise of combining greater security and efficiency in the allocation and use of water resources with flexible, adaptive, contextual decisionmaking that accommodates differences in local

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<sup>4</sup> The statute calls for the development of "principles, policies and guidelines . . . to assure comprehensive and systematic planning and management of water withdrawals and use in the commonwealth, recognizing that water is both finite and renewable." MASS. GEN. LAWS ch. 21G, § 3 (2002). *See also* SPECIAL LEGISLATIVE COMMISSION ON WATER SUPPLY, REPORT OF THE SPECIAL COMMISSION ESTABLISHED (UNDER CHAPTER 13 OF THE RESOLVES OF 1978 AND MOST RECENTLY REVIVED AND CONTINUED BY CHAPTER 9 OF THE RESOLVES OF 1982) TO MAKE AN INVESTIGATION AND STUDY RELATIVE TO DETERMINING THE ADEQUACY OF THE WATER SUPPLY OF THE COMMONWEALTH, Senate No. 1826 (Feb. 1983) at 8 [hereinafter REPORT OF THE SPECIAL COMMISSION].

<sup>5</sup> MASS. GEN. LAWS ch. 21G, § 4 (2002) (establishing a withdrawal volume threshold of one hundred thousand gallons per day, in the absence of subsequent administrative action to lower the threshold, and excluding "nonconsumptive" uses from the calculation of withdrawal volumes); *id.* § 7 (limiting the permit program to "new" withdrawals over the "threshold" volume.)

<sup>6</sup> *See, e.g.,* Franco Ordoñez, *Overuse of Charles Spurs Suit Threat: DEP Accused of Imperiling River*, BOSTON GLOBE, Nov. 20, 2003 (Globe West), at 1.

<sup>7</sup> MODEL CODE, *supra* note 2, at vi (describing the regulated riparian form of water law as a system that in most states has "emerged gradually through a process of small legislative interventions.")

<sup>8</sup> A. Dan Tarlock, *Discovering the Virtues of Riparianism*, 9 VA. ENVTL. L.J. 249 (1990); Robert H. Abrams, *Water Allocation by Comprehensive Permit Systems in the East: Considering a Move Away from Orthodoxy*, 9 VA. ENVTL. L.J. 255 (1990).

circumstances.

The discussion below pursues this theme with a particular focus on the problems of protecting aquatic organisms and maintaining the instream flows on which they depend. Do these new statutory systems in riparian jurisdictions provide wise means for meeting increasing human demands for water supplies while maintaining the ecological integrity of waterways? Do they strike the right balance in providing private entitlements for economic security, investment and innovation on the one hand, and guarantees of instream flow for healthy aquatic ecosystems on the other?

As discussed below, certain kinds of partial reform pose dangers to the protection of instream needs. A statutory formulation or administrative interpretation that gives strong attention to quantifying and securing offstream uses without providing comparable quantification and protection of instream needs can put the ecological integrity of watersheds at risk by failing to treat instream and offstream uses of resources with the same degree of specificity and protective enforcement. The article explores the difference between a "balancing" system that privileges offstream uses in the face of uncertain scientific knowledge, and systems that "balance the budget" for water using adaptive approaches for setting overall goals and discerning instream flow requirements. The discussion draws on illustrative aspects of the Massachusetts experience.

The Massachusetts approach has offered secure delineation of offstream uses while leaving instream needs unquantified and subject to incremental impairment in administrative proceedings. The resulting lopsided protection of offstream uses to the detriment of instream values has set the stage for ongoing challenges, both in court and at the administrative level. A long period of tension and controversy may ensue unless the regulatory regime expands to encompass clear administrative determinations of instream requirements that are as well-defined and protected as the entitlements to meet offstream demands.

Part I of the article provides a factual background for the discussion. The Ipswich River in northeastern Massachusetts has been named one of America's most endangered rivers by the advocacy group American Rivers.<sup>9</sup> The local situation is emblematic of broader difficulties in the implementation of the water management system. The Ipswich River illustrates a growing environmental problem in Massachusetts, and in the eastern states more generally: the impairment of water flows caused by extensive suburban development and construction of new infrastructure.<sup>10</sup> The signs of ecological stress in the Ipswich,<sup>11</sup> and in watercourses elsewhere

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<sup>9</sup> AMERICAN RIVERS, AMERICA'S MOST ENDANGERED RIVERS OF 2003 18-19 (2003), *available at* <http://www.amrivers.org/docs/MostEndangeredRivers2003.pdf>. The Ipswich River had already been listed among the nation's twenty most endangered rivers by American Rivers in 1997. *See* <http://www.amrivers.org/mostendangered/1997report.htm>.

<sup>10</sup> ROBERT J. GLENNON, WATER FOLLIES : GROUNDWATER PUMPING AND THE FATE OF AMERICA'S FRESH WATERS 99-112 (2002) (chapter on Ipswich River, discussing effects of suburban development).

<sup>11</sup> DAVID S. ARMSTRONG, TODD A. RICHARDS & GENE W. PARKER, U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR, WATER-RESOURCES INVESTIGATIONS REPORT 01-4161, ASSESSMENT OF HABITAT, FISH COMMUNITIES, AND STREAMFLOW: REQUIREMENTS FOR HABITAT PROTECTION, IPSWICH RIVER, MASSACHUSETTS,

in the state,<sup>12</sup> highlight inadequacies of the regulatory system.

Part II examines the provisions of the Massachusetts Water Management Act and the Massachusetts Interbasin Transfer Act, as a backdrop for pursuing the question of why environmental degradation and depletion of instream flows occur despite the extensive water management requirements imposed by the legislature. The Massachusetts statutory regime adopts provisions that are characteristic of the more highly developed regulatory systems in the eastern United States, and it tracks the recommendations of the *Regulated Riparian Model Water Code* in many key regards. The system has provided "hard-edged" and well-defined allocations for offstream uses.

As implemented, however, the Massachusetts system has not made parallel commitments to the definition of instream needs. Part III looks at the evolving science and policy of setting instream flow measures to meet an objective of "ecological integrity." In particular, it considers the subsidiary objective of "biological integrity" and the dependency of aquatic organisms on the physical attributes of their environment that are shaped by instream flows. The discussion explores the potential form of legal requirements that might establish allocations of water sufficient to restore and maintain the biological integrity of aquatic ecosystems.

Part IV analyzes whether a regulatory system such as Massachusetts' offers workable means for pursuing the objective of biological integrity and providing the necessary definition and quantification of instream flows through the water rights allocation system. The discussion distinguishes case-by-case "balancing" that incorporates hidden presumptions against instream protection, and procedures for achieving a "balanced budget" that supports both human and biological communities. The institutional challenge is to find flexible and adaptive ways of expanding human water uses while maintaining and restoring the instream benefits of water resources. "Balancing the budget" in Massachusetts water law will require significant efforts to set ecological objectives and to translate these objectives into measurable goals that quantify instream water allocations as thoroughly as water withdrawal rights are quantified in permits. In the meanwhile, it will be important to introduce more safeguards to ensure that withdrawal rights remain flexible rather than fixed, so that they may be subject to ongoing revision.

## **I. The Ipswich River, a Symbol of Regulatory Failure in Water Management**

### **A. Flow Depletion in the Ipswich**

The Ipswich River is a small coastal river in northeastern Massachusetts that meanders through a

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1998–99 (2001), <http://ma.water.usgs.gov/publications/wrir/wri014161/index.htm> [hereinafter USGS REPORT 01-4161].

<sup>12</sup> Commonwealth of Massachusetts Water Resources Commission, *Stressed Basins in Massachusetts* (Dec. 13, 2001) (report of interagency committee), *available at* [http://www.state.ma.us/envir/mwrc/pdf/Massachusetts\\_Stressed\\_Basins.PDF](http://www.state.ma.us/envir/mwrc/pdf/Massachusetts_Stressed_Basins.PDF) [hereinafter *Stressed Basins Report*].

historic landscape for forty-five miles from its source to the ocean.<sup>13</sup> Since pre-colonial times the river has supported a biologically rich ecosystem and an array of human uses. Anadromous fish such as salmon, shad, alewives and smelt, freshwater species such as brook trout and fallfish, and productive shellfish beds in the estuary have provided bountiful resources that were central to the regional economy. In recent times, the river and adjoining public and private parks and nature preserves including the Ipswich River Wildlife Sanctuary have attracted significant recreational use. While the river was used for mills and other manufacturing in early industrial times, the river did not see the extensive industrialization and pollution of many other rivers in the Northeast. Because of its water quality, the Ipswich became an important source of drinking water for municipalities both within the watershed and outside of it. Today the river provides drinking water to approximately 330,000 residents and thousands of businesses in fifteen cities and towns.

Now the river suffers from significant episodes of streamflow depletion. Periods of no flow and extremely low flow occur on a chronic basis. About every other year during the past ten years, the river has run out of water in the dry summer months.<sup>14</sup> While Massachusetts is a relatively water-rich state, summer and early fall conditions in the Ipswich have often resembled those in the dry states of the West. Photographs from recent dry periods show fish kills and dead aquatic organisms, vegetation in areas of formerly open water, and long stretches of dry rocky riverbed.<sup>15</sup> The changes in streamflow have altered the species composition in the ecosystem. Riffle and bank habitats have disappeared as lowered water levels have divided the river into isolated pools. Flow dependent species such as fallfish and brook trout that live only in stream environments have not been able to survive in these conditions. The water quality has also changed. Lower dissolved oxygen levels, higher pollutant concentrations from contaminated runoff and impaired wetlands functions have resulted from the changes in streamflow. Seasonal recreational uses such as canoeing and kayaking have also been affected.<sup>16</sup>

The condition of the Ipswich River has garnered regional and national attention. In 2003 the nonprofit organization American Rivers ranked the Ipswich River third in a national list of America's most endangered rivers.<sup>17</sup> The Ipswich has become a "poster child" of ecological

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<sup>13</sup> This summary of Ipswich River information is drawn from HORSELEY & WITTEN, IPSWICH RIVER WATERSHED MANAGEMENT PLAN i, 2-2 to 2-7 (2003), available at <http://www.horsleywitten.com/ipswich/REPORT.pdf>. See also GLENNON, *supra* note 10, at 101-102; Lou Wagner, *Flow Restoration in Massachusetts: Science and Advocacy Bring Progress in the Ipswich River Watershed*, CONSERVATION PERSPECTIVES: THE ON-LINE JOURNAL OF NESCB (Spring 2003), at <http://www.massscb.org/epublications/spring2003/wagner.html>.

<sup>14</sup> USGS REPORT 01-4161, *supra* note 11, at 8-13.

<sup>15</sup> Photographs from the summer of 1999 are posted at <http://ma.water.usgs.gov/ipswich/default.htm> (last modified April 17, 2003).

<sup>16</sup> HORSELEY & WITTEN, *supra* note 13, at 3-1 to 3-9 (describing effects of flow depletion in the river); IPSWICH RIVER FISHERIES RESTORATION TASK GROUP, IPSWICH RIVER FISHERIES: CURRENT STATUS AND RESTORATION APPROACH (2002), available at <http://www.ipswichriver.org/FishRestReport.pdf> [hereinafter IPSWICH RESTORATION REPORT].

<sup>17</sup> AMERICAN RIVERS, *supra* note 9.

impairment, exemplifying the problems of depletion of instream flows in rivers elsewhere in the eastern states.

## B. Effects of Urban Development on Streamflow

The Ipswich provides a small-scale but particularly dramatic example of widespread and growing water management problems related to urban development.<sup>18</sup> The ecological condition of the Ipswich highlights the multifaceted effects that urbanization and "sprawl" have on instream flows.<sup>19</sup> United States Geological Survey studies have pinpointed a combination of factors that prevent the river from providing habitat for native populations of aquatic organisms and maintaining recreational uses.<sup>20</sup>

First, municipalities have pumped increasing amounts of water from their water supply wells, depleting the groundwater aquifers that otherwise replenish the surface waters.<sup>21</sup> The increasing demands for municipal water supply stem from new development. New commercial and industrial uses require more water, while the subdivision and conversion of rural areas for residential development bring growing human populations, increasing household uses, and use of large amounts of water for lawns and landscaping.

Second, much of this pumped groundwater never makes its way back into the same watershed. Instead, about eighty percent of the municipal supply pumped from wells hydrologically connected to the Ipswich is exported out of the watershed, through water supply and wastewater systems that ultimately discharge elsewhere, bypassing the Ipswich river system altogether.<sup>22</sup> The water exported through sewer systems is significantly augmented by the "infiltration and inflow" of groundwater and stormwater that enter wastewater pipes through cracks and leaky joints.

Third, urban development has led to the creation of impervious surfaces that prevent infiltration of rainwater into the ground. Rainwater runs quickly off of pavement and roofs, through stormwater drainage systems constructed to remove rather than retain water, and into surface

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<sup>18</sup> *E.g.*, Dan Tarlock & Lora A. Lucero, *Connecting Land, Water, and Growth*, LAND USE LAW & ZONING DIG. 3 (April 2002) (examining the relationships between urban development and water management and identifying critical elements of "smart" planning processes.) *See also* Holly Doremus, *Water, Population Growth, and Endangered Species in the West*, 72 U. COLO. L. REV. 361 (2001).

<sup>19</sup> Wagner, *supra* note 13 (summarizing the causes of low flow in the Ipswich)

<sup>20</sup> USGS REPORT 01-4161, *supra* note 11; PHILLIP J. ZARRIELLO & KERNELL G. RIES, III, U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR, WATER-RESOURCES INVESTIGATION REPORT 00-4029, A PRECIPITATION-RUNOFF MODEL FOR ANALYSIS OF THE EFFECTS OF WATER WITHDRAWALS ON STREAMFLOW, IPSWICH RIVER BASIN, MASSACHUSETTS (2000), *available at* [http://water.usgs.gov/pubs/wri/wri004029/whole\\_report.pdf](http://water.usgs.gov/pubs/wri/wri004029/whole_report.pdf).

<sup>21</sup> HORSELEY & WITTEN, *supra* note 13, at 4-1 to 4-9 (discussing impacts of groundwater and surface water withdrawals in the Ipswich).

<sup>22</sup> *Id.* at 4-9 to 4-10 (exports from watershed).

waters, causing "flashy" fluctuations in surface streams rather than a recharge of the aquifers that provide steady and prolonged base flows.<sup>23</sup>

Finally, dams on the river and its tributaries aggravate some of the deleterious effects of low flows. More than thirty dams on the Ipswich and its tributaries, in various states of repair, alter the distribution of water in the river, affecting water quality and habitat.<sup>24</sup>

In summary, changes in land uses, increased municipal pumping, expansion of impervious surfaces, and diversion of water into engineered systems for water supply, wastewater treatment and disposal, and stormwater drainage, have all contributed to the depletion of instream flows. Earlier alterations in the configuration of the river, including old dams, compound the effects of more recent flow changes that impair aquatic habitat. While the Ipswich River provides a particularly vivid illustration of such phenomena, the conditions are typical of many urbanizing areas in otherwise water-rich states of the Northeast.

### C. The Importance of State Law in the Absence of Federal Oversight

The impacts of urban development on instream flows and aquatic habitats are profound, but they do not necessarily trigger the administrative attention and oversight that federal regulatory programs provide. The Ipswich River watershed provides an excellent example of environmental degradation that escapes the various regulatory programs at the federal level that might bring scrutiny of effects on instream flows and aquatic habitats.

Many federal programs can trigger at least some review of instream flow and habitat impacts when jurisdictional requirements are met. For example, construction of dams in navigable waters require analysis of environmental effects by the Army Corps of Engineers under section 404 of the Clean Water Act.<sup>25</sup> Licensing and relicensing of hydroelectric dams under the Federal Power Act entail Federal Energy Regulatory Commission review of impacts on aquatic organisms and recreational values.<sup>26</sup> Federal and private actions that affect listed water-dependent species under the Endangered Species Act also receive federal scrutiny.<sup>27</sup> Withdrawals from "sole source" aquifers must meet federal standards under the Safe Drinking Water Act.<sup>28</sup> Projects that receive federal permits or funding, as well as projects on federal

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<sup>23</sup> *Id.* at 4-11 to 4-13 (effects of impervious surfaces).

<sup>24</sup> *Id.* at 4-13 to 4-14.

<sup>25</sup> 33 U.S.C. § 1344 (2000). *But see* Robert W. Adler, *The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity*, 33 ENVTL. L. 29, 68-69 (2003) (noting the reluctance of the Army Corps of Engineers and the EPA to exercise fully their authority under section 404 of the Clean Water Act to protect ecological integrity).

<sup>26</sup> Federal Power Act, 16 U.S.C. §§ 791a-825u (2000).

<sup>27</sup> Endangered Species Act, 16 U.S.C. §§ 1531-1544 (2000).

<sup>28</sup> Safe Drinking Water Act, 42 U.S.C. §§ 300f-300j-11 (2000).

lands, receive environmental reviews and an assessment of alternatives under the National Environmental Policy Act.<sup>29</sup> Federal lands and waters fall under an array of statutory management programs that may require assessment of instream flow needs.<sup>30</sup> Designations establishing the purposes and uses of federal lands may entail the assertion of federally-reserved water rights for instream purposes.<sup>31</sup>

In many watersheds affected by urbanization and sprawl in the east, however, none of these forms of federal scrutiny and oversight come into play because the projects do not fit within the statutory scope of federal programs. Development activities like those in the Ipswich, involving large groundwater withdrawals and land use practices that impair aquifer recharge, may cause extensive environmental damage while escaping any sort of federal review. Consequently, while environmental reviews of federally-authorized projects in other locations may generate scientific information that is useful in understanding and modeling streamflow and ecosystem dynamics, federal laws provide no directly-applicable regulatory handle.

In the absence of a federal regulatory overlay, the spotlight turns to the adequacy of state laws. The following discussion examines Massachusetts' regulatory system as an example of a rather extensive state water management regime. Massachusetts' Water Management Act and its Interbasin Transfer Act adopted key concepts that now appear in the *Regulated Riparian Model Water Code*.

## **II. Regulated riparianism and the promise of water rights reform: The Massachusetts example**

### **A. Key Regulatory Provisions in Massachusetts Water Law**

In many ways the Massachusetts water management statute typifies a well-elaborated administrative system in a regulated riparian jurisdiction. The statute departs from common law principles by delimiting and quantifying large "consumptive" water withdrawal rights<sup>32</sup> and allowing water uses outside of riparian lands.<sup>33</sup> It provides for expert oversight of water

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<sup>29</sup> National Environmental Policy Act §§ 4321, 4331-4335 (2000).

<sup>30</sup> See, e.g., Michael C. Blumm, *The Amphibious Salmon: The Evolution of Ecosystem Management in the Columbia River Basin*, 24 *ECOLOGY L.Q.* 653, 671-672 (1997) (discussing laws applicable to federal management in the Columbia River Basin).

<sup>31</sup> E.g., *Cappaert v. United States*, 426 U.S. 128 (1976) (federally reserved water right to protect water levels and ensure survival of a fish population at Devil's Hole Monument).

<sup>32</sup> MASS. GEN. LAWS ch. 21G, § 4 (2002) (setting withdrawal volume threshold of one hundred thousand gallons per day, an amount that may be lowered by regulation, and excluding nonconsumptive uses from the determination of withdrawal volumes). See also *id.* § 2 (defining "nonconsumptive use"). Comparable provisions appear in the *Regulated Riparian Model Water Code*. MODEL CODE, *supra* note 2, § 6R-1-02 (exempting "small" withdrawals under 100,000 gallons per day); § 2R-2-13 ("nonconsumptive use"); § 2R-2-06 ("consumptive use").

<sup>33</sup> The permission for nonriparian use is implicit in the lack of any restrictions to particular lands in the statute. *The Regulated Riparian Model Water Code* is more explicit. See MODEL CODE, *supra* note 2, § 2R-1-02 (No prohibition of use based on location of use.)

allocation through administrative processes at the state Department of Environmental Protection (DEP).<sup>34</sup> In consultation with a water planning body, the Water Resources Commission, the Department of Environmental Protection issues regulations that interpret the law and elaborate on the criteria for determining whether permit applications should be approved.<sup>35</sup> The statute applies to both surface waters and groundwaters, integrating the management of hydrologically connected waters.<sup>36</sup>

The system imposes different regulatory requirements for new and existing users.<sup>37</sup> In this bifurcated system, uses of water existing when the statute was enacted may continue only if registered with the Department of Environmental Protection.<sup>38</sup> The statute limits authorized existing uses to actual, quantified withdrawal volumes, properly documented in filings with the department. Authorized withdrawals expire after a specified period (ten years) unless they are re-registered.<sup>39</sup> The registration system provides data and other information about existing water withdrawals to the state administrative agency, although it does not establish an extensive regulatory scheme for limiting or conditioning those uses.

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<sup>34</sup> MASS. GEN. LAWS ch. 21G, §§ 5, 11 (2002) (registration and permitting of quantified volumes).

<sup>35</sup> *Id.* § 3.

<sup>36</sup> *Id.* § 2 (defining "water" as "all water beneath or on the surface of the ground"); *id.* § 3 (requiring the department to adopt regulations "for managing ground and surface water in the commonwealth as a single hydrological system." The integration of surface and groundwater management was a major purpose of the legislation. See REPORT OF THE SPECIAL COMMISSION, *supra* note 4, at 4 ("Efficient use of the Commonwealth's water resources requires conjunctive management of ground and surface water. For that, [sic] to occur, significant changes in groundwater law are necessary.") In this regard, the statute tracks the conjunctive management of ground and surface waters under the *Regulated Riparian Model Water Code*. See MODEL CODE, *supra* note 2, § 2R-2-32 (defining "waters of the state.") See also THOMAS C. WINTER ET AL., U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY CIRCULAR 1139, GROUND WATER AND SURFACE WATER: A SINGLE RESOURCE (1998) (summarizing scientific literature on the interconnectedness of groundwater and surface water).

<sup>37</sup> While the Department of Environmental Protection oversees both registrations and permits, the disparity between new users and existing users in the level of government oversight is a prominent feature of the system. The DEP authorizes new proposed uses based on an expert administrative assessment of the social utility of the proposed use, but the legislature has exempted existing uses from the permit process, relying on temporal priority, instead of subjecting these withdrawals to individualized scrutiny of social utility. In granting exemptions from the permit system for prior uses, the system follows a pattern of legislative concern for existing economic interests that is found in the "grandfathering" provisions of a number of other regulated riparian jurisdictions. MODEL CODE, *supra* note 2, § 2R-1-04 commentary (noting that Connecticut, Indiana, Mississippi, New York, Ohio, and Virginia, in addition to Massachusetts, have provided limited protection to rights to use water based on temporal priority).

<sup>38</sup> MASS. GEN. LAWS ch. 21G, §§ 4-6 (2002) (registration procedures); *id.* § 2 (defining "existing withdrawal"). The Model Code does not so exclude large existing withdrawals from the permit system, but it does establish more lenient requirements when permits are first sought for existing withdrawals. MODEL CODE, *supra* note 2, § 6R-1-03. The Model Code also provides a "registration" procedure for withdrawals that are not subject to permits. MODEL CODE, *supra* note 2, § 6R-1-06.

<sup>39</sup> MASS. GEN. LAWS ch. 21G, § 5 (2002).

All other large water users must obtain a permit for a withdrawal.<sup>40</sup> The permit scheme for "new" withdrawals is the heart of the regulatory system. In effect, the legislation envisions a comprehensive planning process to coordinate the entry of new users in light of preexisting withdrawals.<sup>41</sup> The DEP decides, before a new withdrawal begins, whether the proposed use should be allowed, taking into consideration an array of public interests and environmental and economic impacts, including effects on existing users and impacts on wildlife habitat and recreational uses.<sup>42</sup> Permits in watersheds expire at designated times, so that the agency can, at least in theory, assess the cumulative effects of multiple users and take basin-wide plans into account.<sup>43</sup>

The legislation also envisions excluding new uses as necessary to ensure sustainable use of water resources. It precludes issuing new permits in any watershed where the "safe yield" of the water source will be exceeded.<sup>44</sup> In a watershed that has been closed to new development, new users may gain access to water resources only by rolling back existing uses through purchase of "easements."<sup>45</sup> Thus, the statute contemplates a rudimentary market system for helping shift less valuable uses to new ones while keeping the total quantity of withdrawals within an overall ceiling expressed as the "safe yield."

Massachusetts also has an emergency system for rolling back uses when water supply shortages

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<sup>40</sup> *Id.* §§ 7-11 (permit procedures); *id.* § 2 (defining "new withdrawal").

<sup>41</sup> The DEP issues permits subject to conditions as necessary to serve the purposes of the statute. The permit specifies the withdrawal volume, the use of the water withdrawn, and the term of the permit, which may not exceed twenty years. The permit conditions also include measurement and reporting requirements, implementation of conservation measures, and other requirements to ensure optimal allocation of available water supplies and effective government oversight and enforcement. The DEP may impose in the permit "whatever conditions it deems necessary to further the purposes of this chapter." MASS. GEN. LAWS ch. 21G, § 11 (2002). The *Regulated Riparian Model Water Code* has comparable provisions. MODEL CODE, *supra* note 2, § 7R-1-01 (Permit Terms and Conditions).

<sup>42</sup> The statute enumerates ten sets of factors that the department must consider "at a minimum" in permit proceedings pursuant to its regulations. These factors range from "[r]easonable protection of water uses, land values, investments and enterprises that are dependent on previously allowable withdrawals (MASS. GEN. LAWS ch. 21G, § 7(4) (2002)) and "[r]easonable economic development and the creation of jobs in the commonwealth" (*id.* § 7(10)), to "[r]easonable protection of public drinking water supplies, water quality, wastewater treatment capacity, waste assimilation capacity, groundwater recharge areas, navigation, hydropower resources, water based recreation, wetland habitat, fish and wildlife, agriculture, and flood plains" (*id.* § 7(9)).

<sup>43</sup> MASS. GEN. LAWS ch. 21G, § 11 (2002).

<sup>44</sup> *Id.* § 11 (requiring denial of permit applications when existing, permitted and proposed withdrawals exceed the "safe yield"); *id.* § 2 (defining "safe yield"). The *Regulated Riparian Model Water Code* also relies on a concept of "safe yield" in defining the quantities of water available for withdrawal. MODEL CODE, *supra* note 2, § 2R-2-21.

<sup>45</sup> MASS. GEN. LAWS ch. 21G, § 8 (2002) (allowing a permit application to include "a negotiated agreement with any other owner of property conveying by deed an easement restricting that property owner's right to withdraw from the water source," and requiring the department to consider the easement in determining the availability of water within the safe yield.)

endanger public health, safety or welfare.<sup>46</sup> These provisions grant sweeping powers to the state to ban water uses, curtail issuance of building permits, set priorities for allocation of available water supplies, and require planning, monitoring, and conservation measures. Although this part of the act expands the state's planning and management authority in times of drought, it may be invoked only when the operator of the public water system has requested state assistance by petitioning the DEP for a declaration of a state of water emergency.<sup>47</sup>

In addition to the Water Management Act, Massachusetts' Interbasin Transfer Act,<sup>48</sup> implemented by the Water Resources Commission, sets forth an additional set of approvals for "significant" increases in interbasin transfers of water.<sup>49</sup> This "area-of-origin" statute imposes additional administrative scrutiny when a proposed new water withdrawal will export large quantities of water out of a donor basin. In essence, this law establishes presumptions against such transfers of water out-of-basin, and allows exports only when the applicant demonstrates that all practical measures including metering, leak detection, and conservation of the receiving basin's water supplies have been implemented, and all alternatives have been explored in accordance with the state's environmental impact review statute, the Massachusetts Environmental Policy Act.<sup>50</sup>

#### B. The "Hard-Edged" Quantification of Withdrawal Rights

Given Massachusetts' broad administrative oversight of water withdrawals, why has the water management system failed to protect instream values that are as significant as those in the Ipswich? The statutory regime grants the DEP and the Water Resources Commission strong legal authority for investigating, planning, and managing the uses of water resources. It limits issuance of new permits in two key ways. First, the statute precludes permit issuance when the safe yield of the basin is exceeded. Second, the law requires the agency to take wetland habitat, fish and wildlife, water-based recreation, water quality, and other values dependent on instream flow into account in each permit proceeding. It further provides authority for the administrative agency to revisit periodically its past judgments in permit proceedings about the allocation of water, and to accommodate changing social values and new scientific information. The interbasin transfer statute also imposes special presumptions in favor of "keeping water local" that serve to protect instream flows in the basin of origin. At first glance, then, the combined

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<sup>46</sup> *Id.* §§ 15-17.

<sup>47</sup> The DEP has broad statutory authority to establish by regulation a "mechanism to control water in the commonwealth during water supply and water quality emergencies," *id.* § 3, but it has not sought to use this provision to take action in the absence of a local request for state assistance.

<sup>48</sup> MASS. GEN. LAWS ch. 21, §§ 8B-8D (2002).

<sup>49</sup> *Id.* § 8C. The Commission may not treat any amount over one million gallons per day as "insignificant." *Id.* § 8B. The statute's focus on "increases" prevents the Commission from addressing problems caused by existing diversions.

<sup>50</sup> MASS. GEN. LAWS ch. 30 §§ 62-62H (2002). The *Regulated Riparian Model Water Code* likewise recognizes the "reasonable needs" of basins of origin, although local interests are not singled out for a special level of protection to the extent provided in Massachusetts law. MODEL CODE, *supra* note 2, § 1R-1-14.

elements of the statutory scheme would seem to offer a sound basis for ensuring that new development would stay within limits sufficient to ensure the survival of healthy aquatic ecosystems.

A closer review, however, reveals troublesome aspects of the statutory and regulatory system that have undermined the protection of instream flows. On the one hand, claims to water withdrawal rights have been defined and quantified through the registration and permitting systems, and they have become the basis for assertions of secure entitlements, either as a matter of statutory right or as a matter of practical dependency and political reality. On the other hand, instream needs have not been similarly understood and quantified through the regulatory system. The disparities in framing these different aspects of the water "budget" stem in part from the language of statutory provisions, in part from interpretations of the administrative agencies responsible for planning and regulation, and in part from bureaucratic inaction and lack of resources.

The statute follows policies of the *Regulated Riparian Model Water Code* in establishing more well-defined water withdrawal rights than under the common law.<sup>51</sup> It seeks to offer enough specificity and security for private economic interests to make investment decisions and pursue beneficial development of water resources. Quantifying allocations through registrations and permits also provides a firmer basis for private parties to consider private transactions for shifting water withdrawals from less profitable to more profitable uses. A system of granting private entitlements is a means of fostering economic development and private transactions that optimizes the use of water withdrawals for human benefit.<sup>52</sup>

How "hard-edged" and secure are the allocations of water to offstream uses under the Water Management Act in reality? The Massachusetts statutory system, with its hybrid approach to new and existing uses, offers two different perspectives on the question.

On a spectrum of authority ranging from private autonomy on the one hand, to direct government control of resources on the other, authorizations for water withdrawals in Massachusetts occupy a span of middle ground. For registered volumes, the statute in certain phrases uses a language of ownership to describe the scope of a registered user's control. Such a user is "entitled" to continue withdrawals upon filing necessary documentation,<sup>53</sup> and is deemed to "have" an existing withdrawal.<sup>54</sup>

Nevertheless, the registration is subject to some explicit statutory limitations and government-imposed requirements. The registration statement must be filed with the agency in order to

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<sup>51</sup> MODEL CODE, *supra* note 2, § 1R-1-06 (Legal Security for Water Rights).

<sup>52</sup> See Robert H. Abrams, *Charting the Course of Riparianism: An Instrumentalist Theory of Change*, 35 Wayne L. Rev. 1381 (1989); Robert H. Abrams, *Replacing Riparianism in the Twenty-First Century*, 36 Wayne L. Rev. 93 (1989); Ausness, *supra* note 3.

<sup>53</sup> MASS. GEN. LAWS ch. 21G, § 5 (2002).

<sup>54</sup> *Id.* § 2 (defining "existing withdrawal").

"authorize" the withdrawal; this authorization expires every ten years and must be renewed in order to continue in effect, and the registration process is subject to department regulations.<sup>55</sup> The scope of the department's power to impose regulations is not clearly defined, but includes "reporting and renewal requirements, and verifications standards,"<sup>56</sup> as well as "terms under which an existing withdrawal may be continued by a person other than the original registrant."<sup>57</sup> In summary, the registered volumes are time-limited and subject to government verification and monitoring. They are potentially alienable, but they are subject to administrative rulemaking concerning the terms of transfer. The agency may impose conditions on renewals of registrations, but the statute does not provide elaborate guidance on the scope of this regulatory authority.

The quantification of registered volumes does not imply that the water rights could not be altered by further government action without compensation. While registrations of withdrawals in eastern statutory systems reflect a delineation of property rights in the use of water, these are not as secure as appropriative rights in prior appropriation jurisdictions,<sup>58</sup> and they are unlikely to receive the same level of constitutional protection.<sup>59</sup> Nevertheless, the statute's language of "entitlement" has created a specter of possible litigation that hangs in the background of any discussions about curtailing registered withdrawal rights.<sup>60</sup> The scope of the administrative authority to condition or roll back registered volumes remains a subject of controversy that has not yet reached the courts.

Permits for new withdrawals also define property-like interests in the use of water, but they are

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<sup>55</sup> *Id.* § 5.

<sup>56</sup> *Id.* § 5.

<sup>57</sup> *Id.* § 6.

<sup>58</sup> See Ausness, *supra* note 3, at 554-556 (examining similarities and differences of eastern permit systems and prior appropriation systems).

<sup>59</sup> As the commentary to the *Regulated Riparian Model Water Code* asserts, the scope of constitutional protections is "at least debatable." MODEL CODE, *supra* note 2, § 2R-1-04 commentary. See also Joseph L. Sax, *The Constitution, Property Rights and the Future of Water Law*, 61 U. COLO. L. REV. 257 (1990) (providing an overview of the scope of property rights in water and the nature of constitutional protections)

<sup>60</sup> The contention that registered volumes for groundwater withdrawals are entitlements that are not subject to scrutiny for "reasonableness" finds its origins in the state's earlier acceptance of the "English rule" of "absolute ownership" in its common law governing liability among private parties. *Greenleaf v. Francis*, 18 Pick 117 (1836); *Proprietors of Mills v. Braintree Water Supply Co.*, 149 Mass. 478, 485 (1889). Because the courts abandoned ideas of absolute ownership and moved to more widely accepted ideas of "reasonableness" in other areas of the common law (in particular, the law of drainage and the "common enemy" rule, *Tucker v. Badoian*, 376 Mass. 907 (1978)), there are good grounds to think that the common law principles of groundwater use were evolving in a similar fashion at the time of the adoption of the Water Management Act. See Michael S. Baram & J. Raymond Miyares, *Groundwater Legal and Institutional Analysis* submitted to The Special Legislative Commission on Water Supply (Nov. 1, 1982), *reprinted in* REPORT OF THE SPECIAL COMMISSION, *supra* note 4, at 9, 19-21, 45-50 (discussing Massachusetts common law cases).

explicitly subject to an array of government-imposed conditions similar to traditional regulatory authorizations such as pollution control permits.<sup>61</sup> The government's ongoing regulatory authority to impose and alter conditions to serve the public interest circumscribes the scope of the property interest in a permitted withdrawal.<sup>62</sup> Nevertheless, the effect and indeed the purpose of the permit system is to induce investments, transactions, and dependencies on the basis of quantified volumes.<sup>63</sup> Although permit terms are limited to twenty years, the calculus of social utility in a subsequent permit proceeding is affected by the extent to which the previously permitted uses are now well entrenched. One of the factors that the department must consider in a permit proceeding is "reasonable protection of water uses, land values, investments and enterprises that are dependent on previously allowable withdrawals."<sup>64</sup>

The resulting practical and bureaucratic commitment to ongoing withdrawals is especially strong in the case of institutional users. While the DEP might contemplate new permit conditions in a permit renewal proceeding for a municipal water supplier, it is inconceivable that the agency would deny or severely curtail a permitted volume when new subdivisions and new populations have moved into an urbanizing area and become dependent on the available water supply.<sup>65</sup> For similar reasons, the power of the department to modify, suspend, or terminate a permit during the permit term, "when deemed necessary for the promotion of the purposes of the chapter,"<sup>66</sup> is in reality less sweeping than it might appear on paper. Temporal priority and protection of investments made on the expectation of steady water supplies are powerful themes within the regulatory framework that extend beyond registered volumes to water allocations under new permits.

A lack of integration between the state's permitting decisions and local land use regulation compounds the "steamroller" effect of the quantification process. Massachusetts is a state with many small municipalities and a strong home-rule tradition.<sup>67</sup> No explicit language in the water management statute requires local land use decisions to prevent development if adequate water resources are not available. Thus, local investments in real estate development can occur before

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<sup>61</sup> A. DAN TARLOCK, *LAW OF WATER RIGHTS AND RESOURCES* § 3.97 (2003) (noting that permit criteria "represent a confusing mix between property rights protection and administrative allocation.")

<sup>62</sup> See MODEL CODE, *supra* note 2, § 6R-1-01 commentary (permit requirements as a regulation of riparian rights rather than a "taking").

<sup>63</sup> See MODEL CODE, *supra* note 2, § 1R-1-06 (Legal Security for Water Rights).

<sup>64</sup> MASS. GEN. LAWS ch. 21G, § 7(4) (2002). The statutory concern with protecting existing economic uses has been carried over from similar preoccupations in the common law. See RESTATEMENT (SECOND) OF TORTS § 850A, factor (h).

<sup>65</sup> See MODEL CODE, *supra* note 2, § 2R-2-12 (Municipal Uses) (giving preference to nonindustrial municipal uses of water because such water uses are closely linked to the health, safety and welfare of inhabitants.)

<sup>66</sup> MASS. GEN. LAWS ch. 21G, § 11(7) (2002).

<sup>67</sup> See generally MARK BOBROWSKI, *HANDBOOK OF MASSACHUSETTS LAND USE AND PLANNING LAW: ZONING, SUBDIVISION CONTROL AND NONZONING ALTERNATIVES* § 1.05 (2d ed. 2002); MASS. CONST. art. LXXXIX, § 6.

water management permit proceedings begin at the state level. As a practical matter, then, the bureaucratic commitment to allowing a large withdrawal of water often precedes any careful consideration of environmental impacts, even in an initial permit proceeding.

Finally, the statutory system for recognizing and dealing with emergency drought conditions provides only limited and "last-ditch" means for curtailing the exercise of water withdrawal rights. The *Regulated Riparian Model Water Code* recommends broad governmental powers to impose additional restrictions on permits in times of water shortage.<sup>68</sup> In Massachusetts, though, the state DEP exercises emergency powers only when the public water system operator has asked for state help.<sup>69</sup> The water emergency system as implemented by the agency does not involve planning measures in advance of crisis conditions, nor does it address spillover effects from one municipality or water supply district into another. The security of water withdrawal allocations under the registration and permit systems is thus reinforced by a strong concept of state deference to local decision making concerning emergency police power measures.

In summary, then, the water management statute results in quantified allocations that provide the basis for financial investments and economic benefits. Despite broad discretionary provisions in the statute, permits for new withdrawals are in reality difficult to change in significant ways once they are authorized. Although commentators tend not to view either registrations or permits as vested property-rights that may not be altered without compensation, a concern about judicial and administrative challenges has undoubtedly encouraged a "hands-off" approach toward registered volumes at the agency level, as well as a reluctance to deny or modify permits for new withdrawals.

### **III. Biological Integrity, Physical Integrity, and Instream Flow**

#### **A. Defining and Measuring the Condition of Aquatic Ecosystems**

The volumes of water necessary to support instream habitat needs are not as securely defined as registered and permitted volumes, nor are they reliably protected over time. To understand why this is so under the statute, and why the parity of instream and offstream entitlements matters, this section considers first how instream needs might be defined. Science and policy work tying the viability of aquatic ecosystems to the study of instream flows has focused on the concept of "ecological integrity" in waterways.

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<sup>68</sup> MODEL CODE, *supra* note 2, § 4R-2-02. Drought management strategies as conceived in the model code include measures to curtail uses to protect the ecological integrity of water sources and may include redefining "safe yield" in times of shortage. *Id.* commentary. Such powers could serve as a backup method for setting regulatory flow trigger levels, achieving rollbacks in withdrawals on an incremental basis, and adjusting the allocation of limited resources among users in times of limited supply. Massachusetts has not established a regulatory framework for integrating drought management measures into its planning in this fashion.

<sup>69</sup> MASS. GEN. LAWS ch. 21G, §§ 15-17 (2002). The statute also requires the DEP to issue regulations establishing "a mechanism to control water in the commonwealth during water supply and water quality emergencies." *Id.* § 3. Nevertheless, the agency has not used this apparently broad regulatory authority to address water shortages through advance planning measures.

Scientists have gained increasingly sophisticated understandings about the relationships between the "ecological integrity" of rivers and the dynamics of stream flows. Although the notion of "integrity" itself is a contested concept, significant progress has been made in recent years in articulating the meaning of ecosystem integrity and developing methods for gauging attainment of the objective and measuring levels of impairment.<sup>70</sup> Ecological integrity as defined in the scientific and ecosystem management policy literature typically includes three subcategories for discerning the health or viability of an ecosystem: chemical, physical, and biological integrity.<sup>71</sup>

The purpose of achieving and maintaining ecological integrity appears prominently in the Congressional declaration of goals and policy in the Federal Water Pollution Control Act Amendments of 1972 (now known as the Clean Water Act)<sup>72</sup>: "The objective of this chapter is to restore and maintain the chemical, physical and biological integrity of the Nation's waters."<sup>73</sup> Section 101 of the statute goes on to articulate seven national goals for achieving this objective. One of these, often called the goal of "fishable and swimmable" water, states "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."<sup>74</sup>

Section 303(c) of the Clean Water Act implements the interim goal and serves the overarching objective by calling for promulgation of water quality standards consisting of "designated uses" and "water quality criteria."<sup>75</sup> The standards must take into consideration the "propagation of fish and wildlife,"<sup>76</sup> among an array of factors. To support the development of standards by states, the Administrator of the Environmental Protection Agency issues "information" under section 304(a)(2), "on the factors necessary to restore and maintain the chemical, physical, and biological integrity" of waters<sup>77</sup> and "on the factors necessary for the protection and propagation

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<sup>70</sup> ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION, AND HEALTH (David Pimentel, Laura Westra & Reed F. Noss eds., 2000) [hereinafter ECOLOGICAL INTEGRITY]. See also Alyson C. Flournoy, *Restoration Rx: An Evaluation and Prescription*, 42 ARIZ. L. REV. 187 (2000).

<sup>71</sup> Laura Westra, et al., *Ecological Integrity and the Aims of the Global Integrity Project*, in ECOLOGICAL INTEGRITY, *supra* note 70, at 19, 23 (citing, *inter alia*, J.R. Karr & D.R. Dudley, *Ecological Perspectives on Water Quality Goals*, 5 ENVTL. MGMT. 55 (1981)).

<sup>72</sup> Federal Water Pollution Control Act of 1972, Pub. Law No. 92-500, 86 Stat. 816 (1972), (codified as amended at 33 U.S.C. §§ 1251-1387 (2000)). Robert Adler has explored in depth the origins and implications of the Clean Water Act's objectives. Adler, *supra* note 25.

<sup>73</sup> 33 U.S.C. § 1251(a) (2000).

<sup>74</sup> *Id.* § 1251(a)(2). Although this national goal is often cited as though it were the ultimate objective, in fact it is an interim goal within a broader long-range aim of "chemical, physical and biological integrity."

<sup>75</sup> *Id.* § 1313(c). The water quality standards, developed by the states and approved by the EPA, are to "protect the public health or welfare, enhance the quality of water and serve the purposes of this chapter." *Id.*

<sup>76</sup> *Id.* § 1313(c)(2)(A).

<sup>77</sup> *Id.* § 1314(a)(2)(A).

of shellfish, fish, and wildlife."<sup>78</sup>

In its guidance documents, the EPA makes reference to the statutory goals and objectives in elaborating on the states' roles under the statute. The EPA defines ecological integrity as "the condition of an unimpaired ecosystem as measured by combined chemical, physical (including physical habitat), and biological attributes."<sup>79</sup> "Biological integrity" is defined in turn as "[t]he capacity of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region."<sup>80</sup>

The emphasis on assessing ecosystem structure and function through comparisons to natural habitats in this interpretation of the statutory terms finds strong support in the legislative history of the Clean Water Act. The 1972 House Report states:

"The word "integrity" as used is intended to convey a concept that refers to a condition in which the natural structure and function of ecosystems is maintained. . . . This definition is in no way intended to exclude man as a species from the natural order of things, but in this technological age, and in numerous cases that occurred before industrialization, man has exceeded nature's homeostatic ability to respond to change. Any change induced by man which overtaxes the ability of nature to restore conditions to "natural" or "original" is an unacceptable perturbation. . . . [W]e could describe that ecosystem whose structure and function is "natural" as one whose systems are capable of preserving themselves at levels believed to have existed before irreversible perturbations caused by man's activities."<sup>81</sup>

Older notions that ecosystems might have a single, static "natural state" have been replaced in recent science and policy literature by increasingly sophisticated understandings about how dynamic ecological processes allow ecosystems to respond resiliently to changes. Yet the focus on the importance of protecting key aspects of ecosystem structure and function in order to support an adaptive community of organisms remains central to current interpretations of ecological "integrity."

The EPA's reliance on "unimpaired" and "natural" conditions as the gauge for measuring the relative degree of ecological integrity in aquatic settings thus tracks the well-established use of "unimpaired" or "natural" reference conditions in the scientific and policy literature in assessing

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<sup>78</sup> *Id.* § 1314(a)(2)(B).

<sup>79</sup> Glossary, <http://www.epa.gov/waterscience/biocriteria/glossary.html> (last modified Oct. 21, 2003).

<sup>80</sup> OFFICE OF WATER, EPA, EPA 822-F-02-006, BIOLOGICAL ASSESSMENTS AND CRITERIA: CRUCIAL COMPONENTS OF WATER QUALITY PROGRAMS 1 (Summer 2002), *available at* <http://www.epa.gov/waterscience/biocriteria/technical/brochure.pdf>

<sup>81</sup> H.R. REP. NO. 92-911 at 76-77 (1972). For an extended discussion of congressional intent and the legislative history, see Adler, *supra* note 25 at 32-47.

the health of ecosystems.<sup>82</sup>

The EPA has encouraged the states and tribes to conduct biological assessments ("bioassessments") and to develop biological criteria ("biocriteria") in pursuing their responsibilities under the Clean Water Act. Bioassessments use surveys and other measures of aquatic life to evaluate the existing biological condition in a water body. "[A]ttaining biological integrity reflects good water body health. When human activities disrupt chemical and physical integrity, biological integrity is also compromised, and ecological health declines. Bioassessments are the tools for measuring biological condition. . . ."<sup>83</sup> States use bioassessment data, for example, in reporting to the EPA on whether water bodies attain their designated aquatic life uses for purposes of the National Water Quality Inventory Report required by section 305(b) of the Clean Water Act.<sup>84</sup>

Biocriteria are narrative descriptions or numerical values that draw on bioassessment data to set regulatory standards expressing the desired conditions for aquatic life in water bodies. Biocriteria thus provide programmatic means for working progressively to attain an objective of "biological integrity" by setting measurable goals for supporting specific designated uses for aquatic life.<sup>85</sup> A full-fledged regulatory program to restore and maintain biological integrity would include definitions of the aquatic community in the designated uses, and it would adopt criteria to measure levels of impairment, identify the causes of impairment, and incorporate requirements for implementation of measures to attain the designated uses.<sup>86</sup> One advantage of setting biocriteria, as noted in EPA publications, is that biologically-based goals can also act as surrogate measures for achieving physical and chemical integrity, since the health of aquatic biota depends on the physical and chemical condition of the aquatic environment.<sup>87</sup>

## B. Establishing Requirements to Support Biological Integrity

What would be the key elements of an effective regulatory program for ensuring that instream flows support the biological integrity of a water body? Two sets of important conclusions appear consistently in recent efforts to define the instream flows necessary to support biological

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<sup>82</sup> See James R. Karr, *Health, Integrity, and Biological Assessment: The Importance of Measuring Whole Things*, in *ECOLOGICAL INTEGRITY*, *supra* note 70, at 209.

<sup>83</sup> OFFICE OF WATER, EPA, *supra* note 80.

<sup>84</sup> 33 U.S.C. § 1315(b) (2000).

<sup>85</sup> Robert W. Adler, *Filling the Gaps in Water Quality Standards: Legal Perspectives on Biocriteria*, in *BIOLOGICAL ASSESSMENT AND CRITERIA: TOOLS FOR WATER RESOURCE PLANNING & DECISIONMAKING* 347 (Wayne S. Davis & Thomas P. Simon eds., 1995).

<sup>86</sup> See EPA, EPA 440/5-90-004, *BIOLOGICAL CRITERIA: NATIONAL PROGRAM GUIDANCE FOR SURFACE WATERS* (April 1990), <http://www.epa.gov/bioindicators/html/biolcont.html>.

<sup>87</sup> *Id.*

integrity in aquatic ecosystems.<sup>88</sup>

First, ecological researchers recognize that the instream flows that support biological integrity in aquatic ecosystems cannot be described as a single minimum flow level.<sup>89</sup> Rather, aquatic biota require a "flow regime" characterized by fluctuations in water amounts and conditions over time.<sup>90</sup> Five key components of the flow regime are its magnitude, frequency, duration, timing and rate of change of hydrologic conditions.<sup>91</sup> Changes in any of these elements (for instance, by prolonging the duration or the frequency of low flow events, or reducing the magnitude of high spring "flushing" flows), can have cascading effects. For example, such changes can impair the feeding or spawning abilities of organisms, or allow the growth of invasive species, or change suitable habitat by displacing sediments or reconfiguring channels.

While investigators do not yet have precise understandings of what the "natural flow regime" would be in many New England rivers in the absence of significant impairments, it is by now well-understood that flows that mimic natural conditions would be needed to restore or maintain biological integrity, and that these flows need to include high peak flows in spring above wintertime levels, as well as certain minimum flows and limited low flow frequencies and durations in dry summer months.<sup>92</sup>

A second, increasingly well-accepted concept in the scientific community is that characteristic communities of organisms may be good indicators of overall ecosystem health in the region's rivers.<sup>93</sup> In particular, recent studies have suggested that investigating the specific composition of fish populations in water bodies may provide means that are both accurate and practical for determining ecological integrity.<sup>94</sup>

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<sup>88</sup>The Instream Flow Council, a consortium of state and provincial fishery and wildlife agencies formed in 1998, provides an excellent overview of such efforts in a recent handbook. INSTREAM FLOW COUNCIL, INSTREAM FLOWS FOR RIVERINE RESOURCE STEWARDSHIP (2002).

<sup>89</sup> The use of the term "minimum flow" itself has been criticized for implying that protection of a single, low water level will be sufficient to protect biological integrity. AMERICAN RIVERS, *supra* note 9. The Model Code retains the use of the term "minimum flow" but recognizes the potential need for seasonal variations in the administrative interpretation of this term. "The trend today is to manage withdrawals (including releases from reservoirs) so as to mimic natural seasonal variations in flow in order to preserve the biological integrity of the water source [citation omitted]". MODEL CODE, *supra* note 2, § 3R-2-02 commentary.

<sup>90</sup> N. LeRoy Poff, *The Natural Flow Regime: A Paradigm for River Conservation and Restoration*, 47 BIOSCIENCE 769 (1997).

<sup>91</sup> EPA, New England Office, Ensuring Adequate Instream Flows in New England (May 2003)(fact sheet).

<sup>92</sup> Brian D. Richter, et al., *Ecologically Sustainable Water Management: Managing River Flows for Ecological Integrity*, 13 ECOLOGICAL APPLICATIONS 206 (2003).

<sup>93</sup> See James R. Karr, *Biological Monitoring and Environmental Assessment: A Conceptual Framework*, 11 ENVTL. MGMT. 249 (1987).

<sup>94</sup> YALE SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES, CENTER FOR COASTAL AND WATERSHED SYSTEMS, CONNECTICUT INSTREAM FLOW CONFERENCE 85-113 (2002), available at <http://www.yale.edu/ccws/InstreamFlow.pdf> (conference proceedings from a conference held March 23 and May 4,

The "target fish" approach to determining impairment of a water body involves identifying the mix of fish species in an unimpaired (or relatively unimpaired) setting.<sup>95</sup> The numbers and percentages of flow-dependent species can then provide a target for restoration efforts, and indirectly, a measure of the success in reestablishing a flow regime adequate to support the life cycles of these fish populations as well as the larger community of organisms to which they belong.<sup>96</sup> With careful site-specific study, researchers can identify river reaches that would be suitable for the target fish populations with changes in instream flows, and they can propose flow regime changes through modeling efforts that would likely support these populations.<sup>97</sup> The recovery of target fish populations in a water body gives a good indication that both biological and physical integrity have been restored.

### C. Gaps in Federal Oversight and the Importance of State Law

Despite these scientific advances, ecological understandings have not been effectively translated into regulatory programs for the types of instream flow impacts that occur in the Ipswich River. At the federal level, the Clean Water Act has established broadly defined objectives for restoring and maintaining the ecological integrity of waterways, but the central federal permitting scheme of the statute has focused on the narrower task of controlling "discharges of pollutants" through "point sources," leaving water withdrawals and nonpoint source pollution outside the federal licensing system.<sup>98</sup> The EPA has exhorted the states to pursue development of biological

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2001, summarizing an array of methods for defining instream flow requirements, including the "target fish" approach).

<sup>95</sup> The "Target Fish Community" approach (or "TFC" methodology) for setting measurable ecosystem restoration goals has been developed and applied by researchers at Cornell University in cooperation with state and federal agencies in a demonstration project on the Quinebaug River, where a federally-licensed power plant affects instream flow. MARK B. BAIN & MARCIA S. MEIXLER, *DEFINING A TARGET FISH COMMUNITY FOR PLANNING AND EVALUATING ENHANCEMENT OF THE QUINEBAUG RIVER IN MASSACHUSETTS AND CONNECTICUT* (2000), *available at* <http://www.dnr.cornell.edu/research/IHP/Documents/QRTargMain.pdf>.

<sup>96</sup> Massachusetts Division of Fisheries and Wildlife, *Restoration and Conservation of Aquatic Habitat in Massachusetts Using Fish Community Analyses* (Jan. 12, 2004) (on file with the author) (setting forth a state agency plan for conducting target fish community assessments in Massachusetts, developing Indexes of Biotic Integrity (IBIs), and mapping habitat to support target fish populations, in an effort to establish priorities and set baselines for restoration and conservation endeavors.)

<sup>97</sup> USGS REPORT 01-4161, *supra* note 11 (reporting on an investigation of conditions in the Ipswich River that included a "target fish" analysis); DAVID S. ARMSTRONG & GENE W. PARKER, U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR, OPEN-FILE REPORT 02-438, *ASSESSMENT OF HABITAT AND STREAMFLOW REQUIREMENTS FOR HABITAT PROTECTION, USQUEPAUG-QUEEN RIVER, RHODE ISLAND, 1999-2000* (2003), <http://water.usgs.gov/pubs/of/2002/ofr02438/pdfs/ofr02438.pdf> (similar study in Rhode Island).

<sup>98</sup> As Professor Robert Adler has noted, biological and physical integrity are the "two lost books" in the trilogy of objectives in opening sentences of the Clean Water Act. Adler, *supra* note 25. Although section 502(19) of the Clean Water Act broadly defines the term "pollution" as "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water," 33 U.S.C. § 1362(19), Congress limited the statute's main permit programs to the narrower terms "pollutant" and "discharge of pollutants"--terms that have been interpreted to establish extensive federal controls on chemical impairment of waterways, while largely leaving "biological integrity" and "physical integrity" as aspirational goals. 33 U.S.C. § 1362(6), (12).

criteria in their water quality standards under the Clean Water Act, but it has not required the states to do so.<sup>99</sup> While federal oversight of state implementation of water quality standards results in monitoring and reporting concerning impairment of designated uses in water bodies, including problems caused by flow impairment, the statute provides no direct federal regulation of water rights allocations.<sup>100</sup>

Meanwhile, states such as Massachusetts have been slow to incorporate the concepts of ecological integrity found in the Clean Water Act as mandatory requirements in the administration of their water rights management systems. In Massachusetts, the failure to include protection of designated aquatic life uses as "bottom-line" requirements in regulations under the Water Management Act is particularly notable.

The framework for setting and achieving water quality standards under the federal Clean Water Act and the state's Clean Waters Act<sup>101</sup> is well understood as a matter of chemical pollution control. Yet the state regulatory scheme for water withdrawals fails to incorporate explicit requirements sufficient to ensure that aquatic life uses will be protected from impairment through flow depletion or alteration. Ironically, even if the state acknowledges in reports to the EPA that it is failing to meet water quality standards under the Clean Water Act because water withdrawals are depleting instream flows, that recognition does not necessarily translate into administrative measures to limit water withdrawals under the state water management system.

In summary, the federal Clean Water Act has helped to establish "ecological integrity" and the three subcategories of "chemical, physical, and biological integrity" as policy objectives in the management of water resources. Information and guidance published by the EPA pursuant to the Clean Water Act has served to establish and disseminate accepted methods for investigating and measuring the "biological integrity" of water bodies and for discerning causes of impairment, including physical changes in streamflow and other habitat characteristics. State reports to the EPA about the conditions in waterways under the Clean Water Act and the maintenance of designated uses in water quality standards have increasingly included bioassessment data that

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<sup>99</sup> As critics note, the EPA has more discretionary authority to take measures under various sections of the statute than it has exercised, including the authority to insist upon issuance of biological water quality standards and to promulgate federal standards if the states fail to do so. Adler, *supra* note 25 at 72-73, discussing 33 U.S.C. § 1313(c)(3), (4).

<sup>100</sup> Congress has made an explicit decision not to abrogate state water rights laws, even though water pollution controls necessarily have implications for water quantity allocations, and vice versa. Section 101(g) of the Clean Water Act declares "that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter," and that "nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State." 33 U.S.C. § 1251(g) (2000). When states do incorporate flow requirements in their water quality standards or otherwise establish flow conditions necessary to protect aquatic habitat under state law, however, these state-imposed requirements may receive powerful implementation by the federal government through incorporation in federal permits under the state "certification" provision of the Clean Water Act, *id.* § 1341(a). See PUD No. 1 of Jefferson County v. Washington Department of Ecology, 511 U.S. 700 (1994).

<sup>101</sup> MASS. GEN. LAWS ch. 21, §§ 26-53 (2002).

indicate impairments to the condition of aquatic biota, even when chemical criteria are met.<sup>102</sup> In effect, the objective of biological integrity in the Clean Water Act has served as a touchstone at the state level for ecological investigations of the current conditions of waterways.<sup>103</sup> But the question of what to do about state water rights systems when water withdrawals impair the biological integrity of aquatic ecosystems has been left for resolution in state law.

#### **IV. Pursuing Biological Integrity of Aquatic Ecosystems under State Law: Prospects and Proposals for Reform**

##### **A. Deficiencies in the State Water Management System**

Does Massachusetts' water management system offer workable means for setting regulatory goals for biological integrity, including the definition of biological criteria and the quantification of instream flows? While the regulatory system's failure to protect instream flows is self-evident, identifying the aspects of the statute and the agency actions that give rise to this failure is not as obvious.

Perhaps most central to the administrative ability to set limits on withdrawals is the statutory definition of "safe yield". By defining the amount of water available for withdrawal, this term also implicitly sets the amounts of water that must remain for instream flow. It is a powerful concept in the statutory scheme, because it provides a mandatory cap on administrative authorizations for new withdrawals. Thus, the safe yield concept lies at the heart of the agency's authority to develop a water budget with a "bottom line."

Despite the statute's promise of careful water budgeting, in practice the "safe yield" concept has not produced definitive administrative action to establish the instream flows necessary for the ecological integrity of rivers in Massachusetts. In part, the reasons may be found in the statute itself.

First, the statute makes "safe yield" requirements applicable only to applications for large new withdrawal permits. Registered volumes, as well as smaller withdrawals that fall below the specified threshold of consumptive use, are not automatically barred if the safe yield is exceeded. The statute provides no clear means of preventing these withdrawals from infringing on flows dedicated to instream needs, other than through temporary emergency measures. The agency has the regulatory authority to lower the threshold volumes that fall within the permit system, but it has not exercised this authority.

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<sup>102</sup> OFFICE OF ENVIRONMENTAL INFORMATION & OFFICE OF WATER, EPA, EPA-822-R-02-048, SUMMARY OF BIOLOGICAL ASSESSMENT PROGRAMS AND BIOCRITERIA DEVELOPMENT FOR STATES, TRIBES, TERRITORIES, AND INTERSTATE COMMISSIONS: STREAMS AND WADEABLE RIVERS (2002), [http://www.epa.gov/bioindicators/html/table\\_contents.html](http://www.epa.gov/bioindicators/html/table_contents.html).

<sup>103</sup> For example, a summary of available information on Massachusetts rivers and streams prepared by the Riverways Program of the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement identifies numerous instances of ecological impairment related to low flow conditions. Low Flow Inventory, [http://www.state.ma.us/dfwele/RIVER/rivLow\\_Flow\\_Inventory/home.html](http://www.state.ma.us/dfwele/RIVER/rivLow_Flow_Inventory/home.html). See also Stressed Basins Report, *supra* note 12.

Second, the legislature has failed to state clearly the agencies' mandatory duties to protect the ecological integrity of rivers. The statute defines the safe yield of a water body as "the maximum dependable withdrawals that can be made continuously from a water source."<sup>104</sup> While the legislature's concern with the reliability of municipal drinking water supplies in times of drought is apparent, its concern with the health of aquatic organisms appears only implicitly in the words "safe" and "dependable."<sup>105</sup>

Another section of the statute broadly states the importance of designing "principles, policies and guidelines . . . to protect the natural environment of the water in the commonwealth."<sup>106</sup> The statute appears to delegate broad authority to the Water Resources Commission and the Department of Environmental Protection to exercise administrative discretion, but it fails to state unambiguously that the agencies have mandatory duties to reserve quantities of water for instream flows sufficient to protect ecological integrity.

Thus, the process of setting and achieving ecological goals has been left largely to administrative discretion. The Department of Environmental Protection has taken regulatory steps to elaborate on the sketchy terms of the statute and to infuse the determinations of how much water is available for withdrawal with ecological considerations. The purposes of the permit program as stated in the regulations include "assist[ing] the Department in the comprehensive management of the Commonwealth's water resources . . . in a manner which ensures an appropriate balance among competing water withdrawals and uses, *as well as preservation of the water resource itself*."<sup>107</sup>

Despite some preliminary regulatory steps toward establishing a system that protects instream flows, the concept of setting aside or reserving instream flows by regulations turns out to be more of a promise than a reality. While the regulations describe a methodology for determining the safe yield of a river basin using a "minimum streamflow" adopted by the Water Resources Commission as a reference point, they do not explain how to proceed if the Commission's "minimum streamflow" numbers have not been determined, or if the Commission has not fully addressed ecological concerns in establishing streamflow policies.<sup>108</sup>

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<sup>104</sup> The complete definition of "safe yield" is "the maximum dependable withdrawals that can be made continuously from a water source including ground or surface water during a period of years in which the probable driest period or period of greatest water deficiency is likely to occur; provided, however, that such dependability is relative and is a function of storage and drought probability." MASS. GEN. LAWS ch. 21G, § 2 (2002).

<sup>105</sup> The definition evokes a notion of "safe yield" classically used in describing the physical availability of water available for withdrawal from a groundwater supply or reservoir.

<sup>106</sup> MASS. GEN. LAWS ch. 21G, § 3 (2002).

<sup>107</sup> 310 MASS. REGS. CODE § 36.02 (2003) (emphasis added). The regulations redefine the term "safe yield" as "the maximum annually averaged daily water use consumptive loss rate that can be sustained from a water source with an acceptable degree of risk." 310 MASS. REGS. CODE § 36.03 (2003). This definition rephrases the notion of "safety" and "dependable withdrawals" in terms of "degree of risk," although, like the statute itself, it makes no explicit statement about how to include risks to aquatic life in the analysis.

<sup>108</sup> 310 MASS. REGS. CODE § 36.31 (2003).

In these circumstances, instream flow needs are addressed in practice on a case-by-case basis in individual permit proceedings. The consideration of instream flow is reduced to a review of the demonstrated environmental impacts of a particular proposed withdrawal, without any pre-determined "bottom line." Although the department in permit proceedings must consider, among other factors, the "reasonable protection" of "wetland habitat, [and] fish and wildlife," as well as "[t]he water available within the safe yield of the water source,"<sup>109</sup> the department has no well-defined regulatory concept of total quantities available for allocation, nor does it have a clear definition of the flows that must be protected from withdrawal, which might result in closing a basin to further development.<sup>110</sup>

### B. Agency Vulnerability to Stakeholder Demands

The administrative failure to establish and meaningfully enforce well-defined and clearly quantified allocations of water to instream needs in Massachusetts is not surprising. While the statutes appear to give the Department of Environmental Protection and the Water Resources Commission considerable authority in developing ecological concepts by regulation and administrative policy, this authority is largely discretionary rather than mandatory. In the face of strong economic and political interests, the agencies have not taken steps to exercise their full discretionary authority in setting ecological goals.<sup>111</sup>

The administrative vulnerability to stakeholder demands is compounded when the agencies do not yet have the scientific knowledge that they need in order to translate biological objectives into definitive streamflow requirements. The understanding of the linkages among instream flows, habitat characteristics, and biological integrity have advanced dramatically over the past two decades, and recent intensive studies of specific waterways such as the Quinebaug and Ipswich in Massachusetts have laid the necessary groundwork for articulating measurable criteria in a precise manner in some locations.<sup>112</sup> But the process of converting a general objective of biological integrity into measurable ecological goals and quantified water

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<sup>109</sup> MASS. GEN. LAWS ch. § 7 (2002).

<sup>110</sup> The state's lack of regulatory criteria for instream flow was bluntly stated in a DEP response to EPA comments about the Massachusetts water quality standard: "[W]e do not have the necessary resources, data and tools available to establish valid, scientifically based and legally defensible minimum flows to protect beneficial uses. Without knowing what quantity of flow would be sufficient to protect uses in the state's various surface waters, we are at a loss as to how the EPA would have us establish and enforce such a requirement." Letter from Glenn Haas, Director, Division of Watershed Management, Massachusetts Department of Environmental Protection, to David Webster, Manager, Massachusetts State Office, U.S. EPA Region 1 (July 31, 2003) (on file with the author) (responding to the EPA position that the state water quality standards "should be revised to explicitly state that a sufficient quantity of water is required to protect designated and existing uses.")

<sup>111</sup> See Glennon, *supra* note 10, at 105 (noting the effect of demands by water suppliers in proceedings concerning the Ipswich River).

<sup>112</sup> BAIN & MEIXLER, *supra* note 95; USGS REPORT 01-4161, *supra* note 11; HORSELEY & WITTEN, *supra* note 13; ZARRIELLO & RIES, *supra* note 20.

allocations statewide will require further site-specific investigations in order to identify the requirements that will "work" in different watersheds.

Because ecosystems function in complex ways, the process of setting streamflow requirements can require a process of "learning by doing" or "adaptive management."<sup>113</sup> The criteria-setting process may be an iterative endeavor that involves establishing and achieving interim goals, observing outcomes, and adjusting requirements in light of ecological effects. This is particularly true when the requirements must take into account the dynamic and fluctuating aspects of aquatic needs at different times of year.

In these circumstances, the Water Management Act has created a framework that all too readily allows incremental impairment of ecosystems without a thorough accounting for cumulative effects. The system authorizes water withdrawals that become, for reasons discussed at the outset, the basis for increasingly entrenched investment-backed expectations and offstream dependencies. Without a clear biological goal in mind, new permit proceedings become forums where the "consideration" of factors becomes a "balancing" of documented economic concerns against unquantified and vaguely articulated environmental values.

In the absence of firm biological goals and established instream flow protections, the human needs for water withdrawals and the economic benefits to be derived from them easily overshadow case-specific evidence of local environmental impairment in individual permit proceedings. Meanwhile, the statutory framework does not provide a clear process for measuring and achieving restoration of water bodies once they are impaired as a result of the commitments of water to offstream uses. The result is a steady erosion of instream values.

### C. Comparable Dangers Under the Model Water Code

In theory, other regulated riparian systems are not necessarily vulnerable to the failings of the Massachusetts system. The more comprehensive provisions of the *Regulated Riparian Model Water Code* explicitly adopt the terminology of the Clean Water Act in asserting goals of "chemical, physical and biological integrity" for state protection of instream flows as a component of the determination of a "safe yield" from a water body.<sup>114</sup> Under the Model Water Code, these objectives form the basis for the state's statutory duty to "preserve minimum flows and levels in all water sources as necessary to protect the appropriate biological, chemical, and physical integrity of water sources by reserving such waters from allocation and by authorizing additional protections of the waters of the State."<sup>115</sup> These duties are an explicit part of the trust

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<sup>113</sup> See Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of "New Age" Environmental Protection*, 41 WASHBURN L.J. 50 (2001).

<sup>114</sup> "The 'safe yield' of a water source is the amount of water available for withdrawal without impairing the long-term social utility of the water source, including the maintenance of the protected biological, chemical, and physical integrity of the source." MODEL CODE, *supra* note 2, § 2R-2-21(1).

<sup>115</sup> *Id.* § 1R-1-11; see also *id.* § 3R-2-01 (Protected Minimum Flows or Levels Not to Be Allocated or Withdrawn) and § 3R-2-02 (Standards for Protected Minimum Flows or Levels. The duty to preserve "minimum flows" is an aspect of the duty to conduct comprehensive planning, *id.* § 1R-1-04, in order to protect the public interest and ensure "sustainable development" of water resources. *Id.* § 2R-2-24.

responsibilities of the state.<sup>116</sup> Moreover, the Model Code does not exempt existing uses from the general regulatory scheme, and subjects both new and existing uses to a permit system.<sup>117</sup>

Nevertheless, the *Regulated Riparian Model Water Code* itself does not provide any definitive process for determining the "biological, chemical, and physical integrity" of a water body or for setting regulatory criteria to achieve such objectives. In particular, the Model Code leaves the definition of "biological integrity" of a water source to development in other state and federal requirements, instead of setting substantive requirements on the matter.

"Biological integrity" is simply defined as "the maintenance of water in the source in the volume and at the times necessary to support and maintain wetlands and wildlife (including fish, flora, and fauna) in so far as protection of either is required by federal or State laws or regulations."<sup>118</sup> The necessary "minimum flows or levels" to support aquatic life are likewise left for articulation in other federal or state requirements.<sup>119</sup> In these respects, the Model Water Code, too, leaves the door open for a substantial lag time or even a chronic delay between the initial issuance of permits granting water withdrawal rights and the implementation of a meaningful system of instream flow requirements to support aquatic life.

Studies of other programs involving ecosystem management have identified comparable dangers outside the specific context of state water rights allocation. Professor Oliver Houck, for instance, has examined in depth the biodiversity and ecosystem programs of federal agencies charged with natural resource management at the federal level. He concludes that setting meaningful measures of ecological protection through the identification and protection of indicator species is critical to the success of ecosystem management programs that preserve biological diversity. Aspirational objectives alone are not enough to counterbalance a tendency toward simply allocating natural resources to satisfy human demands. "[H]owever high we raise our sights towards managing the whole, the requirements of individual species will remain the bottom line, or we will have no bottom line, and the entire effort will fail."<sup>120</sup> Similarly, as Eric

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<sup>116</sup> *Id.* § 1R-1-01.

<sup>117</sup> *Id.* § 6R-1-01.

<sup>118</sup> *Id.* § 2R-2-02.

<sup>119</sup> *Id.* § 3R-2-02 commentary ("This section establishes that the standards for minimum flows or levels are not set by this Code but by other relevant federal and State laws . . . . The State agency is to particularize the minimum flow or level for each source through a regulation adopted after suitable planning and study.")

<sup>120</sup> Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 873 (1997). See also Oliver A. Houck, *Are Humans Part of Ecosystems?*, 28 ENVTL. L. 1 (1998) (emphasizing the importance of a two-step process separating the analysis of human desires from the setting of biological goals. "If you have a system predicated on whatever humans want to do as its bottom line, the bottom line disappears; there is no management principle or law." *Id.* at 7. Conversely, programs that create "safety zones" around species may succeed where "[t]he measures of these zones are not what people need or desire; they are the biological needs of the species themselves." *Id.* Cf. James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 617 (2000) (noting that environmental trading markets (ETMs) such as wetlands mitigation banking programs require an environmental "currency" or means to measure the environmental

Freyfogle and Dale Goble find, statutes simply requiring "consideration" of wildlife values along with other factors tend to provide inadequate protection of ecosystems: "If the road to hell is paved with good intentions, the road to extinction [of species] is often paved with statutes requiring 'equal consideration.'"<sup>121</sup>

The commentary to the *Regulated Riparian Model Water Code* reaches similar conclusions about the need for measurable and mandatory ecological goals, even though the model code itself does not provide much guidance on how to go about setting these goals. "One of the more important, yet more controversial, issues confronting a State in managing its waters is to devise legal protection for protecting the integrity of a water source as such. Without respect and protection for the integrity of a water source, one cannot meaningfully discuss, let alone achieve, the sustainable development of the source. . . . The questions that States must address, then, are how to define the protected minimum flows (for surface sources) or levels (for underground sources) as necessary to protect these sources and how to implement the necessary protection."<sup>122</sup>

In light of these considerations, a simple conclusion might be that the Commonwealth of Massachusetts must invest its regulatory resources in quantifying minimum streamflows for its rivers and streams. A more nuanced argument is that Massachusetts and other regulated riparian jurisdictions should designate the instream uses of water (including aquatic life uses) as clearly as they identify offstream needs, and they should provide comparable levels of definition and security for the instream and offstream allocations of water that support those uses.

This is the essence of a recent policy recommendation by the Instream Flow Council that states and provinces should give "equal footing" to the recognition of different sorts of water rights, reservations and licenses.<sup>123</sup> The delays in establishing measurable ecological goals and enforceable criteria for instream flows would not be so problematic if the commitment to water withdrawals made in the interim were in practice equally malleable and reversible. Conversely, the secure commitment of water quantities to offstream uses would not be so ecologically

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equivalence of mitigation projects. "Is the currency capable of capturing what we care about? Answering this requires not only a technical consideration of measurement capacity but a clear judgment by the body politic of the proper environmental protection goal (e.g., no net loss of wetland acres or services?)" *Id.* at 694.

<sup>121</sup> DALE D. GOBLE & ERIC T. FREYFOGLE, *WILDLIFE LAW* 1217-18 (2002) (discussing an array of federal statutes that require administrative "consideration" of impacts on species). In the absence of substantive ecological goals expressed through measurable instream flow requirements, a regulated riparian system faces risks of capitulation to economic interests that are similar to those on federal lands under "multiple use" statutes. *See, e.g.*, Michael C. Blumm, *Public Choice Theory and the Public Lands: Why "Multiple Use" Failed*, 18 *HARV. ENVTL. L. REV.* 405 (1994).

<sup>122</sup> MODEL CODE, *supra* note 2, ch. III, pt. 2 at 81. *See also* Ausness, *supra* note 3, at 580-581 ("Although calculating minimum stream flows and lake levels is complex and time-consuming, these calculations are essential to protect instream uses and should be made by other eastern states.") (citing Tarlock, *Appropriation for Instream Flow Maintenance: A Progress Report on "New" Public Western Water Rights*, 1978 *UTAH L. REV.* 211, 217-20).

<sup>123</sup> INSTREAM FLOW COUNCIL, *supra* note 88, at 142. The recommendation is based on a concern "that offstream demands will be given priority over instream needs as competition for water increases." *Id.* (citation omitted).

dangerous if the definition of those rights were limited by equally secure and well-documented allocations to support the maintenance of instream uses.<sup>124</sup>

#### D. Rebalancing the Water Budget to Protect Aquatic Ecosystems

What legal tools might Massachusetts use in order to "re-balance" its water management system, or give "equal footing" to instream and offstream needs? Arriving at a wiser allocation of resources will likely entail significant new initiatives at the administrative, legislative, or judicial level. Some brief recommendations here focus on measures that could be taken through administrative action under existing statutory authority.

Working within the existing statutory scheme, the state DEP and Water Resources Commission could do much to make the water management system "work" from an ecological standpoint. Most importantly, the DEP and the Water Resources Commission could explicitly incorporate the goal of ecological integrity in regulations, policies and guidelines for determining minimum streamflows and "safe yield." The DEP could establish measurable goals in its regulations and permits by adopting target fish communities and other indicators of the biological integrity of water bodies. Through a regulatory approach based on designated uses of waterways and identification of indicator species, the state would be able to determine its progress toward an objective of ecological integrity, and it could take steps to achieve and maintain designated uses, even before arriving at a definitive quantification of instream flows.

In addition, the agencies could do much to expand the scope and effectiveness of the statutory scheme through administrative interpretation. The agencies have sufficient discretion under existing law, both to insist upon continuing review and adaptive limitations for water withdrawals, and to develop methods for articulating and enforcing instream flow allocations in a more definitive manner. For example, the DEP has the authority to lower the quantity thresholds for withdrawals requiring permits and registration statements.<sup>125</sup> It also has expansive authority to devise permit conditions, including triggers for conservation measures and shortened permit terms. These conditions might include requirements that the permittee itself provide local methods of governance, or guarantees from third parties, sufficient to exclude, monitor, or roll back water uses as necessary to accommodate instream needs. The DEP might also take regulatory steps to reduce the number and size of registered withdrawals that fall outside the scope of the permit system, for example, by strengthening and enforcing the verification and renewal requirements for registrations. And, if the issuance and modification of new permits were more tightly controlled, and "safe yield" limits more closely monitored and enforced, proposed new users would have significant incentives to "buy out" and retire registered uses in

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<sup>124</sup> The concept of requiring "equal footing" in the definition of instream and offstream water allocations is not a new one in the commentary on western states' water management systems and federal reserved water rights. *See A. Dan Tarlock, Appropriation for Instream Flow Maintenance: A Progress Report on "New" Public Western Water Rights, 1978 Utah L. Rev. 211 (1978)* (surveying western state laws and federal laws for recognizing and protecting instream flow rights, and finding that such laws "increasingly accord instream uses equal footing with traditional beneficial uses and require the state to justify a refusal to recognize them.") *Id.* at 217. The issue is a newer one for the eastern states, as they have adopted statutes that seek to quantify water withdrawal rights through permit systems.

<sup>125</sup> MASS. GEN. LAWS ch. § 4 (2002).

order to gain access to water supplies.

In summary, administrative frameworks that give strong attention to quantifying and securing offstream uses without providing comparable quantification and protection of instream needs put aquatic ecosystems at risk. At the same time, implementing a balanced approach that gives comparable attention to defining, measuring and protecting instream and offstream needs is no easy task. Statutory language, administrative practicalities, and gaps in scientific data all hinder the development of a full-fledged water budget with a "bottom line" that can keep aquatic communities thriving in the midst of human urban development. "Balancing" the Massachusetts system will likely require both significant new efforts to investigate and quantify instream needs, and significant new regulatory requirements and permit conditions to prevent firm commitments of water supplies to serve economic interests before instream needs have been addressed. The state should seek to ensure that water withdrawal rights remain sufficiently flexible and subject to frequent review and adjustment, until instream allocations for restoring and maintaining critical ecological functions can be formulated in a more definitive manner.

### **Conclusion**

Statutory systems show great promise in moving the eastern states toward wise planning for water resources. Nevertheless, "lopsided" statutory reforms can imperil the protection of instream needs. The Massachusetts experience in shifting toward a regulated water management system highlights important difficulties in achieving ecologically sound water management when water withdrawal rights become securely quantified, even as ecological goals remain poorly defined and subject to dispute. As the difficulties of statutory implementation in Massachusetts indicate, it is not enough to "consider" aquatic needs, or to invoke aspirational objectives such as "ecological integrity," if these objectives are not converted into measurable and ascertainable goals for supplying aquatic organisms with the resources that they must have in order to thrive. Translating an overarching objective of ecological integrity into measurable instream flow quantities may involve several phases of gathering and adjusting to new scientific information. If instream needs cannot be immediately quantified, offstream allocations, too, must remain open to reassessment, so that the government can revisit allocations of water in working toward restoration and maintenance of ecological integrity in water bodies. A meaningful water budgeting process involves making commitments to instream needs that are comparable to those for offstream uses.