The Berlin Pond Watershed Conservation Project

Presented to the Montpelier City Council

By the Montpelier Conservation Commission

March 23, 2005

Table of Contents

List of Figures

List of Tables

List of Appendices

Executive Summary

Berlin Pond is a natural resource of significant value to central Vermont. The pond serves as the primary public water supply for the City of Montpelier and portions of the town of Berlin. It is a designated Vermont Audubon Society "important birding area." Recreation trails used by Central Vermont residents weave throughout the watershed. Berlin Pond remains one of the few water bodies of its size in Vermont with a totally undeveloped shoreline. For these reasons, Berlin Pond and its watershed are both unique and important.

Today's residents of Montpelier have been fortunate to inherit a legacy of land conservation in the watershed. In 1884, the City began a series of land purchases around the pond, and, despite the fact that 79% of the watershed remains privately owned, the City is fortunate that the watershed remains relatively undeveloped. Studies of other potential water sources in the region have been unable to identify any water sources of comparable quality and capacity to that provided by Berlin Pond. The City demonstrated its commitment to Berlin Pond as its primary water supply with the construction of the $11.5 million water treatment plant in 1998.

Berlin Pond and its watershed are not immune to growing development throughout central Vermont. Development in the watershed presents an increasing threat to the use of the pond as a water supply. Use of pesticides, fertilizers and road salt, the construction of more septic tanks with leach fields, and the possibility for fuel oil spills by trucks making deliveries to residential homes are potential threats associated with development. The Source Protection plan identified 297 existing potential sources of contamination in 2001. Future development in the Berlin Pond watershed can only degrade the City of Montpelier's water supply.

The Montpelier Conservation Commission, in partnership with the Berlin Conservation Commission, the Vermont Land Trust, and other conservation organizations has been proactive in its efforts to permanently conserve additional land in the watershed. Building on a history of success conserving land at little or no cost to the City (such as North Branch River Park, and Irish Hill in the Berlin Pond watershed), this consortium now seeks to conserve additional land in the Berlin Pond watershed through the purchase of land or development rights from willing landowners.

To achieve broader protection of the Berlin Pond water supply, the City of Montpelier can leverage further land conservation in the watershed by offering to donate development rights on the City-owned land around the pond. Placing a conservation easement on the City-owned land will create a strong incentive for raising the funds necessary to conserve an additional acreage of strategically chosen land in the watershed. According to the City's legal counsel, the City has the authority to grant a conservation easement on its lands to a third party, as long the City's authority to manage these lands for water supply purposes is not restricted, and the City receives a public benefit that is equal or greater in value than what the City tenders for conservation.

The City of Montpelier faces a critical juncture in its use of Berlin Pond as a water supply. For over 120 years, residents of Montpelier have benefited from the potable water flowing from this undeveloped watershed. The Montpelier Commission firmly believes it is essential at this time for the benefit of this and future generations to conserve additional land in the watershed.

The Water Cycle and Watersheds

In order to understand the need to conserve watersheds for the purpose of water quality, it is necessary to first understand the basic workings of the water cycle.

The Water Cycle

In an undeveloped area, rain falls onto the soil. The soil acts as a sieve and the water *infiltrates* through the soil. Once it is in the soil, the water either is taken up by vegetation, or continues infiltrating through pores and cracks in the bedrock. A rock or soil that contains and transmits water underground is called an *aquifer*.

An aquifer may be an underground zone of gravel or sand, a layer of sandstone, a zone of cracked rock, or a layer of cavernous limestone. The rain water that has soaked through the soil and into the aquifer will continue soaking down until it eventually meets an impervious surface. Water will continue to collect above this impervious surface, saturating all the pores and cracks in the bedrock. The top of this zone of water or saturation is the *water table*.

The water table is often exposed in the bottom of the deepest notch or depression in the area – typically a valley. When the water table is high enough to emerge at the surface, it becomes a stream The water flows downhill in its stream channel and into a pond (such as Berlin Pond), lake or ocean.

The second half of the water cycle involves evaporation from ponds, lakes, and oceans. Water evaporates, forms clouds, and the cycle repeats with precipitation. The relationships between the different components of the watershed are shown in Figure 1.

Watershed

The word *watershed* refers to an area of land in which all of the rain that falls in that area flows to a common destination. For instance, the Berlin Pond watershed encompasses all of the land on which a drop of rain would end up flowing into Berlin Pond (see figure 2). While the Berlin Pond watershed refers to the land around Berlin Pond in central Vermont, the Berlin Pond watershed is also part of the larger Lake Champlain watershed.

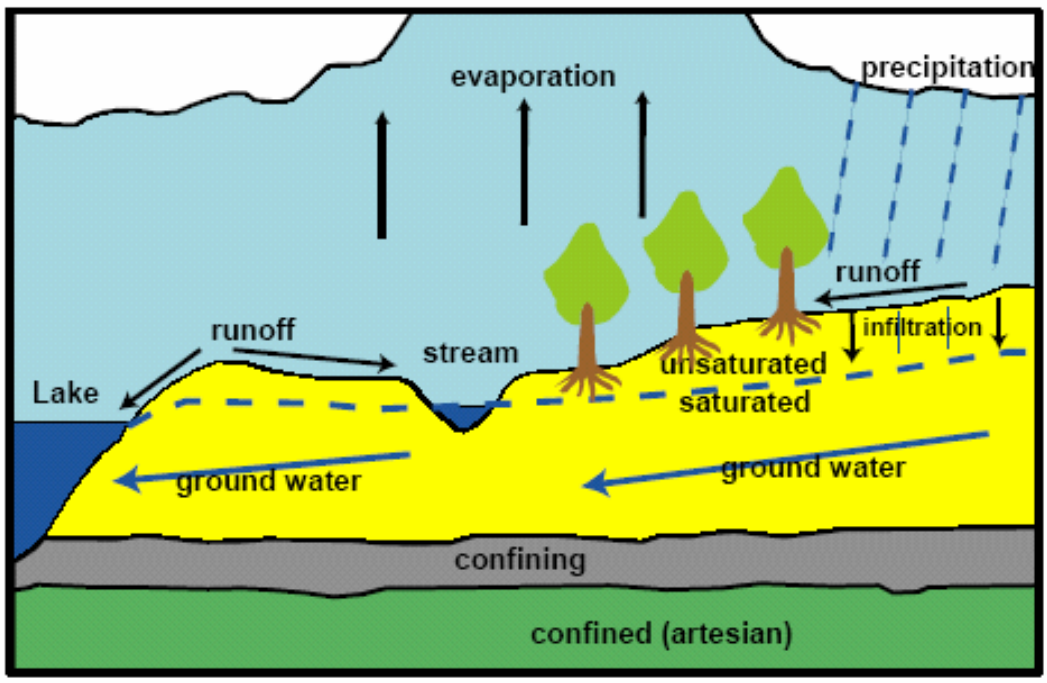

Figure 1: **Cross section through the earth's surface and the water cycle**

(Source: Report of the Status of Groundwater and Aquifer Mapping in the State of Vermont, January 2003, Vermont Department of Environmental Conservation)

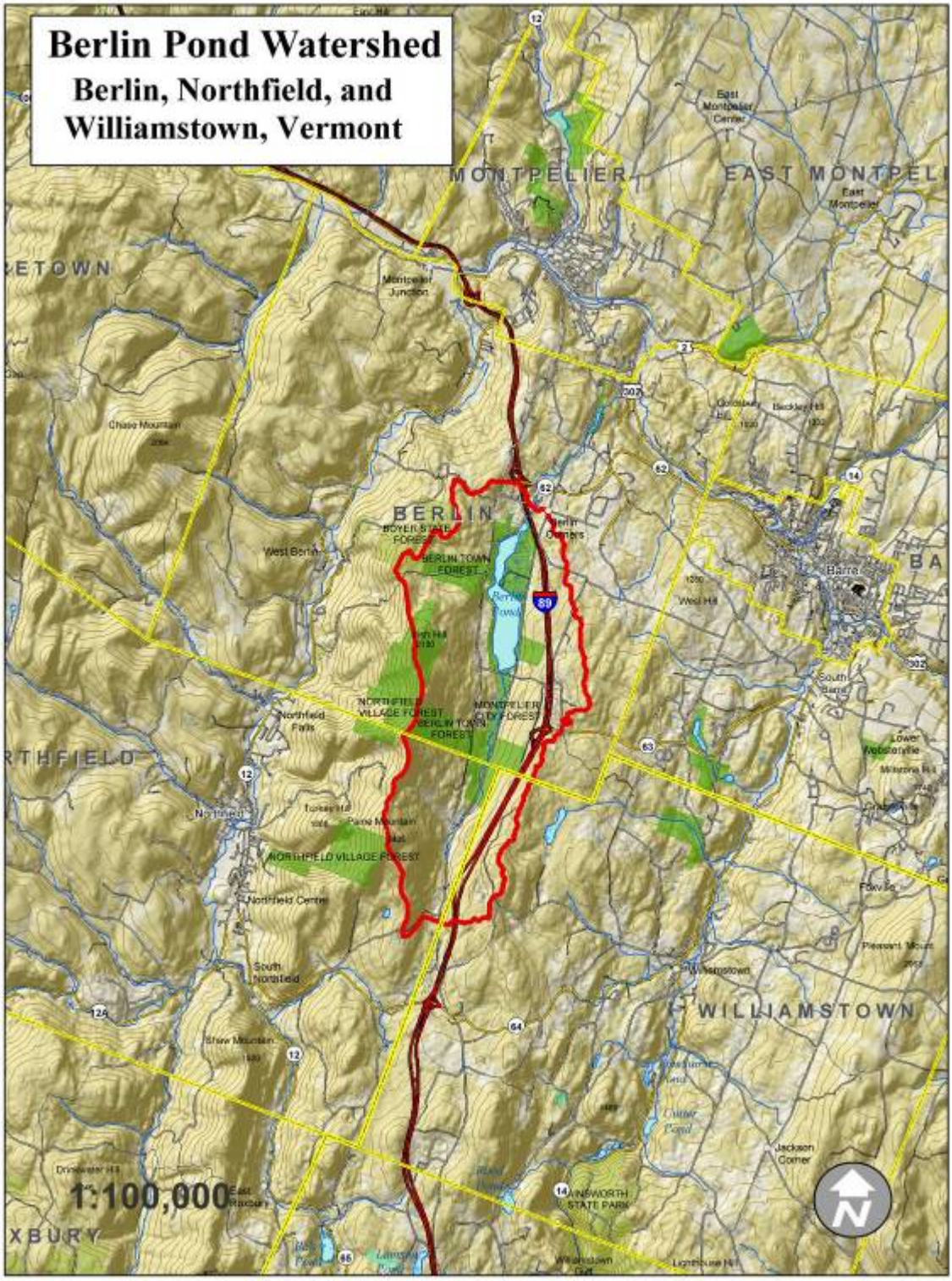

Figure 2. Berlin Pond Watershed Location Map

Types of Public Water Supplies

Most towns and individuals typically get drinking water from two primary sources:

1. **Surface waters**, such as impoundments (ponds, lakes and reservoirs) and flowing waters (rivers and streams), and
2. **Groundwater**, such as wells and springs. Wells are drilled in bedrock (deep) and in gravel deposits, often near rivers.

The most recent data for Vermont, from 2000, indicates that almost 60% of Vermont residents get their drinking water from public water supply systems (see Appendix A. - Water Use in Vermont). Approximately 68 % of the water supplied by these public systems comes from surface water sources. For example, both the City of Burlington and the Champlain Water District draw water from Lake Champlain to serve over 100,000 residents in the greater Burlington area. The City of Montpelier obtains its water from a pond of about 286 acres in the Town of Berlin (Berlin Pond). For many towns with similar population and daily demand as Montpelier, surface waters are also the primary drinking water source (see Table 1). Like many towns in Vermont, Montpelier's water supply is located outside the municipal boundary. Vermont residents who are not served by public systems take their drinking water primarily from groundwater sources (mostly drilled wells).

Table 1: Public Surface Water Supplies

City or Town	Population[1]	Water Supply	Size of Lake or Pond (acres)	Average Daily Demand (MGD[2])	Location of Water Supply
Barre City	9,166	Dix Reservoir	122	2.1	Orange
Bennington	15,637	Bolles Brook	N/A	2.0	Woodford and Glastenbury[3]
Brattleboro	11,996	Sunset Lake	98	1.7	Marlboro
		Pleasant Valley Reservoir	22		Brattleboro
Montpelier	**7945**	**Berlin Pond**	**286**	**1.7**	**Berlin, Northfield, and Williamstown**
Rutland	17,103	Rutland City Reservoir (Mendon Brook)	13	2.4	Mendon
St Albans[4]	7,566	St. Albans Reservoir	58	2.2	Fairfax
St. Johnsbury	7470	Stiles Pond	144	1.4	Waterford

Notes:
1. U.S. Census Bureau population estimates for July 2003 (http://crs.uvm.edu/census/estimates/town/)
2. MGD = million gallons/day
3. Green Mountain National Forest
4. The primary water supply for St. Albans is Lake Champlain.

History of Berlin Pond

The City of Montpelier has been committed to Berlin Pond as its primary source for drinking water for 135 years. Land purchases around the pond by the City to protect the its water supply began in 1884 and continued until 1953. No further acquisition occurred in the watershed until the Montpelier and Berlin Conservation Commissions cooperated to purchase all the land bordering Darling Brook, a major tributary to the pond, between 1999 and 2003. Darling Brook empties into Berlin Pond near the intake siphon for the City's water system. These land acquisitions became additions to the Berlin Town forest and Boyer State Forest.

In 1998, the City furthered its commitment to Berlin Pond as its primary water supply by constructing the $11.5 water treatment plant on Berlin Street. A more detailed summary of activities related to acquiring land and protecting Berlin Pond is provided in Table 2.

Table 2: History of Berlin Pond

Date	Action taken
1870	Montpelier village charter amended to authorize water withdrawal, and piping of that water, to Montpelier village.
1884	Montpelier begins using pond for water supply; City makes first land purchases around pond; purchases along pond will continue through 1928, with more purchases of distribution lands continuing for another 20 years.
1894	State Board of Health makes recommendations to Montpelier regarding ways to protect the water supply, which it considers to be "constantly in danger of pollution".
1903	State Board of Health creates zoning-style regulations to protect water quality, including prohibition on swimming.
1925	State Board of Health expands regulations to prohibit boating and fishing on the pond and tributaries within ½ mile of pond.
1997	Berlin Pond Natural Area report (Montpelier and Berlin Conservation Commissions).
1998-2000	Construction of Montpelier's $11.5 million water treatment plant.
1999	Interest in preserving more land in the watershed (aimed at recreation, wildlife habitat and scenic preservation) by the Town of Berlin and various private groups begins to grow. Addition of 131 acre parcel to Boyer State Forest (purchase by Vermont River Conservancy from Paul Malone and Laura Anderson) – conserved recreation opportunities; vernal pools; wetlands and headwaters of Darling Brook, which flows into the pond.
2000	405 acre addition to Berlin Town Forest (purchase by Vermont River Conservancy from Paul Malone and Laura Anderson) – conserved recreation opportunities; headwaters of various small brooks.
2001	Source Protection Plan for Berlin Pond written.
2002	120 acre addition to Berlin Town Forest (purchase by Vermont Land Trust from Marcus Lawson) – conserved recreational opportunities; reduced chances for future development on mountain; conserved 3,600 feet of both sides of Darling Brook, which enters into pond near water intake pipe.
2002	Water Conservation Study and Plan, undertaken in response to conditions imposed by the Town of Berlin to minimize potential negative impacts on Berlin Pond and its environs from excessive water withdrawals.
2003-2004	United States Geological Survey updates bedrock geological mapping of the Berlin Pond quadrangle.
2004	Heindel and Noyes Water Supply Evaluation of Portions of Berlin Pond Watershed, to evaluate the potential for groundwater sources in the watershed by collecting existing private well yields and water chemistry data.

Berlin Pond Water Supply Infrastructure

Berlin Pond occupies a unique location in relation to the City that relies on its water for its potable water supply. The 286-acre pond, with a reported volume of 1.5 billion gallons, is not only in another town (Berlin), but the pond is over 400 feet in elevation higher than most the public water system's service area, and 76 feet higher than the water treatment plant (Figure 3). This hydraulic head means that untreated water flows by gravity from the pond to the plant, not only saving pumping costs but resulting is less turbidity than would be expected if the water had to be pumped to the plant. In fact, except during short periods during the spring and fall when the pond "turns over" (the seasonal cycling of the pond's water), water from the pond is below the maximum contaminant levels for turbidity (i.e. the cloudiness of the water) set by the State of Vermont even before it goes through the treatment process.

The treatment plant is an important part of the Montpelier water system infrastructure. Before the City's drinking water is pumped to two storage tanks off Town Hill Road and Terrace Street and distributed through over 45 miles of water main, it is treated for bacteria, viruses, parasites, color, taste, odor, turbidity, organic matter, iron and manganese. The one million gallon storage tank adjacent to the treatment facility is used to provide sufficient contact time for the chlorine that is used for disinfection prior to distribution. Since beginning operation in 2000, the treatment plant has provided the City with high quality drinking water that meets or exceeds the minimum standards for drinking water quality in the State. The filtration system also removes many of the contaminants that were formerly controlled by heavy doses of chlorine. The lower concentration of chlorine currently required for disinfection results in great improvement in the taste and odor of the City's water.

Berlin Pond Service Area

The Montpelier water system provides drinking water over 2,300 residents and 250 businesses in Montpelier and portions of the Town of Berlin along the Barre-Montpelier Road (see Figure 3). The Central Vermont Medical Center has been served by Montpelier's water system ever since its own well field in Berlin was discovered to be contaminated with MBTE, a gasoline additive. The water system's total average demand is approximately 1.3 million gallons per day.

There may be additional demands on the City's system if service to the Town of Berlin expands. A recently completed water supply study for the Town of Berlin (Dufresne & Associates, 2003) estimated that the potential service area for such a system (based on a survey of interested potential water users in Berlin) would require over 293,000 gallons per day. After reviewing potential water sources for a potential Town water system, the study recommended that the most economical alternative for Berlin would be to purchase water from Montpelier, indicating the potential for Berlin Pond to eventually provide a significant proportion of Berlin's residents and businesses with water.

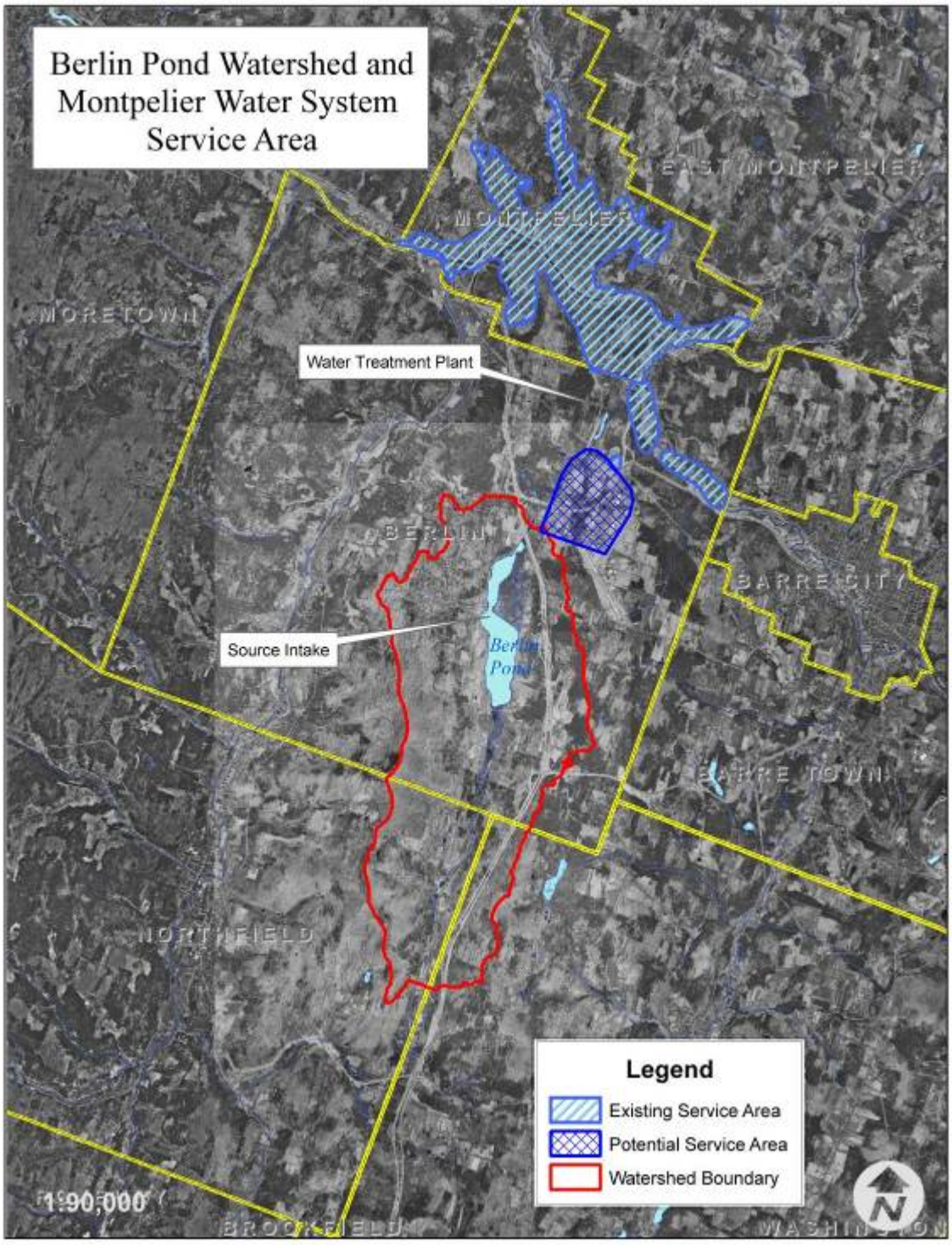

Figure 3- Berlin Pond Watershed and Montpelier Water System Service Area.

Water Quality Threats to Berlin Pond:

The high quality of Montpelier's water supply is largely due to the undeveloped nature of the the Berlin Pond watershed which currently has very few documented sources of contamination (see Figure 4). However, The Berlin Pond Source Protection plan identifies the following significant *potential* sources of contamination in the watershed:

- Contamination from leaking fuel storage tanks
- Chemical spills from vehicles traversing through the Source Protection Area
- Runoff from roads and agricultural lands
- Complex organics or domestic wastes not treated by on-site wastewater systems
- Unregulated use of herbicides, pesticides & fertilizers

The Source Protection Plan identified 297 potential sources of contamination that already exist in the watershed, including 87 septic tanks with leach fields, 56 fuel oil tanks, and documented use of fertilizers, pesticides, and herbicides (Dufresne & Associates, 2001).

Impact of Further Development on Berlin Pond:

Development pressure is increasing across Central Vermont, and the lands in the Berlin Pond watershed are no exception. Recently, subdivisions have been approved in the watershed and new roads have been constructed. As recently as 1999, there was a proposal to develop a large subdivision on Irish Hill, the prominent ridge to the west of the pond.

The soil, underground flows and surface waters, including feeder streams and springs, must be thought of as inseparable parts of the water supply when assessing specific threats to Berlin Pond. Contamination appearing in one part of the watershed will eventually find its way to the Pond.

Potential pollution sources associated with increased development in the watershed include:

- Sediment – sanding roads, construction, poor logging practices, gravel roads, and stream channel erosion
- Petroleum products – heating fuel leaks, gasoline spills, fuel delivery spills
- Salt – winter road maintenance and salt storage
- Bacteria – failing septic systems, agricultural runoff
- Toxic chemical runoff and spills – all chemicals associated with residential future resident and commercial land uses, lawn maintenance, traveled pavement
- Nutrients- all fertilizers from urban and suburban land use will wash into the pond and stimulate the growth of algae that eventually lead to taste and odor issues and increased treatment cost.

In surface waters, increased turbidity resulting from sediment flowing off gravel roads, driveways and agricultural land, especially during large storm events, increases the cost of

water treatment. Increasing urbanization of the watershed, which increases impervious surfaces (more rooftops and driveways) and typically converts forestland to lawns, alters the hydrology of the watershed by preventing water from soaking into the ground. The results are increased storm water flows during large rain events and lower stream flows during periods of drought.

The Waits River bedrock formation, which underlies the Berlin Pond watershed and consists of porous, water-bearing limestone, can be easily contaminated. Although it is fortunate that there has been little documented contamination of the aquifer within the watershed, immediately outside the watershed, drilled bedrock wells are contaminated at the airport (solvents), the Berlin Town Offices area (salt) and the hospital (gasoline additives), rendering these wells no longer suitable as potable water supplies.

Berlin Pond is one of the few remaining surface water supplies in the area suitable for potable water. Rivers in the surrounding area that were once used as public water supplies have been rendered unsuitable for this purpose, in part due to the many hazardous sites associated with historic settlement patterns in Vermont that located communities along water bodies (see Figure 4).

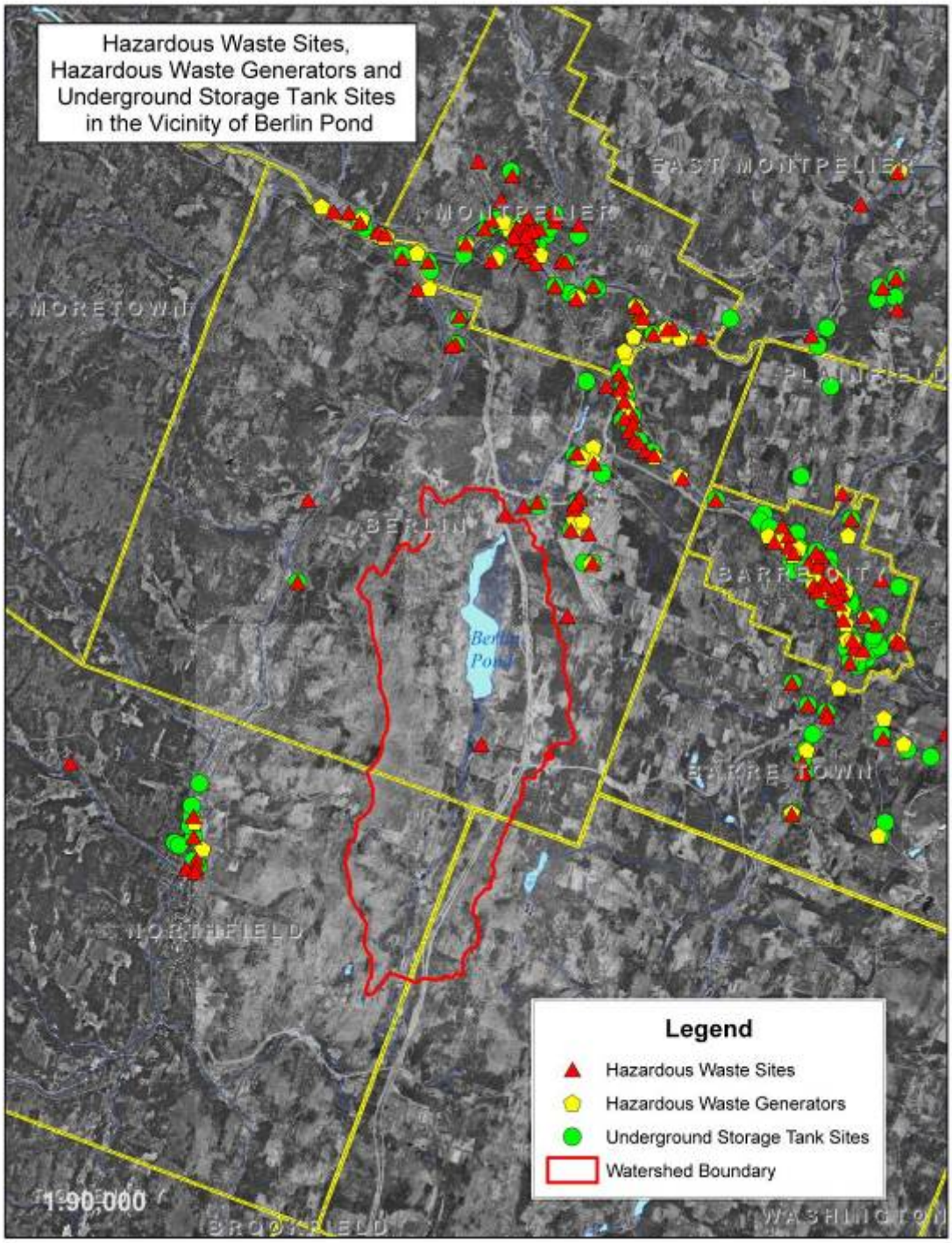

Figure 4: Hazardous Sites in the Vicinity of Berlin Pond
(Source: Vermont Center for Geographic Information)

Other Potential Municipal Water Supplies

Berlin Pond is currently the only source of drinking water for Montpelier residents other than those supplied by privately owned wells. Although the City of Montpelier has not formally conducted an engineering study to identify alternative water supplies for the City, the City was required, as part of the Source Protection Plan for Berlin Pond, to identify *emergency* water sources for the City. The Plan considered three alternative surface water sources: The Dog River, The Stevens Branch, and the Winooski River. The Dog River was eliminated as a source because of its distance (over 17,000 feet west of Berlin Pond). The Stevens Branch, although closer to Berlin Pond (8,000 feet), was eliminated from consideration because of low flows during the summer months and its use for discharge by the City of Barre Wastewater Treatment Facility. The Winooski River was chosen as the emergency water source, even though it also may suffer from low flows in the summer months and is downstream from the Barre Wastewater Treatment Facility. Transporting water from the Winooski would require pumping water overland a distance more than 9,000 feet and over 360 feet uphill to the water treatment plant. (Dufresne & Associates, 2001)

Several other studies have been conducted to consider possible drinking water sources in Central Vermont. The Town of Berlin commissioned a study to determine the feasibility of developing a public water system, which included an evaluation of alternatives for sources of supply (Dufresne & Associates, 2003). Their study also considered the surface water sources mentioned above, but all were eliminated because they "appeared to be non-economical alternatives with low probability for receiving State approval." The Berlin study also considered groundwater sources, but finally decided that the most feasible alternative would be to hook up to an existing public water supply system (either Barre or Montpelier).

Hydrogeological studies conducted during the 1970s identified potential high yield gravel aquifers adjacent to the Winooski and the Dog Rivers that have sufficient volume for municipal water supply. Pumping of a test well near Legare's in East Montpelier indicated a potential sustained yield of 1 million gallons per day. The Town of Northfield has 2 high capacity gravel wells that provide 400 and 600 gallons/minute or 1.2 MGD. Another well that serves a mobile home park in Berlin yields 500 gallon per minute (Hodges, Butterfield and Ashley, 1976). However, developing similar options as municipal water supply sources presents numerous challenges, including land acquisition, source protection, infrastructure development, and increased risk from known hazardous waste sites.

The City of Montpelier recently hired a consultant to evaluate bedrock groundwater resources in the Berlin Pond watershed by analyzing yields and water chemistry in existing wells (Heindel & Noyes, 2004). The study concluded that some wells in the study area have high to moderate yields as domestic water supply wells, and that the type of bedrock is potentially conducive to locating higher yielding community water sources. The advantage of developing a well field near Berlin Pond as a supplemental water source is the relatively undeveloped nature of its watershed and the ability to easily provide for well head protection. The study recommended additional work, including fracture trace analysis of aerial photographs and field geophysical surveys, to fine tune the evaluation of possible locations for high-yielding groundwater sources.

Options for Watershed Protection

Due to the importance of surface waters as drinking water sources for a large majority of Vermont residents, the State of Vermont places a high priority on source protection. Rodney Pingree, Chief of the Water Resources Section, and Acting Director of the Water Supply Division of the Vermont Agency of Natural Resources, has indicated that surface waters will always play a large role in providing a water supply to Vermont citizens, and that for the foreseeable future, Berlin Pond will continue to be a water supply for Montpelier (Pingree, 2005). Mr. Pingree strongly encourages all efforts aimed at source protection, especially land conservation, in the Berlin Pond watershed.

Municipalities generally have three options for surface water source water protection: regulating activities in the watershed, acquiring land, and purchasing development rights (or conveying "conservation easements") on privately owned land. The City of Montpelier has exercised its regulatory authority, and has a long history of land acquisition. The City also has experience with conservation easements (North Branch River Park), but it has not yet used this option for water supply source protection. A more detailed discussion of these options is presented below.

Regulate Activities in the Watershed

In the early 1900's, the State Board of Health created zoning-style regulations to protect the water quality of Berlin Pond, including prohibitions on swimming, boating, and fishing in the pond that still exist. The City has also exercised its authority to regulate activities in the watershed, including privately owned land, as described in the Source Protection Plan (Dufresne & Associates, 2001).

Relying solely on regulations for water supply protection, however, has limitations:

- When applied to private land by one community to landowners in another, regulations have a history of being very unpopular.
- Regulations are subject to change by political bodies, and therefore do not provide permanent protection.
- Finally, on a practical level, regulations of individual landowner activity, from the choice of fertilizers and pesticides to use of salt and sand on steep roads, are difficult to enforce. In addition, enforcement of water quality standards are only possible after an incident has occurred.

Land Purchase

Purchasing land in the watershed from willing sellers, otherwise known as purchasing the "fee interest," provides the most straightforward method for the City to control activities in the Berlin Pond watershed. Many other municipalities in Vermont have been undertaken land acquisition programs in their water supply areas for decades (see Table 3).

Table 3. Surface Water Source Protection through Land Acquisition				
City or Town	**Water Supply**	**Size of watershed (acres)**	**Land publicly owned (acres)**	**% of watershed land publicly owned**
Barre City	Dix Reservoir	11,000	1,200	11
Bennington	Bolles Brook	7721	7653	99
Brattleboro	Sunset Lake	2277	413	18
	Pleasant Valley Reservoir	632	358	57
Montpelier	**Berlin Pond**	**6661**	**1367**	**21**
Rutland	Rutland City Reservoir (Mendon Brook)	12,800	8000	63
St Albans	St. Albans Reservoir	1,347	110	8
St. Johnsbury	Stiles Pond	3905	995	25

In the case of the Berlin Pond watershed, most of the land remains privately owned. Publicly owned land accounts for 1,367 acres of the 6,661 acre watershed, and 346 of those acres are also permanently conserved. A summary of land ownership in the watershed is presented in Table 4 and Figure 4.

Table 4. Land Ownership in the Berlin Pond Watershed		
Landowner	**Acres**	**% of Watershed**
Private Ownership	**5294**	**79**
City of Montpelier	**820**	**12**
Town of Berlin[1]	**491**	**7**
State of Vermont[2] (Boyer State Forest)	**56**	**1**

Notes:
1. The Vermont Land Trust holds a conservation easement on 290 acres of the Berlin Town forest land.
2. The Vermont Housing and Conservation Board holds a conservation easement on the Boyer Sate forest land.

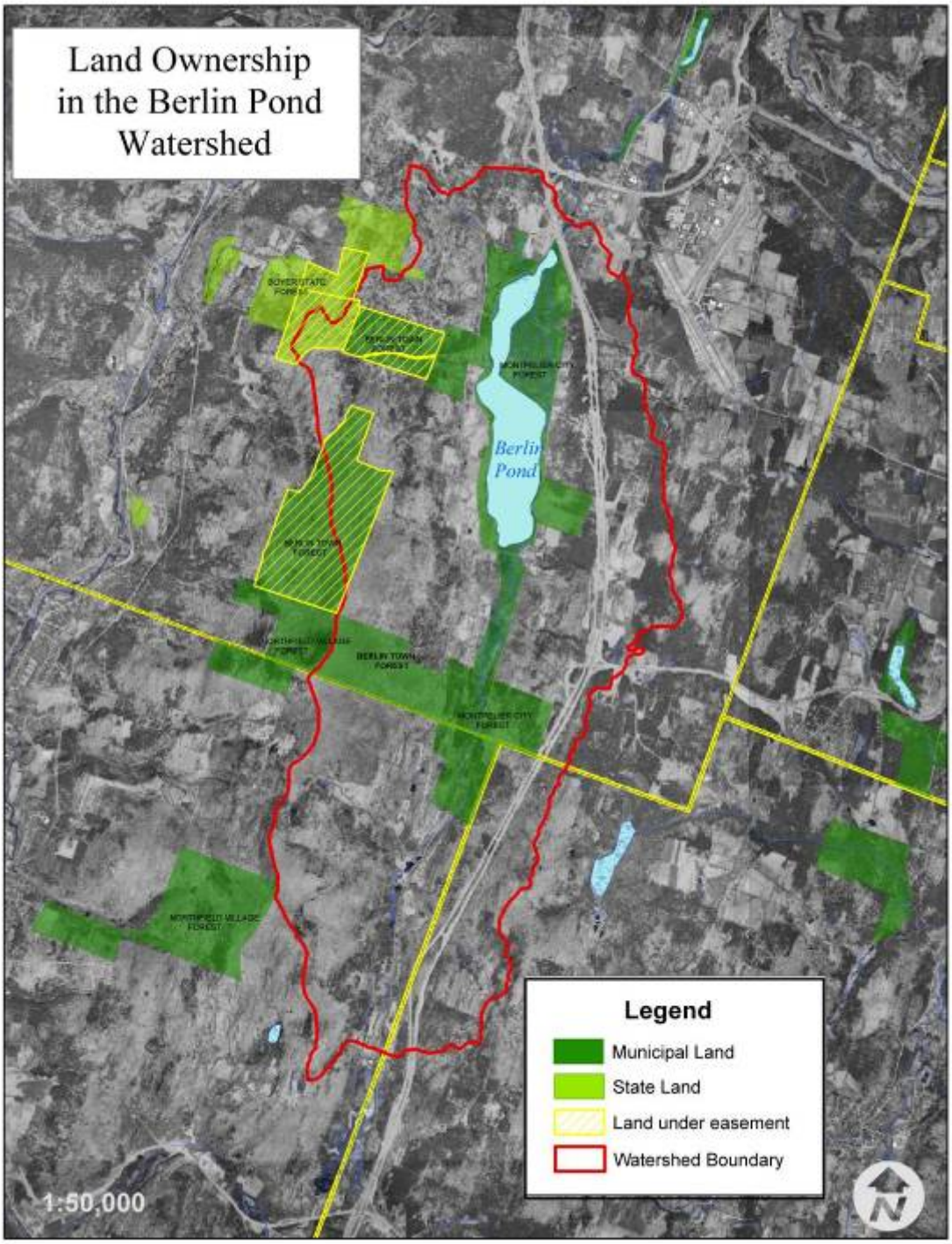

Figure 4: Land Ownership Patterns in the Berlin Pond Watershed

Conservation Easements

A conservation easement is a land deed that transfers some ownership interests from a property owner to another party, typically a land trust. The easement places a set of restrictions on how the property can be used in the future. Also referred to generically as "development rights", a conservation easement prohibits or carefully limits future development while allowing for farming, forestry, recreation, educational and other compatible uses to continue. Land protected by a conservation easement remains in private ownership and can be purchased and sold just like other lands. *However, the easement remains on the property binding all future owners.* Land trusts typically visit each conserved property annually to confirm that the owner is abiding by the terms of the easement, and defends, in court if necessary, their legal interest in the property.

For example, 346 acres of the land in the Berlin Pond watershed that has been acquired and transferred to public ownership since 1999 is also covered by a perpetual conservation easement held by the Vermont Land Trust and/or the Vermont Housing and Conservation Board. Another example is the Town of Brattleboro, where 96 acres of the land purchased for water supply protection is under easement.

Purchase of conservation easements from willing sellers is also an economical method of acquiring control of watershed land. The value of a conservation easement is typically considerably less than the full market value of the property. The landowner may exclude portions of the property from the easement (for example, the area around an existing house) so the value of the easement is reflects the value of the land that is permanently protected. Though the development rights are separated from the property and typically held by a land trust, the land remains in private ownership and stays on the tax roles.

The Berlin Pond Watershed Conservation Project

The Montpelier and Berlin Conservation Commissions has been working for years to build support for land conservation in the Berlin Pond watershed. Both the Montpelier City Council and the Town of Berlin Select Board have signed declarations of cooperation in support of conservation in the Berlin Pond watershed. The Montpelier Conservation Commission's current proposal builds on a long history of cooperation with neighbors and non-profits to accomplish mutual conservation goals.

The Montpelier Conservation Commission believes permanently conserving the City-owned land around Berlin Pond will leverage financial resources to conserve additional land in the watershed. Other conservation organizations are interested in seeing the city-owned land permanently protected, not only for preserving a valuable source of drinking water, but for the unique ecological attributes associated with Berlin Pond, its shoreline and associated wetlands. Vermont Audubon has designated Berlin Pond an "important birding area", one of 17 such areas in the State. Public land in the watershed is enjoyed by many area residents for its recreation trails. As a recent example of collaboration with other conservation organizations, the Montpelier and Berlin Conservation Commissions, The Vermont Land

Trust, the Vermont River Conservancy, and the Friends of Irish Hill, successfully prevented a proposed development on Irish Hill (much of it in the Berlin Pond watershed). This effort succeeded in protecting Darling Brook, one of the pond's primary feeder streams, whose outlet falls near the public water supply intake siphon, as well as land for recreation and wildlife purposes.

The Berlin Pond Watershed Conservation Project will identify lands for protection based on their value to protect the water supply, and for ecological and recreation potential. To identify ecologically significant land in the watershed, including City lands, the Berlin and Montpelier Conservation Commissions, with additional financial support from the Vermont Land Trust, the Housing and Conservation Board, and the Vermont Community Foundation, hired ecologists Brett Engstrom and Marc Lapin to map "natural communities" in the watershed. Natural communities are defined as "an assemblage of plants and animals that are found recurring across a specific landscape under similar environmental conditions where natural processes, rather than human disturbances, prevail." Identification of natural communities provides one method for measuring the biodiversity of an area and can be used to prioritize land for conservation. Their field work was conducted in the fall of 2004 with a final report expected in 2005.

Permanently Conserving Municipal Land

The Conservation Commission has asked the City's legal counsel about the City's authority to enter into such an agreement to convey a conservation easement on City-owned land to a conservation organization. Based on title research, City Attorney Steven Stitzel found that the manner by which the City of Montpelier acquired its Berlin Pond property does not preclude the City from restricting its use through a conservation easement. The properties were purchased with monies from the water fund – an enterprise fund established by the City to fund its public water supply activities (Stitzel, Page & Fletcher, 2005).

According to Attorney Stitzel, the City of Montpelier has the authority to grant restrictions, such as conservation easements, but the City should ensure that it retains all necessary rights for the management of the water supply and water supply infrastructure. He stated that the City should also ensure that it receives a significant public benefit in return for donating the value of the easement.

How does one measure the value of clean water? Consider the following:

- The Town of Berlin has attempted to find a new municipal water supply and concluded that tying into Montpelier's water system was the most feasible option.
- Berlin Pond and its watershed is now as undeveloped, if not more so, than any potential alternative.
- The cost of protecting land in the Berlin Pond watershed will increase at least as rapidly as the cost of any land outside the watershed that may someday be purchased for water supply purposes.

- The City of Montpelier has already spent millions of dollars creating a water supply infrastructure centered on the long-term use of Berlin Pond.

The quality and quantity of the water, the proximity to the City of Montpelier, the capital investment in water supply infrastructure, the elevation, the undeveloped nature of the watershed leads to the conclusion that, if protected, Berlin Pond will continue to provide clean water for generations to come.

Recommendations for Protection of Berlin Pond

The Montpelier Conservation Commission proposes the following agreement for consideration by the Montpelier City Council:

- The City of Montpelier agrees to partner with the Vermont Land Trust and its conservation partners with the common goal of conserving land in the watershed.
- The goal of the conservation partners is to conserve an amount of land, to be determined in consultation with the City, to further protect the water supply and the watershed's ecological resources.
- The City of Montpelier agrees to convey a conservation easement to the Vermont Land Trust on City-owned land in the watershed when the goal above is met.
- The Montpelier City Council, in cooperation with the conservation partners, will establish a steering committee, called the Berlin Pond Steering Committee, to manage this effort.
- The agreement will be in effect for 10 years, or until the conservation goal is met.

Appendix A: Water Use in Vermont

County	Population (thousands)	Public Supply Population Served (thousands)	Public Supply Ground Water (MGD)	Public Supply Surface Water (MGD)	Public Supply Total (MGD)	Domestic Population (thousands)	Domestic Ground Water (MGD)	Domestic Surface Water (MGD)	Domestic Total Withdrawals (MGD)
Addison	35.97	17.42	1.57	0.91	2.48	18.55	1.57	0.01	1.58
Bennington	36.99	24.76	1.61	2.27	3.88	12.23	1.04	0.00	1.04
Caledonia	29.70	13.08	1.22	0.56	1.78	16.62	1.41	0.00	1.41
Chittenden	146.57	120.54	1.22	22.72	23.94	26.03	2.15	0.06	2.21
Essex	6.46	3.42	0.38	0.07	0.45	3.04	0.26	0.00	0.26
Franklin	45.42	20.20	0.88	2.08	2.96	25.22	2.04	0.10	2.14
Grand Isle	6.90	3.86	0.00	0.43	0.43	3.04	0.18	0.08	0.26
Lamoille	23.23	7.42	0.89	0.14	1.03	15.81	1.34	0.00	1.34
Orange	28.23	9.64	0.77	0.41	1.18	18.59	1.58	0.00	1.58
Orleans	26.28	14.48	1.48	0.44	1.92	11.80	1.00	0.00	1.00
Rutland	63.40	40.50	2.46	3.67	6.13	22.90	1.95	0.00	1.95
Washington	58.04	34.54	2.14	4.00	6.14	23.50	2.00	0.00	2.00
Windham	44.22	19.37	1.23	1.99	3.22	24.85	2.11	0.00	2.11
Windsor	57.42	32.58	3.61	0.96	4.57	24.84	2.11	0.00	2.11
Totals	608.83	361.81	19.46	40.65	60.11	247.02	20.74	0.25	20.99

Public Water Supply- **59.4 %**

Surface Water Sources- **68%**
Ground Water Sources- **32%**

Domestic (Private) Supply- **40.6 %**

Surface Water Sources- **1.2 %**
Ground Water Source- **98.8 %**

Source: USGS, Estimated Use of Water in the United States for 2000 (http://water.usgs.gov/watuse/)

Appendix B: References

Dubois and King, 1994, *Water Supply Study for Berlin Corners, Town of Berlin, Vermont.*

Dufresne & Associates, 2001, *Source Protection Plan, Berlin Pond, City of Montpelier WSID # 5272.*

Dufresne & Associates, 2002, *Water Conservation Study and Plan.*

Dufresne & Associates, 2003, *Final Municipal Water Supply Study, Town of Berlin, Vermont.*

Engstrom, B. and M. Lapin, ongoing, *Natural Community Mapping in the Berlin Pond Watershed* (to be completed Spring 2005).

Heindel and Noyes, 2004, *Water Supply Evaluation; Portions of Berlin Pond Watershed, Berlin, Vermont.*

Hodges, A.L. Jr. and D. Butterfield, 1972, *Ground-Water Availability in the Barre-Montpelier Area.*

Hodges, A.L. Jr., D. Butterfield and J.W. Ashley, 1976, *Ground Water Resources of the Barre-Montpelier Area.*

Howard, J.K., 2001, *Berlin Pond Amphibian and Reptile Inventory.*

Meyers, J., 1997, *Berlin Pond Natural Area; Geography, Human History, Natural Resources.*

Pingree, Rodney I., 2005, *Letter to Committee to Conserve Lands in the Berlin Pond Watershed*, dated March 22, 2005.

Stone Environmental, ongoing, *Berlin Pond Hydrologic Analysis,* a study to evaluate the impact of varying water withdrawal rates on water levels in Berlin Pond under different climatic conditions.

Stitzel, Page & Fletcher, 2005, *Letter to City Manager William Fraser*, dated March 17, 2005.

Vermont Department of Environmental Conservation, 2003, *Report of the Status of Groundwater and Aquifer Mapping in the State of Vermont.*

United States Geological Survey, 2000, *Water Use In Vermont* (http://water.usgs.gov/ watuse)