Groundwater Quantity Regulation in Vermont: A Path Forward

Evan Mulholland*

Groundwater in Vermont is a resource that is not extensively regulated, nor well understood, but it is taken for granted by thousands of Vermonters every day. Only a sliver of the planet's water is liquid freshwater, with over 99% of that sliver located underground in aquifers.[1] Approximately 246,000 people in Vermont draw their domestic water supply (over 20 million gallons per day (mgd)) from individual groundwater wells, and approximately another 117,000 rely on public water systems that draw from the ground.[2] Further uses of groundwater include agricultural and industrial applications, as well as use in consumer goods, which incorporates water into the finished product, such as bottled water.[3] Arguably the most important function of groundwater in Vermont and New England is in maintaining stream flows vital to aquatic ecosystems and recreational use through its interaction with surface water. In this paper, I will describe the hydrology of New England's groundwater resource and the various statutes and regulations that govern its use in Vermont. I will next describe in detail the regulatory structures in place in various eastern states and summarize the different possible regulatory structures for groundwater. Finally, I will critique the recent Vermont regulation proposed in the Vermont House of Representatives in 2004 and offer some suggestions for the future of groundwater regulation in Vermont.[4]

I. DESCRIPTION OF GROUNDWATER AND THE SURFACE WATER–GROUNDWATER INTERACTION

In order to assess the various plans for the management of groundwater, it is useful to define some terms and identify the features of the groundwater resource in New England and, in particular, Vermont.

Groundwater is defined as that water below the earth's surface which saturates the substrate in which it is contained.[5] A substrate can be any

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1. ROBERT GLENNON, WATER FOLLIES 40–41 (2002).
2. *See* Susan S. Hutson et al., United States Geologic Survey, Circular 1268, *Estimated Use of Water in the US in 2000*, (revised Feb. 2005).
3. *See generally id.*
4. The Vermont regulation has now passed and is law. *See* addendum.
5. *See* E.C. Pielou, *Fresh Water*, *in* WATER RESOURCE MANAGEMENT 537 (A. Dan Tarlock et

material below the earth's surface, but in Vermont the groundwater is generally contained in either bedrock fractures or glacial deposits of sand and gravel.[6] The water in these layers fills all available interstices, or spaces, between the grains of sand or between the chunks of bedrock.[7] An aquifer is another name for a saturated substrate that can hold and yield water in recoverable amounts.[8] All aquifers have an impermeable base layer that prevents the water from percolating down to lower layers of rock, and which creates a reservoir of useable water.[9] The porosity of an aquifer is the percentage of the substrate's volume that is open space and is able to be filled by groundwater.[10] Permeability is the speed at which groundwater can flow through a substrate.[11] This can vary from a fraction of an inch to many feet per day.[12] A more useful way of measuring the permeability of an aquifer is by its specific yield. Specific yield is the amount of water that can flow through a substrate minus the amount that is unrecoverable due to the residual molecular attraction between the water and the substrate material.[13]

Above the saturated layer is the unsaturated region made of soil or rock, with available interstices filled with both water and air.[14] Depending on the geology, the unsaturated layer can be hundreds of feet thick or may not exist at all. The line between the saturated layer and the unsaturated layer is known as the water table.[15] When the water table intersects with the earth's surface, meaning that there is no unsaturated layer, the result is a spring or a wetland.[16]

A. Origin and Hydrology of Groundwater

The groundwater that flows in our aquifers originated from different sources. Some deposits are ancient, formed by the original deposition of sedimentary rock layers (sometimes called fossil water) or during the

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al., 5th ed. 2002).

6. Perry G. Olcott, *Groundwater Atlas of the United States: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont*, HA 730-M (1995), *available at* http://capp.water.usgs.gov/gwa/ch_m/index.html.

7. *See* E.C. Pielou, *supra* note 5, at 537.

8. *See* MARTIN JAFFE & FRANK DINOVO, LOCAL GROUNDWATER PROTECTION 8 (1987).

9. Gabriel Eckstein & Yoram Eckstein, *A Hydrogeologic Approach to Transboundary Groundwater Resources and International Law*, 19 AM. UNIV. INT'L L. REV. 201, 210 (2003).

10. *See* E.C. Pielou, *supra* note 5, at 538.

11. *See* JAFFE & DINOVO, *supra* note 8, at 8.

12. *Id.* at tbl. 3.

13. *See* E.C. Pielou, *supra* note 5, at 538–39.

14. *Id.* at 537.

15. *Id.*

16. *Id.*

cooling of magma.[17] Other water deposits are more recent and result from the percolation of rain and snowmelt through the unsaturated layer; this downward percolation is known as recharge.[18]

Practically all surface waters interact with the groundwater in some way.[19] Although the connections between streams and aquifers are complex and little-studied, there are generally two ways in which groundwater and surface water are connected. First, the surface water in some streams recharge's the local groundwater table by means of seepage through the surface water body's beds and banks.[20] If a stream recharges the groundwater, it is known as a losing stream.[21] The second type of connection is where water bodies are replenished by the discharge of groundwater to the surface.[22] This is called a gaining stream, or spring-fed pond.[23] The base flow of streams (the flow that is not due to precipitation runoff or snowmelt) is due to groundwater.[24]

Another way to conceptualize a gaining stream is to imagine a stream bed as below the level of the local water table. The groundwater would continually flow into the stream, seeping through the banks, as it would in a well dug below the water table. Although the simplification of groundwater to one water table level is useful for this type of conceptualization, in reality there are numerous flow regimes at different depths and speeds, possibly even flowing in different directions, due to varying levels of hydraulic pressure.[25] Some aquifers are quite deep and practically unconnected to shallower aquifers.[26]

B. Vermont's Groundwater

Broadly, Vermont consists of a folded and faulted bedrock formation overlaid by glacial deposits of sand and gravel in river valleys and

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17. *Id.*

18. JAFFE & DINOVO, *supra* note 8, at 9.

19. *See* E.C. Pielou, *supra* note 5, at 537.

20. *See* DAVID H. GETCHES, WATER LAW IN A NUTSHELL 272 (3d. ed. 1997).

21. Eckstein & Eckstein, *supra* note 9, at 210.

22. Nancy M. Trautmann et al., *Groundwater: What It Is and How to Protect It* (2005), *available at* http://pmep.cce.cornell.edu/facts-slides-self/facts/gr-wh-hw-grw85.html.

23. Eckstein & Eckstein, *supra* note 9, at 214.

24. Thomas C. Winter et al., United States Geologic Survey, Circular 1139, *Groundwater and Surface Water: A Single Resource*, Box B (1998), *available at* http://water.usgs.gov/pubs/circ/circ1139. This lengthy circular provides a good background on much of the material condensed above; *see also* DIV. OF GEOLOGY AND DIV. OF WATER SUPPLY, DEP'T OF ENVIRONMENTAL CONSERVATION, REPORT ON THE STATUS OF GROUNDWATER AND AQUIFER MAPPING IN THE STATE OF VERMONT 7 (Jan. 2003), *available at* http://www.anr.state.vt.us/dec/geo/pdfdocs/RptLeg.pdf.

25. *See id.* at 36.

26. *See id.* at Box A.

uplands.[27] In some areas, the bedrock itself is exposed. Outside of the Green Mountain Range, much of the groundwater is contained in the bedrock itself in what are known as crystalline rock aquifers.[28] In these formations, the rock itself (often gneiss and schist) is practically impermeable, and the water flows through fractures and joints in the rock.[29] Relative to other types of aquifers, crystalline rock aquifers contain small quantities of water per volume of rock and are usually hydraulically connected to the overlying glacial deposit, so that wells pumping water from the overlying deposit may draw water from the lower crystalline rock aquifer.[30] The flow of groundwater in these aquifers is usually from the uplands to the valleys, although, as noted above, the flow patterns can be complex, with different flow channels that may, for instance, bypass an intervening stream bed.[31] Approximately 80% of privately drilled wells in Vermont draw water from this type of bedrock aquifer.[32]

In the Green Mountains, much of the groundwater is contained in carbonate rock aquifer.[33] The rock of this formation is composed of limestone, dolomite, and marble; and is soluble, with groundwater found both in cracks in the rock and in cavities formed by the dissolution of the surrounding rock.[34] It is permeable 300 to 500 feet down.[35] Below that there is little recoverable water.[36] There are few studies about this formation, but, in general, the direction of flow is also from the uplands to the valleys.[37]

In most places in Vermont, the bedrock aquifer is beneath superficial aquifers that consist of either till or stratified drift.[38] Till is the unsorted sand and gravel mixed deposit remaining after the last glaciation.[39] Stratified drift is of the same origin but is a gravel deposit which has been sorted and layered by particle size.[40] These are sometimes found as

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27. *See generally* Olcott, *supra* note 6. Most of this section of text is drawn from this source.
28. *Id.*
29. *Id.*
30. *Id.*
31. Winter, *supra* note 24, at Box H.
32. *See* VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION, WATER QUALITY DIVISION, VERMONT WATER QUALITY ASSESSMENT REPORT (305b Report) 65 (2004), *available at* www.vtwaterquality.org/planning/docs/305b/pl_305b04-toc.pdf.
33. Olcott, *supra* note 6.
34. *Id.*
35. *Id.*
36. *Id.*
37. *Id.*
38. *Id.*
39. *Id.*
40. LAURA MEDALIE & RICHARD B. MOORE, GROUNDWATER RESOURCES IN NEW HAMPSHIRE: STATIFIED DRIFT AQUIFERS 10 (1995), *available at* http://water.usgs.gov/pubs/wri/wrir_95-4100/html/pdf.html.

terraces, or long ribbons known as eskers.[41] These stratified deposits underlie 14% of New Hampshire.[42] These water bearing formations are important for Vermont as well. For example, Brandon, Vermont draws much of its public water supply from a stratified drift aquifer.[43] Similarly, 20% of private wells in the state draw water from sand and gravel aquifers.[44] Although sand and gravel aquifers are generally shallower and have a higher yield than bedrock aquifers, they are under a more direct influence by surface water and are more likely to be contaminated.[45]

As is true for all aquifers, the only natural way water can enter the groundwater system in Vermont is through percolation of rain, snowmelt, and surface water down to the aquifer, a process known as recharge.[46] Often, when a water table is artificially lowered through groundwater pumping, the level of water in a stream can be higher than the water table in the adjacent aquifer.[47] As described above, this stream is a 'losing stream'; some of the stream flow is lost to recharging the aquifer known as induced infiltration recharge.[48]

II. VERMONT'S GROUNDWATER MAPPING EFFORTS

Three categories of mapping data currently exist regarding Vermont's groundwater: (1) early maps, (2) more recent detailed maps, and (3) well logs of certified well drillers.[49] Drought in the mid-1960s led to the first efforts of geologic mapping to ascertain favorable locations in which to drill for groundwater.[50] By 1975, the Vermont Geologic Survey (VGS) completed groundwater potential maps for 66% of the land area of Vermont.[51] These maps offered a general picture of groundwater potential for a large majority of Vermont residents. Between 1976 and 1982, four studies were completed with a greater level of detail: (1) White River Junction; (2) Barre-Montpelier, (3) Rutland, and (4) the Upper Winooski River Basin.[52] According to the Water Supply Division, at least two of

41. *Id.* at 7.
42. *Id.* at vi.
43. Minutes of the Brandon Town Meeting (March 15, 2004) (on file with the Vermont Journal of Environmental Law), *available at* http://www.town.brandon.vt.us/Minutes/2004/minutes14.htm.
44. VERMONT WATER QUALITY ASSESSMENT REPORT (305b Report), *supra* note 32, at 65.
45. Interview with Dennis Nealon, Hydrogeologist, Department of Environmental Conservation in Waterbury, Vt. (April 7, 2005) (on file with author).
46. MEDALIE & MOORE, *supra* note 40, at 2.
47. *Id.* at 10.
48. *Id.*
49. *See* Groundwater and Aquifer Mapping, *supra* note 24.
50. *Id.*
51. *Id.*
52. *Id.*

these lack the level of detail needed to conduct planning for water development at the town level.[53] Additionally, a significant number of wells have been drilled since 1982, further limiting the usefulness of the twenty-year-old maps. [54]

Although increased funding for updated maps is scarce, in 2001 the VGS created a detailed groundwater map of Arlington, Vermont, which has been used by its local officials.[55] The VGS, if allocated more money, would focus on more maps of this scale, as they believe that more of this type of research is needed to understand the aquifers of the state.[56]

The final source of groundwater data that is maintained by Vermont is the recorded logs of individual private well drillers. Since 1966, well drillers, as a condition of their license, have been required to report information about drilled wells to the Water Supply Division.[57] This data includes the physical location of the well, the total depth, the depth to bedrock if applicable, and the yield in gallons per minute.[58] About 90,000 such records exist with a wide range of accuracy and usefulness.[59] None of this data, unfortunately, has been tabulated or analyzed and much of it remains in paper files in Waterbury, Vermont.[60]

III. VERMONT GROUNDWATER USE

According to the United States Geologic Survey (USGS) in 2000, 43 million gallons of groundwater per day (mgd) were withdrawn from Vermont's aquifers.[61] Unlike western states where most groundwater is used for agriculture, the majority of the 43 mgd is withdrawn from wells supplying private individual domestic users and public water systems. Forty-one percent of Vermonters who are self-supplied withdraw 20.7 mgd,[62] and municipal supplies withdraw 19.5 mgd.[63] In total, 70% of

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53. *Id.*

54. *Id.*

55. Interview with Larry Becker, Vermont State Geologist, in Waterbury, Vt. (Apr. 29, 2005) (on file with author).

56. *Id.*

57. Nealon, *supra* note 45. *See also* Environmental Protection Rules, Well Driller Licensing Rule, Chapter 15, § 701(b), *available at* http://www.anr.state.vt.us/dec/watersup/wdrule/AdoptedWellDrillerLicensingRule8-26-02.pdf.

58. *Id.* at § 701(b).

59. Nealon, *supra* note 45.

60. *Id.*

61. Circular 1268, *supra* note 2. Unless other wise noted, all statistics in this section are from this Circular.

62. A negligible percentage of the private domestic use is from lakes and streams.

63. According to the USGS, total municipal use in Vermont is 60.1 mgd, meaning that 40.6 mgd of municipal supply is from lakes and streams. The City of Burlington draws all of its water from Lake Champlain. *See* United States Environmental Protection Agency, *Local Source Water Protection*

Vermont residents use groundwater in their households.[64] Other users of groundwater in Vermont include: irrigation (0.33 mgd out of 3.78 mgd total of water used for irrigation in Vermont);[65] industrial (2.05 mgd out of 6.91 mgd total);[66] and power plants (0.33 mgd out of 355 mgd).[67] Since, as will be discussed below, there are no permit or reporting requirements for groundwater withdrawal in Vermont, these numbers are necessarily estimates. In order to update the groundwater withdrawal figures for 2005, one must take into account the approximately two to three thousand new wells drilled each year for individual use.[68]

IV. POTENTIAL VERMONT GROUNDWATER QUANTITY PROBLEMS

Although most publicized groundwater problems in Vermont have been due to natural and introduced contaminants in the water supply, the likelihood for groundwater *quantity* problems will only increase as the demand on the supply grows.

Vermont is blessed with ample precipitation in most years. Total yearly precipitation ranges from about 40 inches-per-year in the lowlands and valleys up to 50 or 70 inches-per-year along the Green Mountains.[69] In addition, being a well-watered state, the population density has not yet reached the levels that could result in serious localized water shortages as has occurred in nearby New England states. For instance, towns in the Nashua River watershed in the Ipswich River Basin have withdrawn groundwater at a rate great enough to result in seasonal shortages and decreased stream flows in the local rivers.[70] In fact, the Ipswich River has gone completely dry in recent years, a phenomenon resulting from

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Program Case Studies: Burlington, Vermont, *available at* http://www.epa.gov/safewater/protect/casesty/burlingtonx.html.

64. 305B REPORT, *supra* note 32, at 65.

65. Although the VT Department of Agriculture estimated in 2003 that 85 to 90% of VT farms use groundwater. *Id.* at tbl.7.

66. Industrial use includes water used for such purposes as fabricating, processing, washing, diluting, cooling, or transporting a product; incorporating water into a product; or for sanitation needs within the manufacturing facility. *See generally* Circular 1268, *supra* note 61.

67. Power plant use is limited to water converted to steam during production. *Id.* at tbl.10.

68. Nealon, *supra* note 45.

69. Oregon Climate Service, Oregon State University, *Average Annual Precipitation: Vermont* (2000), *available at* http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/VT/vt.gif (last visited Sept. 1, 2006).

70. *See* MICHAEL HEIDORN ET AL., SOURCE WATER STEWARDSHIP PROJECT EXCHANGE TEAM, NASHUA RIVER WATERSHED (SQUANNACOOK AND NISSITISSIT SUB-BASINS): SOURCE WATER STEWARDSHIP EXCHANGE TEAM REPORT 6–7 (July 2003), *available at* http://www.nashuariverwatershed.org/releases/sws_rpt.doc; *see also* GLENNON, *supra* note 1, at 99.

increased population pressures on the groundwater in the area.[71] In recent years, localized shortages have occurred. In 2003, six public water supplies experienced a lack of sufficient water to meet their needs. These shortages occurred in Jericho Heights in Jericho, Oglewood in Milton, Magic Village in Londonderry, Deep Rock Water FD #8 in Barre Town, Eaton's Mobile Home Park in Royalton, and Windy Hill Acres in Springfield.[72] In 2004, shortages were reported in Westford Northridge Owners Association in Westford, Maple Leaf Farm in Underhill, Mount Snow Village Water System in Dover, Albany Water System in Albany, and Montgomery Center Water System in Montgomery.[73] The Water Supply Division of the Department of Environmental Conservation acknowledges that these shortages exclude the possible effects that groundwater withdrawals may have on the health of Vermont's ecosystems due to the little-studied interaction between groundwater and streams, lakes, and wetlands.[74]

Taking into account Vermont's social and geologic characteristics, there are five broad types of problems which may affect groundwater quantity and should be considered when drafting new regulations. The first is localized aquifer draw downs in either bedrock or sand and gravel aquifers. When either too many new wells are drilled in a certain area, or the existing wells withdraw water at an increased rate, the local water table sinks in what is known as a cone of depression.[75] Water may not be able to percolate downward fast enough nor flow laterally from adjoining aquifer sections quickly enough to replace the water withdrawn. Drilling deeper wells would solve this problem, but not perpetually.

The second problem is similar to the first, but expanded to an entire aquifer or watershed. If more groundwater is withdrawn from a region than can be replaced by recharge, the aquifer will eventually be depleted. This might take a long time due to the slow speed at which groundwater flows through some aquifers, but with enough time and enough powerful wells, aquifers can be exhausted; even in New England.

The third problem is decreased stream flow. This occurs when a high yielding well near a gaining stream creates a cone of depression that effectively reverses the direction of groundwater flow and draws water from the streambed towards the well, reducing or eliminating stream flow.[76] This effect is intensified when the water used is either consumed or transferred out of the stream basin. To illustrate, a domestic or agricultural water user

71. GLENNON, *supra* note 1, at 101–9.
72. 305B REPORT, *supra* note 32, at 65.
73. Nealon, *supra* note 45.
74. Nealon, *supra* note 45.
75. JAFFE & DINOVO, *supra* note 8, at 78.
76. *See generally* GLENNON, *supra* note 1, at Ch. 7 (regarding the Ipswich River).

eventually discards the used water back into the nearby stream through field run-off or septic leachate, while the water used by a water bottler or other trans-basin transferor does not end up back in the system.[77]

The fourth problem is one that is often overlooked: reduced rates of recharge. In order for precipitation to recharge an aquifer, it must remain on the surface of the rock or soil long enough to percolate downwards; development, in the form of impervious surfacing like asphalt, roofing, sidewalks and patios, prevents aquifer recharge.[78] Precipitation is channeled into sewers and flows directly into streams and lakes, bypassing the aquifer. It has been estimated that the average quarter acre residential lot results in an approximately 40% decrease in recharge rate.[79] In some areas, this increased imperviousness is the leading cause of groundwater (and streamflow) quantity problems.[80]

Finally, groundwater quantity problems can exacerbate groundwater contamination problems. This can occur in two ways. First, by simply decreasing the amount of water in an aquifer, whether by pumping or by reducing recharge, the concentration of pollutant per unit of water will increase.[81] Pumping tends to both draw contaminated water to the point of withdrawal and disperse contaminants through the aquifer.[82] A more detailed understanding of the hydraulics of a specific aquifer would simplify the monitoring of contaminants and the prediction of where and how quickly they may flow in the aquifer.[83]

V. LEGAL FRAMEWORK FOR GROUNDWATER IN VERMONT

A. Common Law and Groundwater Protection Statute

For purposes of surface water, Vermont is a riparian state.[84] Each person whose property abuts a lake or stream has common law rights to use the water in a reasonable way.[85] The state government's authority to

77. *See Water Conservation Gets a Boost*, N.H. UNION LEADER, April 24, 2005 (quoting New Hampshire state hydrologist Brandon Kernen) ("The stress on the resources is caused by sprawling communities that displace water, take it from one source and pipe it to another watershed and the commercial and industrial users where water is a main ingredient or discharged as steam.").

78. CEI ENVIRONMENTAL EDGE, WATER WARS HEAT UP: STREAMFLOW DECLINES HAVE MANY CAUSES 1–3 (October 2003).

79. *Id.*

80. *Id.*

81. Alison M. Gregory, *Groundwater and its Future*, 11 STAN. ENVTL. L.J. 229, 233 (1992).

82. Nealon, *supra* note 45; *see also* Gregory, *supra* note 81, at 233.

83. *Id.*

84. Stephen Dycus, *Vermont*, *in* 6 WATERS AND WATER RIGHTS 815 (Robert E. Beck ed., 1994).

85. Getches, *supra* note 20, at 15.

regulate streamflow (and possibly groundwater flow) stems from Chapter II, Section 67, of the Vermont Constitution, as interpreted by the Vermont Supreme Court in *Hazen v. Perkins*.[86] Under *Hazen*, the state's power to regulate stream flow is based on the constitutional authority to regulate fisheries.[87] This case also discusses and establishes precedent for the public trust doctrine. In Vermont, according to *Hazen*, and as codified by statute, the public trust extends to navigable water bodies and their beds and banks.[88] Unlike New Hampshire, the public trust in Vermont does not encompass groundwater.[89]

Legislation to extend the public trust doctrine to Vermont's groundwater was introduced during the 2005 legislative session, but is yet to be acted upon.[90] It is unclear what would result from an act declaring that the groundwater of the state is part of the public trust. So far in New Hampshire there has been no reported case law interpreting the public's trust in groundwater. Some critics argue that even without a statute, the public trust doctrine should be extended to any groundwater that affects surface water.[91]

Until 1985, groundwater use in Vermont was subject to the absolute ownership rule; there was no limit at all on an overlying landowner's use of groundwater.[92] As in other states, the common law did not recognize the interconnection between groundwater and surface water. Groundwater was considered part of one's land, incident to ownership, while the use of surface water was only limited by the riparian rights doctrine.[93] The riparian right was usufructory–a right to use. In 1985, the legislature passed the Groundwater Protection Act (GPA) which states:

> It is the policy of the state of Vermont that it shall protect its groundwater resources to maintain high quality drinking water and shall manage its groundwater resources to minimize the risks of groundwater quality deterioration by limiting human activities that present unreasonable risks to the use

86. Joseph S. Maclean, *Streamflow Policy in Vermont: Managing Conflicting Demands on the State's Waters*, 19 VT. L. REV. 191, 204–05 (1994); Hazen v. Perkins, 92 Vt. 414 (1918).

87. *See* Hazen v. Perkins, 92 Vt. 414, 420 (1918).

88. VT. STAT. ANN. tit. 29, § 401.

89. *See* N.H. REV. STAT. ANN. § 481-1 (2005) and N.H REV. STAT. ANN. § 485-C:1 (2005).

90. *See* H. 294, 2005-2006 Legislative Session (Vt. 2005); S. 151, 2005-2006 Legislative Session (Vt. 2005).

91. Eric Swensen, *Pubic Trust Doctrine and Groundwater Rights*, 53 U. MIAMI L.REV. 363, 380-81 (1999).

92. *See generally* Dycus, *supra* note 84.

93. *See* Dycus, *supra* note 84, at 815.

> classifications of groundwater in the vicinities of such activities while balancing the state's groundwater policy with the need to maintain and promote a healthy and prosperous agricultural community.[94]

This groundwater quality statute calls for the classification of the state's groundwater into four categories: Classes I through IV.[95] Class I is defined as groundwater of "uniformly excellent" character which has "no exposure to activities that pose a risk to its use."[96] So far no aquifers have been designated Class I. Class II is also defined as groundwater of "uniformly excellent" character, but is "exposed to activities which may pose a risk... ."[97] There are no aquifers currently classified as Class II, although this classification has been proposed for the groundwater of Brandon, Vermont.[98] Class III is defined as groundwater suitable for household use.[99] All groundwater in Vermont not otherwise designated falls in Class III by default.[100] Class IV is defined as groundwater that is non-potable, but may be used for industry or agriculture or similar uses.[101] There are eight designated Class IV aquifers in Vermont, including several landfills and the Pine Street Barge Canal area in Burlington.[102]

Although the main thrust of the GPA is source protection, the statute abolishes the common law rule of absolute ownership and declares that groundwater use is subject to the correlative rights rule.[103] Additionally, the GPA established a cause of action for the "unreasonable harm caused by another person withdrawing, diverting, or altering the character or quality of groundwater."[104] So far, there have not been any reported cases under this statute, although it is likely that groundwater disputes have occurred and may have been settled without litigation, for instance, by drilling a deeper well.[105]

Due to the lack of litigated disputes, correlative rights in groundwater have not yet been interpreted by the courts in Vermont. According to the

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94. VT. STAT. ANN. tit. 10, § 1390 (2004).
95. VT. STAT. ANN. tit. 10, § 1394(a) (2004).
96. *Id.*
97. *Id.*
98. Nealon, *supra* note 45.
99. VT. STAT. ANN. tit. § 10, 1394(a) (2004).
100. *Id.*
101. *Id.*
102. 305B REPORT, *supra* note 32, at 65.
103. VT. STAT. ANN. tit. 10, § 1410(a) (2004).
104. VT. STAT. ANN. tit. 10, § 1410(c)-(d). Note that the statute contains a preference for agriculture and silviculture. Agricultural and silvicultural users are only liable if they are shown to be negligent or reckless. All other users are subject to liability if their use is found to be unreasonable.
105. Nealon, *supra* note 45.

definition in the Second Restatement of Torts, correlative rights in groundwater are similar to riparian rights in surface waters.[106] All landowners whose land overlies an aquifer have equal rights, and in times of scarcity, water is apportioned in a manner similar to stream apportionment for riparians.[107] Another definition describes the proportionate share of each overlying landowner as "predicated...solely on his or her current...need for water."[108] Correlative rights are more restrictive than reasonable use. Under reasonable use, as long as there is no waste, one can apply groundwater on one's own land without limitation.[109] Correlative rights, in contrast, are limited by the quantity of available water in the aquifer and one's need for its use.[110]

B. Groundwater Protection Rule and Strategy

The Groundwater Protection Rule and Strategy was adopted by Vermont pursuant to VT. STAT. ANN. tit. 10, §1392(d), and is codified as Chapter 12 of the Environmental Protection Rules of Vermont.[111] It contains detailed regulations on how to classify groundwater under the 1985 statute.[112] These regulations make no mention of withdrawals or quantity concerns, even in terms of the effect intensive withdrawals may have on contamination movement or concentration

C. Water Supply Rule

The Water Supply Rule deals with technical details of how to source water for public supplies and how to maintain uncontaminated drinking water.[113] This rule was revised April 25, 2005, and now includes regulations concerning, among other things, bottled water and bulk water.[114] Under this rule, the Vermont Department of Environmental Conservation

106. Geoffrey Commons, *Vermont's New Groundwater Law*, 10 VT. L. REV. 479, 479 n.3 (1985) (citing Restatement Second of Torts 254-5 (1982)).

107. *Id.*

108. 93 C.J.S. Waters § 204 (2005).

109. Matt Berkowitz, *Bottling the Water Bottlers*, 22 TEMP. ENVTL. L. & TECH. J. 235, 243 (2004).

110. *Id.* at 244.

111. ENVIRONMENTAL PROTECTION RULES, CHAPTER 12, GROUNDWATER PROTECTION RULE AND STRATEGY (2005), *available at* http://www.anr.state.vt.us/dec/watersup/GWPRS/GWPRS2005.pdf.

112. *Id.*

113. Agency of Natural Resources, Vermont Department of Environmental Conservation, Water Supply Rule, *Environmental Protection Rules Ch. 21* (April 25, 2005), *available at* http://www.anr.state.vt.us/dec/watersup/wsrule/Vermont%20WSR%20April%202005.pdf.

114. *Id.* §§ 11.1, 11.2.

requires permits for public water supplies, nonpublic water supplies above a certain number of users, and bottled and bulk water suppliers.[115] Permits required include source, construction, operating and water supply permits.[116]

There are only a few sections of this regulation that could be used to regulate groundwater withdrawals. For source permits, one of the criteria to be considered is the potential interference with other water supply withdrawals.[117] In other words, if a new water supply source has the potential to decrease the yield of an existing water supply, a permit might not be issued. For operating permits, if a public supplier's water demand exceeds the supply, the operator must look for more water.[118] This seems to assume the perpetual availability of groundwater and ignores the possibility of over-withdrawal. The section on bottled water permits is solely concerned with purity and labeling; there is no mention of quantity or potential interference.[119]

A more promising section of the Water Supply Rule is contained in part three of Appendix A: Water Supply Source Development and Protection. An applicant for a source permit has to show that there will be adequate water available for the proposed use.[120] Applicants for surface water use must identify the "existing uses" of the surface water, including the "minimum stream flow."[121] For groundwater users, the regulations state that if the development interferes with existing wells, the interference must be resolved.[122] For example, the applicant must connect the neighboring well to the public source or drill the neighboring well deeper. Interestingly, the section on "groundwater under direct influence of surface water" does not regulate groundwater withdrawals to the extent they might affect nearby streams or lakes.[123] Instead it solely concerns quality issues, such as bacterial contamination of the groundwater.[124]

115. *Id.*
116. *Id.* § 3.0.
117. *Id.* § 4.1.1.4, 4.1.1.5(e).
118. *Id.* § 7.7.
119. *Id.* § 11.
120. *Id.* app. A, § 3.0.
121. *Id.* app. A, § 3.2.5.
122. *Id.* app. A, § 3.3.5.5(a).
123. *Id.* Appendix A, § 3.4.
124. *Id.*

D. Vermont Water Quality Standards

The Vermont Water Quality Standards (WQS) establish minimum flow rules for the rivers and streams of the state.[125] The WQS are based on VT. STAT. ANN. tit. 10 § 1258.[126] The flow rule requires a minimum water level, which is defined as the lowest mean flow for seven consecutive days that would occur in a drought that had a 10% probability of occurring in any given year.[127] Section 2-02 details the "Natural Flow" regime, describing the calculations necessary to determine what amount of water can be withdrawn from a stream in each of the classes: A1, A2, and B1 through B3.[128] For example, for streams in Class A1, the most restricted class, there can be no diminishment of the natural flow "by more than 5% of 7Q10 at any time."[129] Although the WQS do not explicitly mention groundwater withdrawals, it could be possible to regulate some withdrawals based on the effect of pumping near a spring or stream.

E. Snowmaking Withdrawal Rules

The rules regulating water withdrawals for snowmaking purposes are the result of a 1995 rulemaking and can be found at Chapter 16 of the Vermont Environmental Protection Rules, promulgated pursuant to VT. STAT. ANN. tit. 10 §§ 1031, 1032.[130] Before 1995, this chapter applied only to alterations in streams due to hydroelectric dams and permit requirements for the alteration of the course or flow of any stream with a drainage area of ten square miles or larger.[131] In 1995, the chapter was amended to include rules "conservation flow standards" to analyze new surface water withdrawals for snowmaking expansions.[132] Existing users were grandfathered in, subject to future review.[133] The general standard for the winter flow limit is the February Median Flow (FMF); the FMF is 0.8 cubic feet per second per square mile of drainage area if site specific data is

125. State of Vermont Water Resources Board, *Vermont Water Quality Standards* (2000), *available at* http://www.state.vt.us/wtrboard/rules.htm.

126. VT. STAT. ANN. tit. 10, § 1258 (2005). The water level is known as 7Q10.

127. Agency of Natural Resources, Vermont Department of Environmental Conservation, Water Supply Rule, *Environmental Protection Rules Ch. 21.* § 1-01(B)(42). (April 25, 2005) *available at* http://www.anr.state.vt.us/dec/watersup/wsrule/Vermont%20WSR%20April%202005.pdf.

128. *Id.* § 2-02.

129. *Id.* § 3-01(C)(1).

130. Vermont Agency of Natural Resources, Environmental Protection Rules, Chapter 16, *available at* http://www.anr.state.vt.us/dec/rules/pdf/chap16.pdf.

131. VT. STAT. ANN. tit. 10, §§ 1001–1021 (2004).

132. VT. STAT. ANN. tit. 10, §§ 1031-1032 (2004).

133. *Id.*

unavailable.[134] Under the rules, each user of surface water for snowmaking must report the pump rate and total water use.[135] New proposed withdrawals are limited based on the FMF.[136]

It might be possible to construct a general groundwater withdrawal regulation to protect stream flows based on the snowmaking framework. Some potential impediments, however, may include the difficulty in determining the direct effect of an individual's groundwater pumping on a stream or other water body. Such a regulation should focus on large commercial groundwater users since it would be easier to link intensive pumping with its effect on stream flow.

F. Vermont Wetland Rules

The Vermont Wetland Rules were adopted in 1986 and re-authorized in January 2002.[137] The only mention of groundwater in these rules pertains to wetlands, specifically that wetlands protect and recharge the groundwater.[138]

G. Act 250: Vermont's Land Use and Development Law

Chapter 151 of Title 10 of the Vermont Statutes is Vermont's Land Use and Development Law, known as Act 250.[139] Simply put, this Act requires that certain developers obtain a land use permit before construction.[140] Act 250 has a broad reach and governs much development in the state. Although groundwater concerns are not commonly addressed in Act 250 proceedings, they may be in the future. Act 250 has a limited jurisdiction: the relevant categories of jurisdiction include: (a) any construction on more than ten acres, except for forestry or farming, and any construction on one acre if the town has not instituted zoning laws; (b) ten or more housing units in a five mile radius in five years; and (c) any development above 2,500 feet in elevation.[141]

Act 250 permits are granted as long as the development does not contravene the ten criteria listed in the Act.[142] For groundwater withdrawals, three criteria are important: (1) streams, (2) water supply; and

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134. Vermont Agency of Natural Resources, Environmental Protection Rules, 16 § 3 (1996).
135. *Id.* § 16-04.
136. *Id.* § 4.
137. Water Resources Board, Vermont Wetland Rules (Jan. 1, 2002), *available at* http://www.state.vt.us/wtrboard/wet/wetrule2002.pdf.
138. *Id.* at § 5.2.
139. VT. STAT. ANN. tit. 10, §§ 6001–6092 (2005).
140. Cindy C. Argentine, Vermont Act 205 Handbook 2 (1998).
141. VT. STAT. ANN. tit. 10, § 6001(3) (2004).
142. VT. STAT. ANN. tit. 10, §6086 (2004).

(3) impact on existing water supply.[143] Statutory section (a)(1)(E) requires that development must maintain the natural condition of the stream when feasible.[144] Criterion (2) requires a developer to have a sufficient water supply to meet its needs.[145] Criterion (3) stipulates that the development must not cause an "unreasonable burden" on the existing water supply.[146] A proposed commercial plant, for instance, that pumps large quantities of groundwater for cooling and production would likely be forced to show that its groundwater use would not affect stream flow or unreasonably burden nearby residential or public wells. Unfortunately, there has been little focus on groundwater quantity issues during Act 250 hearings, possibly due either to lack of actual interference or unorganized opposition.[147] Furthermore, there has been little mapping, research, or understanding of the groundwater resource and its interaction with surface water.[148]

One of the more controversial users of groundwater in the North Eastern United States in the past ten years have been commercial bottlers. While discussion of ClearSource (formally Hidden Springs and then Vermont Pure) has not been as heated as the arguments over bottling in other states, some concern remains about both the effect of bottling on local streams and the conversion of a public good into private gain.[149] ClearSource was originally granted an Act 250 Permit in 1988 to bottle up to 1000 gallons water per day from a privately owned spring.[150] In 1993, the company was granted an amended permit, allowing expansion of the bottling operation.[151] Interestingly, water supply was only considered under Criterion (2)–sufficient water available–and only for the water needs of the employees, not the water used for bottling.[152] Criterion (3) was marked "N/A" on the application, meaning that no yield determination was needed and that assessment of interference was not applicable.[153] The new permit can be read to require, however, continuous monitoring of the brook into which the spring otherwise would have flowed and periodic reports to the Vermont Department of Environmental Conservation under criteria (1)(A), stream flow.

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143. *Id.*
144. *Id.* § 6086(a)(1)(E).
145. *Id.* § 6086(a)(2).
146. *Id.* § 6086(a)(3).
147. *See* generally VT ANR Act 250 database *available at* http://www.anr.state.vt.us/site/cfm/act250/.
148. Nealon, *supra* note 45.
149. Author's discussion with members of Water First in Randolph, Vt.
150. Permit application #3R0578 (Vt. District Environmental Commission #3).
151. *Id.*
152. *Id.*
153. *Id.*

Another example is Vernon Senior Housing in Vernon, Vermont. When proposed, the development would have consisted of twenty-four apartments in a two-story building, requiring 3,625 gallons per day of groundwater.[154] The developers had trouble locating a well with a yield high enough to allow the desired density. Despite a record of letters from abutting landowners concerned about the effect of the new well on their own water supplies, the Commission based its initial analysis on Criterion 9(B), the effect of septic fields and well drilling on prime agricultural soils, not Criterion 3, interference with nearby water sources.[155] An Act 250 permit was granted in May 2005, but the Commission retained jurisdiction in case any impact develops on adjacent water supplies.[156]

Pike Industries, a proposed stone quarry in Williamstown, Vermont, was denied an Act 250 permit in June 2004.[157] This is one of the few cases where the Commission took into account the potential effect of a project on the neighbors' groundwater supplies. The Commission found that due to incomplete evidence and a lack of a clear test of the proposed quarry's effect on the aquifer, the permit should be denied.[158]

A contrasting example is Barre Granite Quarry. In this instance, the commission granted the Act 250 permit despite the fact that the quarry's operation involved dewatering, resulting in a reduction to the local aquifer.[159] The Commission determined that nine peoples' wells might be affected.[160] As a condition of the permit, the company agreed to drill monitoring wells and, if necessary, drill deeper wells for those affected.[161] The commissioner reached the opposite result of Pike Industries by granting the permit even though the quarry could have potentially burdened existing users' water supply.

A final example of the way the Commission analyzes Criterion (3) during the permitting process is George Boissoneault's subdivision proposal. Boissoneault planned to subdivide a parcel into 25 single family lots.[162] Although the permit was denied for other reasons, the Commission found the development to be in compliance with Criteria (2) and (3).[163] That is, there was enough water to supply each lot with its own well, and

154. Permit application #2W1017-1 at 1,5 (May 24, 2005) (Vt. District Environmental Commission #2).
155. *Id.* at 2–3.
156. *Id.* at 6.
157. Permit application #5R1415 (Vt. District Environmental Commission #5).
158. *Id.*
159. Permit #7L1079 (Vt. District Environmental Commission #7).
160. *Id.*
161. *Id.*
162. Permit #6F0499 (Vt. District Environmental Commission #6).
163. *Id.*

there would be no unreasonable interference with the adjoining landowners' supply. The Commission calculated the available water supply by multiplying the amount of yearly rainfall by the percentage likely to percolate down and recharge the aquifer.[164] Although the Commission recognized that this was an estimate and that accurate predictions could not be made without drilling and testing, the Board relied on the estimate in determining compliance with Criteria (2) and (3).

It is difficult to draw a conclusion from the Commission's practice of analyzing the criteria which relate to groundwater withdrawals. What is clear however, is that more research into the hydraulics of the groundwater resource and the groundwater-surface water interaction would be useful for both parties in Act 250 hearings.[165]

VI. GROUNDWATER REGULATION IN OTHER STATES

A. New Hampshire

New Hampshire is probably the state most similar to Vermont in terms of groundwater hydrology and size.[166] New Hampshire, however, unlike Vermont, has a comprehensive system of regulations for the withdrawal of groundwater. Sixty percent of New Hampshire residents rely on groundwater for drinking.[167] In 1995, 82 million gallons per day were withdrawn from the aquifers in the state.[168] Of that 82 mgd, 31 mgd was used for private domestic supply, another 31 mgd for public supply, and 20 mgd for commercial and agricultural use.[169]

The New Hampshire legislature has determined that groundwater and surface water combined are an "invaluable public resource" to be conserved and managed for the public good.[170] It codified the public trust as extending to all waters of the state above and below ground.[171] No litigation has occurred so far regarding the public trust in groundwater, but a citizens group has used it as a cause of action in its suit against USA Springs, a New

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164. *Id.*

165. *See generally* Nealon, *supra* note 45. (looking generally at all the maps created of the two states).

166. Olcott, *supra* note 6.

167. New Hampshire Department of Environmental Services, *Guide to Groundwater Protection* 2 (2004), *available at* http://www.des.state.nh.us/dwspp/pdf/des_guide_to_ground_water.pdf.

168. *Id.*

169. *Id.*

170. N.H. REV. STAT. ANN. § 481-1 (2004).

171. N.H. REV. STAT. ANN. § 481-1 (2004); *See* also 485-C (2004); *See also* Coakley v. Maine Bonding, 618 A.2d 777 (1993) (maintaining that the public has an ownership interest in groundwater).

Hampshire bottling company.[172] Additionally, New Hampshire law sets up four classifications for its groundwater protection and management, which is similar to Vermont.[173]

Besides a classification system, New Hampshire regulates "large groundwater withdrawals."[174] This is defined as any withdrawal over 57,600 gallons in a 24-hour period.[175] As of 1998, a permit is required for any "large withdrawal" of groundwater.[176] Regulations set up a tiered system dividing large withdrawals into minor and major withdrawals.[177] Minor large withdrawals are those between 57,600 and 144,000 gpd in an area with few other users or natural resources, while major large withdrawals are over 144,000 gpd or are in an area with significant users or natural resources.[178] In order to receive a permit for any major large withdrawal, the state must find that the withdrawal would not result in adverse impacts, including (a) capacity reduction in private wells, (b) reduction below the designed flow rate in public water supplies, (c) reduction of surface water or river flows in violation of New Hampshire water quality rules, and (d) contamination of wells or surface waters resulting from a groundwater flow alteration.[179] The state can grant a permit conditionally, or with a mitigation agreement.[180] Essentially, New Hampshire uses similar criteria to those listed in Vermont's Act 250, but puts specific emphasis on them by means of a separate permit. New Hampshire's regulations also capture heavy groundwater users who might not meet the jurisdictional requirements of Act 250.

So far there have been eleven large groundwater withdrawal permits granted since 1998, including four golf clubs, four municipal wells, and three water bottlers.[181] No impacts were adverse enough to result in a denial of a permit application. New Hampshire granted the permits either directly, or with a condition or mitigation.[182]

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172. *See* Brief for Petitioner-Appellant at 1, Save Our Groundwater v. New Hampshire Department of Environmental Services (2004), *available at* http://www.appealslawyer.net/briefs/SOG_NOA_re_USA_Springs_Permit.pdf.

173. N.H. REV. STAT. ANN. § 485-C:5 (LexisNexis 2006).

174. *Id.* § 485-C:14-a.

175. *Id.*

176. *Id.* § 485-C:21.

177. New Hampshire Regulation Env-Es 387, *available at* http://www.des.state.nh.gov/rules/adopt_387.pdf#search=%22nh%20administrative%20rules%20env-ws%20387%22; *see also* New Hampshire Regulation Env-Es 388, *available at* http://www.des.state.nh.us/Rules/adopt_338.pdf#search=%22nh%20administrative%20rules%20env-ws%20387%33.

178. *Id.*

179. *Id.*

180. *Id.*

181. E-mail from Timothy Nowak, Hydrogeologist, New Hampshire Department of Environmental Services, to Evan Mulholland (May 2, 2005) (on file with author).

182. *Id.*

In addition to the withdrawal permit scheme, New Hampshire regulates bulk water withdrawals from surface water bodies.[183] This put bulk water regulation on an equal footing with groundwater regulation. Among other things, bulk water in New Hampshire is used for filling swimming pools, hydroseeding, and dust control. According to the bulk water regulations, the user (a) must have the riparian right holder's permission, (b) must not withdraw enough water to create an adverse impact to biota or recreation, and (c) the withdrawal must be reasonable; it must not adversely affect riparian landowners downstream.[184] The volume trigger for state registration is either 20,000 gpd averaged over seven days or 600,000 gallons over 30 days.[185]

The New Hampshire legislature has addressed water use in the last two years. Two acts were passed at the end of the 2005 legislative session. The first, H.B. 215, requires, as of January 1, 2006, registration of any withdrawal or discharge of water over 20,000 gpd, or 600,000 gallons in a thirty day period.[186] The second, H.B. 69, effective August 30, 2005[187] and provides for public hearings in the municipalities affected by large groundwater withdrawals.[188]

B. Maine

Maine is one of the last states in which the common law rule of absolute ownership of groundwater stands.[189] The most recent case, *Maddocks v. Giles*, was decided in 1999 and involved a gravel excavation quarry that diminished the flow of a spring on nearby private land.[190] The Court ruled that such a diminishment was not an actionable claim and that the rule of absolute dominion remained.[191] The Court called on the legislature to act if it was dissatisfied with the result.[192] Like Vermont,

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183. New Hampshire Department of Environmental Services, Water, WD-WSEB-1-17 (2002 *Supply Engineering, Water Withdrawals from Surface Waters for Bulk Transport and Delivery*), *available at* http://www.des.nh.gov/factsheets/ws/ws-1-17.htm.

184. *Id.*

185. *Id.*

186. N.H. REV. STAT. ANN. § 488:3 (2005), *available at* http://www.gencourt.state.nh.us /legislation/2005/HB0215.html.

187. Amended § 485-C:21.

188. N.H. REV. STAT. ANN. § 485-C:21 (2005), *available at* http://www.gencourt.state.nh.us /legislation/2005/HB0069.html.

189. *See* Maddocks v. Giles, 728 A.2d 150 (Me. 1999). (holding that the absolute dominion rule was the correct instruction to the jury); *see also* ORLANDO E. DELOGU, MAINE IN 6 WATER AND WATER RIGHTS 405 (Robert E. Beck ed., 1994) (describing the proscription of negligent or malicious groundwater withdrawal in Maine, and describing the rejection of the absolute right to waste).

190. *See* Maddocks v. Giles, 728 A.2d 150 (Me. 1999). .

191. *Id.* at 153.

192. *Id.* at 154.

Maine receives abundant rainfall, however Maine has localized conflicts over water use. For instance, there has been seasonal competition between Maine's blueberry farmers' need for increased summer irrigation and the in-stream flow necessary to maintain wild salmon stocks.[193]

In 1987, Maine passed the Groundwater Protection Program which created a new cause of action against a person who withdrawals in excess of domestic beneficial use and interferes with another's preexisting beneficial use.[194] Although few cases address this statute, it appears the *Maddocks* Court ignored or overruled the statute. Also in 1987, Maine approved a prohibition against out-of-township transfers of water by pipe or container larger than 10 gallons, with an exception for transfers that would not harm health, safety or welfare.[195] At least one critic claims that this law may not be valid and also may not be a reasonable policy for the protection of groundwater.[196] A 1995 case applied this prohibition against out-of-township transfer, where the court ruled that a certain bulk transfer of water should not be authorized because the applicant did not show that the transferee (a commercial bottler) would bear a hardship if the water was not delivered. [197]

More recently, in 2002, Maine adopted a New Water Use Reporting Program, which did not grant any new water use rights but merely required reporting of withdrawals beyond defined thresholds.[198] Withdrawals of water must be reported if they are from a stream or brook (or groundwater within 500 feet of a stream or brook) and consist of 20,000 gpd in a watershed of less than 75 square miles, or a withdrawal in excess of the 7Q10 when the watershed exceeds 75 square miles.[199] Withdrawals from a lake or pond that are 10 acres or less (or groundwater within 500 feet of the lake or pond) must be reported when they reach 30,000 gallons per week.[200] The ratios are similar depending on the size of the pond or lake.[201] Groundwater withdrawals of more than 50,000 gpd from a site more that 500 feet from a water body must also be reported.[202] The following uses are exempt from the reporting requirement: non-consumptive uses (such as dams), household uses, public water supplies, withdrawals subject to existing reporting requirements, emergencies, and water from storage

193. GLENNON, *supra* note 1, at 127.
194. ME. REV. STAT. ANN. tit. 38, § 402(2) (1964).
195. ME. REV. STAT. ANN. tit. 22, § 2660-A(1), 2660-A(3)(A) (1964).
196. Delogu, *supra* note 188, at 405.
197. Centamore v. Dep't of Human Services, 664 A.2d. 309 (Me. 1995).
198. ME. REV. STAT. ANN. tit. 38, §§ 470-A-G (1964).
199. *Id.* § 470-B.
200. *Id.*
201. *Id.*
202. *Id.*

ponds.[203] Presumably, Maine is gathering information on water usage patterns and may institute a permitting system soon. According to the program, Maine should have drafted in-stream flow rules by January 1, 2005, but has not.[204] State Representative Robert Duplessie proposed legislation to tax all water bottled in the state, based on the idea that bottlers are profiting from Maine's natural resources.[205]

C. South Carolina

Although South Carolina has a different geologic structure than Vermont, and different water needs, it has been regulating groundwater withdrawals since 1976.[206] South Carolina passed the Groundwater Use and Reporting Act (Act), to set up a system to monitor and regulate the use of groundwater in the state. The Act requires only reporting of withdrawals, but in certain areas, mainly on the coast, a permit is needed for any groundwater withdrawal, except for emergencies, non-consumptive uses, and household non-commercial use.[207] Another source of groundwater regulation is the South Carolina Drought Response Act of 1985 which gives state agencies substantial authority to regulate groundwater use in times of scarcity.[208] South Carolina has not extended the public trust doctrine to its groundwater.

D. Massachusetts

Traditionally, landowners in Massachusetts have had absolute ownership over groundwater beneath their land, except when excessive withdrawals may cause subsidence of a neighbor's property.[209] In 1985, Massachusetts adopted the Water Management Act (WMA).[210] Section 4 of the WMA requires the Massachusetts Department of Environmental Protection (DEP) to regulate new surface or groundwater withdrawals over 100,000 gpd, excluding non-consumptive uses which do not affect water

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203. *Id.* § 470-C.

204. *See* Misty Edgecomb, *Maine Water Allocation a Concern*, BANGOR DAILY NEWS, January 20, 2005, at B1.

205. *Maine Eyes Tax on Bottled Water*, MONTPELIER TIMES ARGUS, April 17, 2005, *available at* http://www.timesargus.com/apps/pbcs.dll/article.AID=2005504M03252.

206. S.C. CODE ANN. §§ 49-5-10 to 150 (West 2005).

207. S.C. CODE ANN. §§ 49-5-60 to 70 (West 2005).

208. S.C. CODE ANN. §§ 49-23-10 to 10-100 (2004).

209. Denis Binder, *Massachusetts*, *in* 6 WATERS AND WATER RIGHTS 418 (Robert E. Beck ed., 1994).

210. MASS. GEN. LAWS ch. 21G, §§ 1-19 (2004).

quality or quantity.[211] Under the WMA, new withdrawals of over 100,000 gpd are prohibited without a permit.[212] The DEP determines if the proposed withdrawal is within the safe yield of the water body or aquifer.[213] The statute also allows new applicants to negotiate restrictions on existing rights or to purchase existing rights, subject to approval by the DEP.[214] Transfers of rights are permitted, again subject to the DEP's approval.[215] The criteria used by the DEP to deny or grant a new permit include need, environmental effects, alternatives, and proposed conservation measures.[216] Unfortunately, the WMA has not been effective in preserving minimum stream flows in watersheds like the Ipswich River Basin.[217] In 2000, the USGS determined that the combination of municipal and individual groundwater pumping and the export of sewer water to central treatment plants caused the Ipswich to dry up in the summer.[218]

Until recently, groundwater in Massachusetts has been excluded from the public trust doctrine. The public trust traditionally extended to beds and banks of navigable water bodies and to the coastal lands below the mean high tide line.[219] In 2003, Massachusetts passed the Environmental Endangerment Act in which "natural resources" are defined as "land, fish, wildlife, biota, air, water, groundwater and drinking water supplies belonging to, managed by, held in trust by, appertaining to or otherwise controlled by the commonwealth or any local government."[220] Although this does not explicitly extend the public trust to groundwater, it may serve to limit the traditional common law rule of absolute ownership.

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211. *Id.* § 4. However, section 4 also provides an option for the Department of Environmental Protection, by regulation, to establish a threshold volume lower than 100,000 gdp for any particular water source pursuant to findings that the water source "is in need of special protection" based on production demands. Furthermore, the term "non-consumptive use" is specifically defined by regulation. 310 Mass. Code Regs. 36.03 (2005) ("Non-consumptive use means any use of water which results in its being discharged back into the same water source at or near the withdrawal point in substantially unimpaired quality or quantity.").

212. *Id.*

213. Lee P. Breckenridge, *Massachusetts*, *in* 6 WATERS AND WATER RIGHTS 664 (Robert E. Beck ed., repl. vol. 2005).

214. *Id.*

215. Note that interbasin transfers require a separate permit under the Interbasin Transfer Act of 1983. MASS. GEN. LAWS ch. 21, § 8C (2004).

216. Breckenridge, *supra* note 192, at 664–65.

217. GLENNON, *supra* note 1, at 105.

218. *Id.* at 107.

219. Denis Binder, *Massachusetts*, *in* 6 WATERS AND WATER RIGHTS 422 (Robert E. Beck ed., 1994).

220. MASS. GEN. LAWS ch. 21L, § 1 (2004).

E. Connecticut

Connecticut is a regulated riparian rights state for purposes of surface water.[221] Connecticut has adopted a unified Water Diversion Policy Act requiring permits for all water users in the state, including groundwater.[222] The permitting agency considers the proposed withdrawal's effect on stream flow, on other users, and on wetlands, and is also required to look at alternatives to the proposal, including conservation measures.[223] As in Massachusetts, interbasin transfers are subject to extra regulatory oversight.[224] Certain uses are exempt from the permit requirement, such as withdrawals under 50,000 gpd, diversion of storm water in an area under 100 acres, emergencies, and dam repair.[225] Fees are associated with the water diversion permits, varying between $1,200 and $4,000 depending on quantity of water diverted, in addition to a $500 annual fee.[226] The state has the power to restrict permitted uses during water supply emergencies.[227] A hierarchy of uses was proposed in 2000 to supplement the Water Diversion Act but has not been adopted.[228] Connecticut has adopted minimum flow standards for the state streams, with water diversion permits partially based on these limits.[229]

The Connecticut Environmental Protection Act extended the public trust to groundwater, among other natural resources.[230] It states that there is a "public trust in the air, water, and other natural resources of the state of Connecticut and that each person is entitled to the protection, preservation and enhancement of the same."[231] Although reversed on appeal, the trial court in 2000 in *City of Waterbury v. Town of Washington* held that a certain river diversion was a violation of the public trust in water.[232]

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221. Ann Astarita, *Connecticut*, *in* 6 WATERS AND WATER RIGHTS 267 (Robert E. Beck ed., 1994); *see also* City of Waterbury v. Town of Washington, 800 A.2d 1102 (Conn. 2002) (recounting the history of Connecticut water law).

222. CONN. GEN. STAT. §§ 22a-365 to 387 (2004).

223. CONN. GEN. STAT. § 22a-373(b)(8) (2004).

224. CONN. GEN. STAT. § 22a-369(10) (2004).

225. CONN. GEN. STAT. § 22a-377 (2004).

226. CONN. GEN. STAT. § 22a-372(e) (2004).

227. CONN. GEN. STAT. § 22a-378 (2004).

228. CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION, REPORT TO THE GENERAL ASSEMBLY ON STATE WATER ALLOCATION POLICIES PURSUANT TO PUBLIC ACT 98-224 25 (2000), *available at* http://dep.state.ct.us/\wtr/div/wtrallc.pdf.

229. CONN. GEN. STAT. § 26-141(a) (2004).

230. CONN. GEN. STAT. § 22a-15 (1995).

231. *Id.*

232. City of Waterbury v. Town of Washington, X01UWYCV 97140886, 2000 Conn. Super. LEXIS 355, at 114-5 (Conn. Super. Ct., Feb. 16, 2000), rev'd, 800 A.2d 1102 (Conn. 2002).

F. Michigan

Michigan has new groundwater legislation pending that may inform Vermont's policy makers. In general, groundwater withdrawals in Michigan are subject by statute to the reasonable use rule.[233] The public trust applies to the bed of navigable inland lakes and streams.[234] The Michigan Constitution, although not mentioning groundwater explicitly, may be another source of authority for groundwater protection. It states that "the conservation and development of the natural resources of the state are hereby declared to be of paramount public concern in the interest of the health, safety and general welfare of the people."[235]

In 1994, Michigan adopted the Natural Resource and Environmental Protection Act, which requires reports by users of surface and groundwater who have the capabality to withdraw over 100,000 gpd in a 30-day period, even if the actual amount withdrawn is less.[236] This Act was passed mainly to guard against large diversions from the Great Lakes basin.[237]

Other laws affecting water use in Michigan include the Aquifer Protection and Dispute Resolution Act of 2003[238] and the Federal Water Resources Development Act.[239] Under the former, a citizen who suspects that a nearby high-capacity well is interfering with his water supply can request the state investigate the possible hydraulic connections between the two and propose solutions.[240] Since 2003, 16 complaints have been investigated, all of which were resolved through voluntary remedial actions.[241] The Federal Water Resources Development Act prohibits export of Great Lakes waters without consent of the eight governors of the Great Lakes states.[242] A proposed annex would allow fewer restrictions on exports as long as the bottles are less than 5.6 gallons.[243]

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233. MICH. COMP. LAWS § 600.2941 (2004).

234. Veryl N. Meyers, *Michigan, in* 6 WATERS AND WATER RIGHTS 429 (Robert E. Beck ed., 1994).

235. MICH. CONST. art. IV § 52.

236. MICH. COMP. LAWS § 324.32705 (2004).

237. MICH. COMP. LAWS § 324.32702 (2004).

238. MICH. COMP. LAWS §§ 324.31700-324.31713 (2004).

239. 42 U.S.C. § 1962d-20(d) (2000).

240. MICH. COMP. LAWS § 324.31702 (2005).

241. Russ Harding, *Groundwater Regulation: An Assessment 12* (2005), *available at* http://www.mackinac.org/archives/2005/s2005-01.pdf.

242. 42 U.S.C. § 1962d-20(d) (2000).

243. Bill O'Brian, *Michigan's Fresh Water Remains on the Market*, TRAVERSE CITY REC. EAGLE, March 9, 2005, *available at* http://www.record-eagle.com/2005/mar/0309edit.htm.

New legislation, the Water Legacy Act, was proposed in 2004 as a response to the ongoing Nestlé Waters dispute.[244] A county judge in Michigan, in 2003, enjoined Nestlé's subsidiary's groundwater pumping based on the environmental effect of the water withdrawal.[245] The appeals court stayed the injunction and allowed the pumping to continue. The original case against Nestlé is still pending. The Water Legacy Act would require permits for the following levels of water withdrawals from either ground or surface waters: a) any withdrawal of two million gpd in a 30 day period, or 100 million gallons per year; or b) any withdrawal in excess of 100,000 gpd in any thirty day period deemed by the Department of Environmental Quality (DEQ) to cause or likely to cause "an adverse impact to the (1) quantity or quality of the waters or water-dependent natural resources of the Great Lakes basin, (2) to the public health, safety, or welfare or the environment, or (3) to the public trust in the natural resources of the state or public rights in navigable waters."[246]

On May 27, 2005, Michigan Governor Jennifer Granholm issued a moratorium on permits or approvals for new or increased bottled water operations until the legislature passes the new regulations.[247] The moratorium does not apply if the bottler certifies that bottled water will be distributed within the Great Lakes Basin.[248]

The former director of the Michigan DEQ, Russ Harding, has criticized the Water Legacy Act as being too strict and for creating a needless, expensive regulatory scheme.[249] Harding points out the difficulties in planning a project when the outcome of a permit hearing is uncertain and would rather permits be required only after an aquifer is shown to be in danger of significant irreversible depletion.[250] He also argues for privatization and tradable water rights by which demand would be efficiently balanced with supply.[251]

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244. S.B. 1087, 92d Leg., Reg. Sess. (Mich. 2004) (referred to Committee on March 10, 2004), *available at* http://www.legislature.mi.gov/documents/2003-2004/billintroduced/senate/pdf/2004-SIB-1087.pdf.

245. Harding, *supra* note 240, at 4.

246. CONN. GEN. STAT. §§ 22a-365 to 387 (2004).

247. Press Release, Office of the Governor, State of Mich., Granholm Issues Executive Directive Placing Moratorium on Bottled Water Permits (May 27, 2005), http://michigan.gov/gov/0,1607,7-168-23442_21974-119000--M_2005_5,00.html.

248. *Id.*

249. Press Release, Mackinac Center for Public Policy, Despite Governor's Claims, Proposed Water Legacy Act Unnecessary, Existing Groundwater Laws Ample, Says Former DEQ Director (May 5, 2005), *available at* http://www.mackinac.org/article.asp?ID=7089.

250. *Id.*

251. *Id.*

G. Wisconsin

Wisconsin is included in this section because of a unique provision in its groundwater regulations. Groundwater in Wisconsin is subject to the reasonable use rule.[252] According to *State v. Michels Pipeline Construction Inc.*, no user of groundwater in Wisconsin is subject to liability unless the withdrawal causes unreasonable harm, or the withdrawal has a direct influence on a surface water body.[253] As of 2004, a permit is required for any new high capacity wells (capable of producing over 100,000 gpd).[254] An additional level of environmental review is required for high capacity wells that: (a) are within 1,200 feet of an outstanding resource water; (b) have a significant environmental impact on a spring; (c) are in the area of a groundwater discharge greater than one cubic foot per second for 80% of the time (i.e., a spring); or (d) will divert or consume 95% of the withdrawal.[255] These four categories of high capacity wells that are subject to more stringent environmental review seem to mirror the dangers of groundwater pumping for the purpose of bottling. Category (d), for example, seems especially targeted at bottlers, for who else would consume all the water withdrawn, with none reentering the watershed as run-off? Nonetheless, Wisconsin has not extended the public trust doctrine to groundwater, rather applying it only to navigable waterways.[256]

VII. ANALYSIS OF GROUNDWATER PROBLEMS AND SOLUTIONS: VERMONT'S PERSPECTIVE

Vermont has yet to face serious groundwater quantity issues. The few instances of local shortages can usually be solved by drilling more wells, deeper wells, or by extending the reach of the public water supply. Increased population pressures and increased groundwater demand by industry and agriculture, coupled with a drought year or three, may bring groundwater quantity to the forefront. There are two types of groundwater quantity problems Vermont may face in the future, both of which will be worsened by the lack of research, mapping, and adequate understanding of the resource.

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252. Michael J. Cain, *Wisconsin*, *in* 6 WATERS AND WATER RIGHTS 857 (Robert E. Beck ed., 1994).

253. State v. Michel's Pipeline Construction Inc., 217 N.W. 2d. 339, 350–51 (Wis. 1974).

254. WIS. STAT. ANN. § 281.34(2) (West 2005).

255. Wis. STAT. ANN. § 281.34(4)(a) (West 2005).

256. Caine, *supra* note 251, at 860.

The first problem is groundwater shortages on a local level. This problem can manifest itself in two ways. Individual groundwater users could interfere with existing wells, or alternatively, with surface water resources. The first is the problem envisaged by Criterion (3) of Act 250, requiring that new development not adversely affect existing water supplies.[257] High capacity wells may not be covered by Act 250, however, if they are not associated with a development that meets the 10-acre jurisdictional threshold.[258] If Act 250 does apply, lack of knowledge and testing of the groundwater and of its flow direction and speed may make consideration of Criterion (3) difficult. Additionally, the impacted well owners may not know to intervene in the hearing in a timely manner.

The second type of local groundwater shortage–pumping enough groundwater to adversely affect nearby springs or streams–is the danger contemplated by the Wisconsin statute. It may be possible to regulate groundwater withdrawals that have such effect on surface waters through Act 250's Criterion 1(E) streams,[259] or by means of extending the Water Quality Standards (WQS) minimum flow rule to groundwater withdrawals within a certain distance from the stream.[260] There are limitations to both techniques. The jurisdictional requirement of Act 250 might allow some groundwater users to avoid state overview of their effect on stream flow. As for extending WQS standards to groundwater withdrawals, it would be especially difficult without intensive sampling and monitoring, to determine accurately which groundwater users adversely affect a diminished stream or spring. Furthermore, the issue of which groundwater user to target for administrative action requires attention. If many users are contributing to the problem, the application of the WQS minimum flow standards may not be equitable. Appealing to Vermont's correlative rights framework may help, but would require administrative staff to decide which users need to limit pumping and to enforce those limitations.

Another problem would be groundwater shortages on a region-wide scale. Simply put, if enough wells are drilled, and the pumping rate exceeds the recharge rate, the groundwater level will drop and the resource will diminish. This problem is also exacerbated by limited groundwater mapping and knowledge of recharge potential, aquifer boundaries, flow rates, etc. Any attempt to rectify region-wide groundwater quantity problems by requiring permits for new wells runs into a causation problem. That is, why should a new well user be penalized for a basin-wide situation

257. VT. STAT. ANN. tit. 10, § 6086(a)(3).
258. VT. STAT. ANN. tit. 10, § 6001(3)(A).
259. VT. STAT. ANN tit. 10, § 6086(a)(1)(E).
260. Vermont Water Quality Standards, *supra* note 125.

he or she did not cause? Using the correlative rights framework to solve the problem has the same deficiencies as described above. Another aspect of the region-wide problem is the increased imperviousness of towns and cities and the resulting drop in recharge rate. Other factors decreasing the recharge rate are consumptive uses, such as bottling and the export of sewage waste downstream from the basin. Both of these factors should be considered when crafting a solution to the potential problem of basin-wide groundwater shortages.

Solutions for some of these potential problems were proposed in twin bills in 2004 in the Vermont Legislature. House Bill 722 called for the public trust doctrine to be extended to groundwater and would set up a system of five year permits for withdrawals in excess of 100,000 gpd, excluding domestic use, agricultural use, and public water supplies.[261] The decision to grant or deny a permit was to be made according to the "public good" and permit fees would have been levied of $20 per 10,000 gpd pumped, up to $1,000, using the proceeds for a mapping fund. The 2005 groundwater bill in the Senate would have just extended the public trust to groundwater and set aside funds for increased groundwater mapping.[262]

The 2004 House proposed bill can be criticized in a few ways. It exempts three of the biggest users of groundwater from any regulation at all, leaving the bill to only apply to commercial and industrial users. While a hierarchy of uses is beneficial to make sure that certain uses are given preferential treatment by the agency granting the permit, excluding them entirely even from reporting does not seem to serve the purpose of fair use of the groundwater resource. Also, it is likely that the fees paid would barely dent the estimated cost of effective groundwater mapping.[263] Any groundwater legislation ought to earmark funds for mapping beyond what is taken in as fees.[264]

Any groundwater legislation effort must also take a critical look at the 100,000 gpd threshold for requiring a permit. This commonly used limit was criticized by a 2004 report published by the Water Policy Center and focused on Georgia's 100,000 threshold.[265] The author of this paper consider decreasing the limit, pointing out that 100,000 gpd is large enough

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261. H.0722, 2003-2004 Leg. Sess. (Vt. 2004), *available at* http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2004/bills/intro/H-722.HTM.

262. S.0151, 2005-2006 Leg. Sess. (Vt. 2005), *available at* http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2006/bills/intro/S-151.HTM.

263. Vermont's Department of Environmental Conservation estimated that the least expensive four year mapping effort would cost $2.7 million. *See* Status of Groundwater, *supra* note 49, at 11.

264. A groundwater bill was passed on May 2006; *See* addendum.

265. JENNIFER ADAMS ET AL., MINIMUM WATER USER LEVELS REQUIRING STATE PERMITS: IS GEORGIA'S 100,000 GALLONS/DAY APPROPRIATE? Paper No. 2004-003 (2004), *available at* http://www.h2opolicycenter.org/pdf_documents/water_workingpapers/2004-003.pdf.

water to supply 250 to 300 four-person homes or irrigate more than 100 acres.[266] Additionally, without a reporting requirement for smaller users, the State has no way of calculating the cumulative effect on an aquifer of a cluster of users pumping at less than 100,000 gpd each.

Bottled Water Solutions

Conflicts over the consumption of the groundwater resource by bottled water companies have flared up in several states in the past decade, most notably in New Hampshire, Michigan, and Wisconsin. Although similar conflicts have not yet occurred in Vermont, demand for bottled water continues to rise and such conflict seems inevitable. In 1990, bottled water was a $2.7 billion dollar market in the United States, and by 2001 sales reached $6.5 billion and show no signs of leveling.[267] "Bottled water is consumed by 60% of Americans and it is America's second largest non-alcoholic beverage expenditure."[268] The market is such that each bottler has an incentive to extract as much of the resource as possible, since the company does not have to bear the externalities of reduced stream flow or interference with nearby wells. The bottlers' only costs, besides operational costs, are the costs of drilling deeper wells if necessary and of relocating if an aquifer is drawn down below a useable level.

Tara Boldt-van Rooy suggests as a first step extending the public trust to all natural resources, including groundwater.[269] Next, she would restrict bulk withdrawals and require a permit limiting extraction to a rate that is sustainable in a given water management district.[270] As an alternative to a government-controlled permit system, Rooy would encourage states to experiment with eco-labeling or a consumer tax on bottled water.[271] Presumably, eco-labeling would direct consumers to bottlers who adopt environmentally sound practices, weeding out abusive pumpers. In addition, states could impose a tax on consumers, rather than producers, the revenue from which would be used "to preserve springs and their environments."[272]

Matt Berkowitz emphasizes the difficulty of implementing regulations when agency staffers base decisions on whether to grant permits on

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266. *Id.* at 1.

267. Tara Boldt-van Rooy, *Bottling Up Our Natural Resources: The Fight over Bottled Water Extraction in the United States*, 18 J. LAND USE & ENVTL. LAW 267, 270 (2003).

268. Matt Berkowitz, *supra* note 109, at 236. Soft drinks are number one. *Id.*

269. Rooy, *supra* note 266, at 295.

270. *Id.* at 296.

271. *Id.* at 297.

272. *Id.*

imprecise balancing tests and lists of factors.[273] Instead, Berkowitz proposes drafting specific numeric guidelines directly addressing how much water can be taken from a spring without adversely affecting an ecosystem that relies on a continued stream flow.[274] This concept is similar to Vermont's minimum flow rules for surface water withdrawals in that it sets a calculable limit to how much water can be diverted from a given stream. A final idea Berkowitz proposes to defray the cost of the staff needed to administer and monitor an expanded system is a tax on groundwater extraction.[275] The tax would be on a sliding scale based on quantity pumped and on proximity to a valuable spring or stream.[276] The more water withdrawn and the closer to a water body, the higher the tax. This would serve both to limit the amount of water that could be profitably pumped and to provide funds for the state agencies charged with administering the program.

VIII. VERMONT SOLUTIONS AND CONCLUSION

In order to draft an effective groundwater quantity protection statute and regulation, one must first ask which problem or problems the statute will be intended to solve. Also, one should ask if the statute is meant to address existing problems or problems that may occur in the future. The best place to start is by funding more monitoring wells, more research, and more mapping of the groundwater in Vermont. It is hard to regulate the effects of unknown processes and interactions. Additionally, all major users of groundwater (and surface water) should be required to report how much water they have withdrawn, on what days, from what location, and from what depth. This data would be invaluable, but only if the DEC is adequately funded to analyze the information.

A good and workable model may be the Maine reporting statute. If the statute is intended to address the problem of localized shortages and well interference with neighboring wells, springs, or stream flow, a good place to start regulation may be to limit groundwater pumping. Another way of attacking this problem would be to mandate a review of all new wells over a certain size, limiting withdrawal amounts as a condition of the permit. This would have to be coupled with a review of existing users to ensure that groundwater is not being pumped wastefully or unreasonably. For a basin-wide groundwater shortage, one solution would be to increase the recharge

273. Berkowitz, *supra* note 109, at 257.
274. *Id.*
275. *Id.* at 258.
276. *Id.*

rate by either limiting the percentage of impervious cover or engineering a method to slow storm water run-off so that it percolates through the soil instead of running directly into a river or lake.

Another solution would be a tax structure similar to Berkowitz's idea could work for both the local problem and the region-wide problem. As long as domestic users were excluded, tax that increased as a rate of withdrawal increase would encourage conservation. It would also internalize the cost of diminished groundwater on the most prolific users and help pay for the intensive mapping needed for all regulatory proposals. No matter which path Vermont chooses, the discussion of how to deal with the increasing use of Vermont's groundwater resource will be sure to continue.

2006 ADDENDUM

During the 2006 legislative session, the State of Vermont passed Act 144, "[a]n Act relating to groundwater management" (the "Act").[277] The whole of the Act expires on July 1, 2011.[278]

First, this Act prohibits the withdrawal of more than 50,000 gallons of groundwater per day from any well drilled after July 1, 2006, without an interim permit issued by the secretary of the Agency of Natural Resources (ANR). Withdrawals for fire safety, agriculture, agricultural or dairy processing, dewatering operations during building construction, geothermal energy production, or public sanitation are specifically exempted from the interim permit program. Withdrawals from existing sources are not affected by the Act.[279]

Second, effective July 1, 2006, any water bottler applying for a permit to bottle more than 50,000 gallons per day (gpd) from a single source must provide a geologic cross section and groundwater contour map of an area surrounding the proposed source. This water bottler provision applies to the expansion of existing sources as well as new sources, and applies regardless of whether the source is above or below ground.[280]

Third, the Act establishes a committee to study potential programs for the regulation of groundwater in Vermont, with a final report to be submitted to the legislature on January 15, 2008. This committee is also charged with investigating the legal consequences of declaring groundwater to be a public trust resource.[281]

Fourth, the Act requires ANR to investigate sources of funding for the completion of the mapping of Vermont's groundwater resources.[282] This project has recently been estimated to cost approximately ten million dollars.[283]

Last, the Act requires ANR to report to the legislature on the Agency's efforts to collect and analyze data on the groundwater resource in the State, including an analysis of any localized links between water supply shortages

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277. An Act Relating to Groundwater Management (Act 144), 10 VT.STAT.ANN. §§ 1415, 1675(g), 8003(a)(6) (2006) *available at* http://www.leg.state.vt.us/docs/lefdoc.cfm?URL=/docs/2006/acts/ACT144.HTM.

278. *Id.* § 7.

279. *Id.* § 1. As of July 26, 2006, no individuals or companies had applied for an interim permit from the Vermont Agency of Natural Resources pursuant to section 1 of the Act. Email from Dennis Nealon, Hydrogeologist, Vermont Department of Environmental Conservation to Evan Mulholland (July 26, 2006) (on file with author).

280. 10 VT.STAT.ANN. § 2.

281. *Id.* § 3.

282. *Id.* at § 4.

283. *See*, Ken Picard, *Retaining Water*, SEVEN DAYS, July 5, 2006, *available at* http://www.sevendaysvt.com/features/2006/retaining-water.html.

and groundwater withdrawals and an accounting of the amount of water permitted to be bottled daily by Vermont's commercial bottlers.[284]

During the Spring 2006 legislative session, there was significant opposition to the temporary moratorium contained in the bill. The president of Vermont Pure, a large water bottler in Randolph, Vermont, thought that the moratorium could hurt his business's prospects for expansion and testified against the bill.[285] On the other hand, environmentalists and some legislators supported the bill, understanding that regulation is needed to ensure the protection of the groundwater resource.[286] Several stated that what most concerned them were large out-of-state or international corporations taking selling massive quantities of Vermont's groundwater in the global marketplace.[287]

Notably, the final bill deferred for two years the decision to declare groundwater a public trust resource. During floor debate on the bill, House members expressed opposing views as to whether the public trust should include groundwater. One member even argued that the bill would constitute an unconstitutional taking of private property without compensation.[288]

Section five of the Act, calling for a comprehensive report to the legislature on actual groundwater withdrawals in the state and any effects resulting from these withdrawals, is at the heart of Act 144. Once an accurate assessment is made of how much water is being extracted in Vermont and by whom, along with a picture of the regional and local impacts of groundwater withdrawals, wise and efficient regulation will be more likely.

It remains to be seen if any interim groundwater permits will be granted during the five-year moratorium that began on July 1st of this year. As of the July 26, 2006, no interim permit applications have been filed with the Vermont Agency of Natural Resources.[289]

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284. VT. STAT. ANN. tit. 10, §6086(a)(1)E (2004).

285. John Dillion, *Senate Committee Looks at Water Extraction Moratorium*, VERMONT PUBLIC RADIO, April 5, 2006, http://www.publicbroadcasting.net/vpr/newsmain?action=article &ARTICLE_ID=898472 (last visited April 7, 2006).

286. *Id.*

287. Picard, *supra* note 282.

288. *See* H.R. 294, JOURNAL OF THE HOUSE (Vt. 2006).

289. *Id.*

The complete text of the Act follows:

NO. 144. AN ACT RELATING TO GROUNDWATER MANAGEMENT.
(H.294)

It is hereby enacted by the General Assembly of the State of Vermont:
Sec. 1. 10 V.S.A. chapter 48, subchapter 5 is added to read:

Subchapter 5. Interim Groundwater Withdrawal Permit

§ 1415. INTERIM GROUNDWATER WITHDRAWAL PERMIT

(a) As used in this section:

(1) "Groundwater" means water below the land surface.

(2) "Person" means any individual, partnership, company, corporation, cooperative, association, unincorporated association, joint venture, trust, the state of Vermont or any department, agency, subdivision, or municipality, the United States government or any department, agency, or subdivision, or any other legal or commercial entity.

(3) "Withdraw" means the removal of groundwater by any method or instrument.

(b) No person shall withdraw more than 50,000 gallons of groundwater a day from a well drilled after July 1, 2006, for commercial or industrial purposes without first receiving from the secretary of natural resources an interim groundwater withdrawal permit under this section. Prior to issuance of a permit under this section:

(1) The secretary shall determine that such withdrawal meets the applicable requirements of section 1675 of this title and any applicable rules adopted thereunder or the requirements adopted pursuant to subsection (e) of this section; and

(2) the applicant shall submit to the Vermont state geologist and the department of environmental conservation a geologic cross section and groundwater contour map of an area, the size of which shall be in conformance with appendix A, part 3, subsection 3.3.5.2 of the Vermont water supply rule, surrounding the proposed source of the groundwater withdrawal.

(c) Groundwater withdrawal by a public water system, as that term is defined in section 1671 of this title, or for use for fire safety, agriculture, agricultural or dairy processing, dewatering operations during building

construction, geothermal energy production, or public sanitation shall be exempt from the requirements of this section.
(d) A permit issued under this section shall be valid for the period of time specified in the permit but not more than five years.
(e) The secretary of natural resources may adopt rules to implement the provisions of this section and to establish criteria for the issuance of a permit under section 1675 of this title for commercial or industrial groundwater withdrawals from a well drilled after July 1, 2006.

Sec. 2. 10 V.S.A. § 1675(g) is added to read:
(g)(1) Effective July 1, 2006, a public water system applying for a permit under this section for the bottling of more than 50,000 gallons of drinking water a day from a single source for public distribution and sale shall, in addition to complying with the requirements of this chapter and any rules adopted thereunder, submit to the Vermont state geologist and the department of environmental conservation a geologic cross section and groundwater contour map of an area, the size of which shall be in conformance with appendix A, part 3, subsection 3.3.5.2 of the Vermont water supply rule, surrounding the proposed source.

(2) The requirements of subdivision (1) of this subsection shall apply to a public water system permitted under this section when the system proposes to expand the bottling of drinking water from a single source such that the total gallons of water bottled from the single source would exceed 50,000 gallons a day.

Sec. 3. STUDY OF GROUNDWATER REGULATION AND FUNDING
(a) A committee is established to examine potential regulatory programs to protect the groundwater resources of the state. The committee shall issue a preliminary report of its findings to the house committee on fish, wildlife and water resources, the senate committee on natural resources and energy, and the house and senate committees on agriculture by January 15, 2007. The committee shall issue a final report of its findings to the house committee on fish, wildlife and water resources, the senate committee on natural resources and energy, and the house and senate committees on agriculture by January 15, 2008. The final report shall include:

(1) A recommendation from the committee as to whether the groundwater resources of the state of Vermont should be declared a public trust resource.

(2) An analysis of the regulatory implications of declaring the groundwater of the state to be a public trust resource if the committee so recommends under subdivision (1) of this subsection.

(3) A proposed schedule for the groundwater mapping of the state by the agency of natural resources.

(4) A proposed appropriation to the agency of natural resources for the groundwater mapping of the state, including any proposed new or existing revenue sources that may be used by the agency to aid in funding the groundwater mapping.

(5) Proposed legislation for the regulation of groundwater withdrawal in the state, addressing:

(A) The type of groundwater withdrawals subject to regulation;

(B) A threshold amount or amounts of groundwater withdrawal subject to regulation;

(C) Groundwater users exempt from regulation;

(D) The regulation of interbasin groundwater transfers;

(E) The fee to be charged for regulated groundwater withdrawal;

(F) Monitoring, reporting, or recordkeeping requirements for regulated groundwater withdrawal; and

(G) Any other issues deemed relevant by the committee.

(b) The committee shall consist of the following members:

(1) the secretary of natural resources or his or her designee;

(2) the state geologist or his or her designee;

(3) the secretary of agriculture, food and markets or his or her designee;

(4) one member each from the house committees on agriculture and on fish, wildlife and water resources and the senate committees on agriculture and on natural resources and energy as appointed respectively by the speaker of the house and the committee on committees;

(5) a representative appointed by the governor from each of the following: the business community, municipalities, a local environmental organization, a regional or statewide environmental organization, and the general public;

(6) two representatives of the agricultural community appointed by the governor.

(c) The committee may elect a chair and a vice chair and may hold public hearings. Legislative council shall provide support for the committee.

(d) All members of the committee shall serve on the committee for the duration of the study unless circumstances dictate a permanent replacement. Vacancies shall be appointed in the same manner as original appointments.

(e) Legislative members are entitled to per diem payment and reimbursement for expenses pursuant to 2 V.S.A. § 406.

Sec. 4. GROUNDWATER MAPPING

The agency of natural resources shall explore all available alternatives for the immediate initiation of groundwater mapping in the state, including working in cooperation with the U.S. Geologic Survey and obtaining the necessary funding from the U.S. Environmental Protection Agency. The agency shall report its findings to the house committee on fish, wildlife and water resources, the senate committee on natural resources and energy, and the house and senate committees on agriculture by January 15, 2007.

Sec. 5. AGENCY OF NATURAL RESOURCES GROUNDWATER REPORT

On or before January 15, 2008, the agency of natural resources shall submit a report to the senate committee on natural resources and energy and the house committee on fish, wildlife and water resources regarding the status of the agency's efforts to collect and analyze information regarding the groundwater resources of the state. The report shall include:

(1) An analysis by the agency of natural resources of whether the withdrawal of groundwater or bottling of drinking water in certain geographic areas of the state has impacted the use or quality of groundwater or surface water for domestic drinking water or other purposes;

(2) A listing of any areas identified under subdivision (1) of this section, a summary of how the agency of natural resources responded to groundwater or surface water shortages in those areas, and agency recommendations on how to avoid similar impact areas in the future;

(3) A compilation of groundwater supply information included in the well completion or closure reports submitted to the agency of natural resources in the last 15 years by licensed well drillers;

(4) The amount of drinking water approved for bottling per day from each source in the state permitted under 10 V.S.A. § 1675 for use by a bottled water facility;

(5) Any groundwater mapping completed by the agency; and

(6) Any other information deemed relevant by the agency.

Sec. 6. 10 V.S.A. § 8003(a)(6) is amended to read:

(6) 10 V.S.A. chapter 48, relating to well drillers <u>and groundwater withdrawal</u>;

Sec. 7. SUNSET

10 V.S.A. chapter 48, subchapter 5 (interim groundwater withdrawal permit) is repealed July 1, 2011.

Approved: May 15, 2006.