



The Nelson A. Rockefeller Center at Dartmouth College

The Center for Public Policy and the Social Sciences

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### THE VALUE OF LAKE CHAMPLAIN

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#### *An Economic and Environmental Analysis*

Presented to the Vermont House Committee on Fish, Wildlife and  
Water Resources

PRS Policy Brief 1516-01

February 14, 2016

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*This report was written by undergraduate students at Dartmouth College under the direction of professors in the Rockefeller Center. Policy Research Shop (PRS) students produce non-partisan policy analyses and present their findings in a non-advocacy manner. The PRS is fully endowed by the Dartmouth Class of 1964 through a class gift in celebration of its 50<sup>th</sup> Anniversary given to the Center. This endowment ensures that the Policy Research Shop will continue to produce high-quality, non-partisan policy research for policymakers in New Hampshire and Vermont. The PRS was previously funded by major grants from the U.S. Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE) and from the Ford Foundation and by initial seed grants from the Surdna Foundation and the Lintilhac Foundation. Since its inception in 2005, PRS students have invested more than 50,000 hours to produce more than 130 policy briefs for policymakers in New Hampshire and Vermont.*



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## **EXECUTIVE SUMMARY**

As Lake Champlain, the sixth largest freshwater lake in North America, continues to suffer from excessive phosphorous pollution and expansive algae growth, the State of Vermont faces a costly mandate from the Environmental Protection Agency to curtail the pollution. The cleanup will require a budgetary expenditure of \$156 million per year for ten years, and although the Lake is a popular natural attraction for Vermonters and tourists to visit, it is difficult to conceptualize Lake Champlain's actual worth to the state and the areas that surround it in the Lake Champlain Basin. When there is such a large bill to pay, Vermonters are asking what the benefits are to improving the water quality of Lake Champlain, and if it will improve their lives in the Green Mountain State.

This report determines, primarily through quantitative analysis, an estimation of the value of Lake Champlain. By identifying sectors of the economy and environment that are affected by the Lake, such as property values and the fishing industry, and then assigning those sectors concrete dollar values, this report attaches an approximation dollar value to represent Lake Champlain's worth to the State of Vermont. In addition, this report assigns an approximate dollar value to the potential economic losses that could result if the phosphorous pollution is not addressed. These values are put in the appropriate context throughout the report, and are connected with the Lake's water quality, the City of Burlington, and the State of Vermont as a whole. Several interviews with Vermont residents and business managers help illustrate these connections, as well as the role that the Lake plays in Vermont society. With all of the economic values considered and placed in the appropriate societal context, this report finds that Lake Champlain is currently worth a minimum of roughly \$580 million annually, which could increase to at least \$763 million with a clean-up. The potential losses due to pollution in Lake Champlain, assuming a one-meter water clarity decrease, could total at least \$177 million. This includes an annual loss of \$18 million, as well as a \$159 million decrease in seasonal property value.

## **1. INTRODUCTION**

Lake Champlain is a source of pride for Vermonters. It attracts tens of thousands of tourists each year, for activities such as swimming, boating, and fishing. Counties that border the Lake, such as Chittenden County and Grand Isle County, are seeing the greatest population increases in the entire state.<sup>1</sup> The Lake is also a significant driver of the state's economy, one of the state's main sources of drinking water, and a top spot for recreation due to the many state parks that border the Lake's shoreline.

Currently, the Lake faces a serious phosphorous pollution threat. If left untreated, algae growth caused by phosphorous accumulation could disrupt recreational activities in the Lake, contaminate drinking water, harm ecosystems for animals and humans, and likely negatively impact the state's economy. The balance of nutrients is critical in any ecosystem, and in lake ecosystems, phosphorus is often a limiting nutrient. In other words, it is sometimes the first nutrient to be exhausted and, therefore, the main nutrient limiting a plant's growth. The opposite is also true; when a limiting nutrient is present in

large quantities, plant growth is extensive. In Lake Champlain, an abundance of phosphorous has led to a large presence of algae in many regions of the Lake. Algae blooms can produce toxins, or types of bacteria, that can be harmful for humans and animals. These blooms are most likely to develop in warm, shallow, and slow-moving water, so the most likely areas for Lake Champlain to suffer from algae-issues are along its shores and its bays.<sup>2</sup>

There are two main sources of pollution: point-source pollution and nonpoint-source pollution. Point-source pollution accounts for about five percent of the pollution of Lake Champlain, and is the pollution that can be attributed to a particular place. Examples of point source pollution include wastewater treatment plants and pipe leaks. Conversely, nonpoint-source pollution is the kind of pollution that cannot be traced, such as runoff from farms and agricultural lands as well as soil erosion and storm-water discharges. In Vermont, dairy farms are a notable source of the phosphorous that ends up in Lake Champlain. This type of pollution accounts for 95 percent of the phosphorous contamination of the Lake.<sup>3</sup> One way to mitigate this issue would be the creation of a statewide storm-water utility. This would not only address the storm-water runoff problem, but also generate revenue, which could be used for the Lake's cleanup efforts. A template for what this system would look like can be found in PRS Policy Brief 1213-01, "Assessing the Feasibility of a Vermont Statewide Stormwater Utility," which was presented to the Vermont House Committee of Fish, Wildlife, and Water Resources in 2013.<sup>4</sup>

Over the past 30 years, there has been a continuous increase of phosphorous levels in many segments of Lake Champlain, with the worst segment of the lake reaching around 60 micrograms of phosphorus per liter. This, along with the Federal Clean Water Act, has caused the Environmental Protection Agency (EPA) to step in and put regulations in place to limit the total daily phosphorus load that can be dumped into the Lake, with a price-tag of \$156 million per year for ten years to be paid by the state. These regulations take the form of Total Maximum Daily loads, or TMDLs, and have been greatly disputed by Vermonters. TMDLs are the "amounts of pollution that a body of water can receive without impairing vital uses, such as drinking water supply or support of aquatic life."<sup>5</sup> A 2008 lawsuit against the EPA demanded new TMDLs for the State of Vermont.

However, as the federal government intervenes in Vermont in order to control the water quality of Lake Champlain, the Lake's pollution is taking a toll on more than just its ecosystems and neighboring lands. Lake Champlain is intrinsically interconnected with every Vermont resident and its contamination can have significant environmental, economic, and social effects for the state.

The State of Vermont is also taking its own action to fight water pollution, inspired primarily by the growing concern over Lake Champlain. Vermont Act 64 (H.35), which was passed in 2015, is "an act relating to improving the quality of State waters."<sup>6</sup> This act, which is an unfunded mandate, reflects an "all in" approach to the pollution, establishing new standards for roads, agriculture, forestry, and developed land in Vermont. This legislation applies to every city and town in the state, regardless of each

one's proximity to Lake Champlain. Bringing critical erosion areas along road drainage systems up to basic maintenance standards is a key feature of this legislation. It is the hope that Act 64 will help reduce sediment and nutrient pollution, improve resilience to storm damages, and lower long-term maintenance costs in the state.<sup>7</sup>

Property around Lake Champlain, which is traditionally valued much higher than inland property, is decreasing in areas that are suffering from the most severe algae infestations. A decrease in property values would cause a decrease in property tax revenues, which are responsible for about 67 percent of education funding in Vermont.<sup>8</sup> The recreation and tourism industries in Vermont are susceptible to a similar decrease in value, also due to a decrease in the Lake's water quality. In addition, many Vermonters depend on Lake Champlain for drinking water, and while public water systems have created a very refined purification process, non-public sources remain at risk of contamination. If the phosphorous loading in Lake Champlain is not reduced, the ensuing algae boom may have tremendous implications for the Vermont economy and the daily lives of Vermonters.

## **2. PURPOSE STATEMENT**

Upon the request of the Vermont Senate Committee on Health and Welfare, this paper seeks to assign a concrete value to Lake Champlain. Because the final goal for the paper is to produce an aggregate value, the research for this report is largely quantitative as opposed to qualitative, although there is a qualitative analysis portion of the report which details how Vermont residents view the Lake and how geography affects their perceptions. The primary methodology for research separates different sectors of the economy, as well as the environmental factors that influence Vermont's economy, and then attaches a value to each sub-group. These sub-groups include property values, tourism and recreation, and drinking water, among others. The final goal of this report is to take a value from each sub-group, add them together, and have an estimate for the value of Lake Champlain based on a solid foundation of monetary values.

To provide a comprehensive context for these values, this report will also describe the current state of the Lake Champlain Basin's economy, environmental and pollution trends, and how these factors interact. This report will illustrate a clear connection between the water quality in Lake Champlain and higher economic yields for the Lake Champlain Basin, along with the entire state of Vermont. The qualitative section of this report will then illustrate how the water quality of the Lake interacts with Vermont society. This information will be drawn from interviews with managers of businesses that border Lake Champlain, and will then be analyzed to determine how a Lake clean-up could benefit the State of Vermont.

Because encompassing the value of the Lake is such a broad question, there are some routes of research which were initially considered that this report will ultimately not pursue. At first, the prospect of writing about a "historical value" to the Lake was considered. This would involve attempts to assign a value to events such as the Battle of Lake Champlain in 1812, which may only be possible by observing the revenue

generated by historical societies and cultural associations. Unfortunately, because of the non-profit nature of the majority of these organizations, little economic data is available to the public. Even if this data was readily available, the number that would be assigned to it would be markedly small compared to other economic and environmental values that have already been collected. Investigations into the value of Lake Champlain culture, such as the culture created by the students at the University of Vermont in Burlington, were omitted for similar reasons.

### **3. QUANTITATIVE ANALYSIS**

#### *3.1 Value of the Property Surrounding Lake Champlain*

##### *3.1.1 An Overview of the Vermont Property Tax System*

Up until 1996, public education in Vermont was primarily funded by local sources, driven by local property taxes. The state would step in only when financial assistance was required in low-income communities. In 1996, however, the Vermont Supreme Court declared that the current state assistance plan was unconstitutional (*Brigham vs. State of Vermont*).<sup>9</sup> Following this ruling, the Vermont General Assembly granted the state sole responsibility for financing education, and instituted a new state property tax system.

Consequently, the State of Vermont now has two property taxes in place that account for a large portion of state revenue. These are the statewide education tax and the statewide real estate transfer tax. The money collected from each tax travels to the state capital, where it is divided to pay for public schools and various other functions of the state. When the property base for these taxes is lowered, the decrease in value affects the state as a whole. Either the state has to accept a decreased amount of revenue or it has to raise tax rates to match previous amounts of revenue. Therefore, if property values decrease around Lake Champlain, Vermonters will either face less revenue for the state, or potentially even a rise in tax rates to compensate. Because of the state's redistribution policy for property tax revenue, even if a Vermont resident does not live in an area close to Lake Champlain, a decrease in property value around the Lake may cause an increase in their property tax rate.

##### *3.1.2 Comparing Property Values of Border-Towns to their County Totals*

One point of interest for this report was to determine if bordering Lake Champlain significantly benefits municipalities economically. For this purpose, we sought to determine whether or not the towns that border Lake Champlain carry a disproportional amount of the property value within their counties. The equalized municipal property value of each Vermont municipality that borders Lake Champlain was collected from the Vermont Department of Taxes.<sup>10</sup> Equalized values of properties are based on the Grand Lists for each municipality in the state, which are listings of the value of all real estate parcels and business property within each municipality.<sup>11</sup> There are 22 Vermont municipalities that directly border Lake Champlain. In order to observe whether or not municipalities that border Lake Champlain have higher property values than land-locked

municipalities, the equalized municipal property value of border-towns in each county was compared to the county’s total property value. The percentages are based on information from the Vermont Department of Taxes.

Because each municipality in Grand Isle County borders Lake Champlain, it was omitted from border-town/county analyses. This ratio for border-town/county property value was found for each county, and that percentage was compared to other border-town/county ratios. These ratios included categories such as population and land area in square miles, with numbers taken from the U.S. Census Bureau and Virtual Vermont. Outside of property values, the Per Capita Income of border-towns compared to those of their counties offer another unit of analysis<sup>12</sup> to see if border towns fare exceptionally well due to the Lake. However, instead of a percentage, this statistic was a difference in the Per Capita Income between the border-town average and the county value. The comparisons are illustrated below in Table 1.

**Table 1. Border-Town Contributions to Total County Property Value**

<b>County</b>	<b>County Property Value due to Border-Towns</b>	<b>County Population due to Border-Towns</b>	<b>County Land Area due to Border-Towns (sq. miles)</b>	<b>Per Capita Income Difference (Border-Town – County Total)</b>
<b>Addison</b>	28.51%	23.16 %	35.81%	\$418
<b>Chittenden</b>	48.39%	51.09%	43.02%	\$6,230
<b>Franklin</b>	49.74%	43.18%	35.92%	\$1,041
<b>Rutland</b>	2.03%	2.15%	7.97%	-\$3,249

The goal of this analysis was to find whether or not the border-town/county total property value percentage for each county was higher than each one’s percentage of county population and county land area, as well as whether or not the difference in Per Capita Income was always positive. In Table 1, percentages that are *less* than the property value percentages are colored green, for those numbers appear to indicate that border-towns are responsible for a larger percentage of county property value than expected from those variables. Conversely, percentages that are *greater* than the property value percentages are colored red, for those numbers seem to illustrate that border-towns are responsible for a smaller percentage of county property value than one might think from that percentage. Similarly, Per Capita Income statistics were colored green if the border-town average was greater than the county total, and colored red if that average was less than the county total.

As illustrated by the mix of colors in Table 1, it appears that no pattern emerges to support a statement about property values being worth more or less than expected from statistics in other categories. Thus, it is not conclusive if bordering Lake Champlain affects municipal property values in any significant way.

### 3.1.3 Greater Value in Lakefront Property than Inland Property

On a more concentrated scale than municipalities that border Lake Champlain, actual property on the Lake seems to be clearly more valuable than inland property. Lakefront property is some of the most desirable real-estate in Vermont. Due to the inherent beauty of lake views and the sound of flowing water, property is simply worth more to people on lakes rather than inland.

Lake Champlain, because of its oblong shape, has a very large amount of lakefront property and waterfront footage. By analyzing retail values of property around Lake Champlain, there is a clear difference between lakefront property and inland property. For example, in 2010, a 5,300 square foot house *on Lake Champlain* was priced at \$2,499,000; while conversely, a 5,300 square foot *inland* house was on the market for \$1,095,000.<sup>13</sup> A more recent study which was published in 2015 states that “single family and seasonal residences within 100 meters of Lake Champlain are expected to sell nearly 30 percent and 49 percent more than similar residences that are located outside this area.”<sup>14</sup> The Lake almost certainly plays a significant role for there to be such a dramatic difference in price.

### 3.2 Environmental Effects on Property Values

University of Vermont Professors Jon D. Erickson and Brian Voigt recently published a report titled “An Assessment of the Economic Value of Clean Water in Lake Champlain.” Their conclusion states that “for both single family residential and seasonal home purchasers, higher water quality was associated with increased property selling price.”<sup>15</sup> The study also employs the use of a Secchi disk test; a tool for measuring water quality. A one-meter increase in Secchi disk depth, which means an additional meter in which the disk is still visible underwater, was equated with “nearly 3 percent and 37 percent increases in selling prices for single family residential and seasonal homes, respectively.”<sup>16</sup>

The levels of phosphorous in different areas of Lake Champlain were found to be strongly correlated with the Secchi disk measurements. As a result, the predictions for Lake Champlain TMDL and water quality impacts were used to estimate the future effects that phosphorous pollution had on property values. The phosphorous load that the Lake is predicted to have “is estimated to result in a \$4,900 and \$53,000 price decrease per average single family dwelling and seasonal residence, respectively.”<sup>17</sup> Conversely, lake clean-up and phosphorous reductions that are associated with meeting mandated TMDL targets “are estimated to result in a \$5,700 or \$61,000 price increase per average single family dwelling and seasonal residence, respectively.”<sup>18</sup> These findings are laid out in Table 2 below:

**Table 2: Potential Impacts on Properties Bordering Lake**

Impacts	Single Family Dwelling	Seasonal Residence
---------	------------------------	--------------------



<b>Future Phosphorous Impact</b>	<b>-\$4,900</b>	<b>-\$53,000</b>
<b>TMDL Clean-Up Impact</b>	<b>+\$5,700</b>	<b>+\$61,000</b>

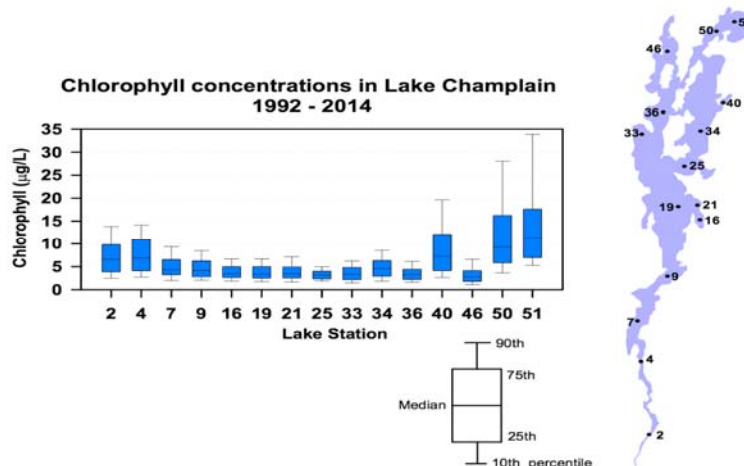
Although there is no data regarding the number of single family dwellings that border the Lake, there are “almost 3,000 seasonal properties in towns bordering Lake Champlain with \$700 million in value.”<sup>19</sup> Using the impact values above, an estimated \$159 million could be lost in seasonal residence property values to future phosphorous loads, while an estimated \$183 million could be gained if the TMDL clean-up was completed. While these numbers are only estimates based on the correlation of phosphorous levels and Secchi disk measurements, they provide an illustration of the potential benefits that would come with a clean-up of Lake Champlain.

### 3.2.1 Effects on Different Regions of Lake Champlain

It is important to note that different regions of Lake Champlain suffer from different levels of pollution. In fact, bays are usually the most affected by pollution and algae concentration. A useful measure to illustrate the effects of algae on the value of property is to compare the property values in regions of the Lake that suffer from different levels of pollution. For example, St. Alban’s Bay and Malletts Bay are similar regions, as each one houses several residential neighborhoods that border the Lake. However, St. Albans Bay has been suffering from a deteriorating environment for the past couple of decades, while Malletts Bay is situated in a relatively healthy region of the Lake. By comparing the property values in each of these regions, the goal is to find a connection between the health of the local environment and the health of the local housing market.

Below, labeled Figure 1, is a graph that illustrates the levels of Chlorophyll-A in different regions of the Lake. Point 40 and points 50 and 51 are of particular interest because they have high levels of Chlorophyll-A, which correlate directly to high levels of algae growth. Point 40 is the location of St. Albans Bay and point 25 is the location of Malletts Bay.

**Figure 1. Chlorophyll Concentrations**



Source: [http://www.vtwaterquality.org/lakes/docs/lcmonitoring/lp\\_lc-chlorophyll.pdf](http://www.vtwaterquality.org/lakes/docs/lcmonitoring/lp_lc-chlorophyll.pdf)

Groupings of property value in both St. Albans Bay and Malletts Bay are found on the next page (see Fig. 2). The property information on these images was taken from Zillow.<sup>20</sup> The search was narrowed to show properties that ranged from 1,000-1,500 square feet, as to compare similarly sized homes. These images illustrate a large contrast in property prices between the two areas. St Albans Bay (left), which has high levels of Chlorophyll-A, has average property values of \$219,000 for 1000-1,500 square foot homes listed on the website. Malletts Bay (right), which has much lower levels of Chlorophyll-A, has an average home value of \$460,000 for 1000-1,500 square foot homes listed on the website. This can be extended to several other areas around the lake. The northern region of the lake, near points 50 and 51 also exhibit lower property values and have a higher chlorophyll concentration, while the area near grand isle has markedly higher property values and better water quality.

**Figure 2. Comparison of Property Values in Different Regions**



Source: [www.zillow.com](http://www.zillow.com)

The devaluation of property values in certain areas of the Lake has become an especially relevant topic for parts of the state. This year, a town assessor in the border-town of Georgia lowered the value of 37 homes with lakeshore property. Each home's price was decreased by \$50,000.<sup>21</sup> As a result, the town's tax base was lowered by \$1,850,000. As pollution of the Lake continues, property values will continue to decline.

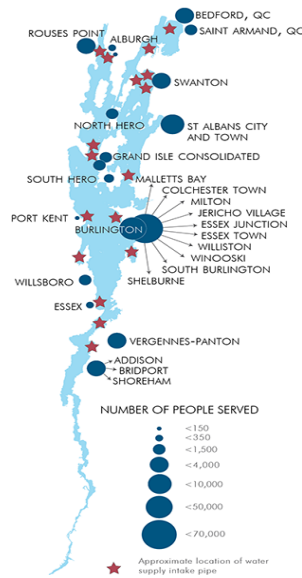
Apart from the impact on seasonal and permanent homes, it is important to consider the loss in future value of the lake. If pollution continues to increase, the state could lose millions of dollars in future real estate developments and tourism. The Lake should not be viewed as a stagnant economic resource, but one that can be grown and expanded. While the opportunity cost of forgoing a lake clean-up is unquantifiable in terms of future developments, it is an important element to consider.

### 3.3 Dependence on the Water Quality of Lake Champlain

#### 3.3.1 The Value of Lake Champlain's Drinking Water

Many Vermonters get their drinking water from Lake Champlain, and 73 water systems in the state of Vermont draw from it.<sup>22</sup> Roughly 20 million gallons are removed from Lake Champlain daily to provide 145,000 people with drinking water, which is approximately 20 percent of the Basin population.<sup>23</sup> The City of Burlington and the Champlain Water District water systems serve many cities and towns within Chittenden County, and are among the largest water suppliers in the Basin.<sup>24</sup> As shown by Fig. 3 on the next page, while many municipalities that draw from the Lake for drinking water border it, there are a number of towns, such as Williston and Essex, which do not.

**Figure 3. Sources of Lake Champlain Drinking Water**



Source: <http://www.lcbp.org/water-environment/human-health/drinking-water/>

The presence of high levels of phosphorous presents a significant risk for the supply of public water from Lake Champlain. As a comparative example, in 2012, parts of Lake Erie experienced a massive algal bloom, leaving over 500,000 people without safe drinking water, as a result of high levels of algal toxins called microcystins.<sup>25</sup>

While public water suppliers in areas affected by the algae in Lake Champlain have become increasingly skilled in treating water, there is little known about the quality of water withdrawn from the Lake by individual homeowners. Unlike the public water systems, these unregulated supplies likely undergo very little treatment. Because they draw from the same sources as public water systems that are highly contaminated before treatment, these individuals are likely exposed to similar levels of contamination. A clean Lake Champlain is an important feature for the health of Vermonters that use these drinking sources.

In an attempt to quantify the economic value of water from Lake Champlain, Vermont State Economic Research Analyst Kenneth Jones estimated that the cost of a gallon of water removed from the Lake was one penny per gallon.<sup>26</sup> This rate was multiplied by the

20 million gallons removed daily from the Lake, which includes the amount of water pumped into both New York and Vermont. Attempts to find the value specific to Vermont have been unsuccessful thus far, although Vermont does have 47 more water systems than New York,<sup>27</sup> and thus likely pumps more water from the Lake than its neighboring state. This yields a value of \$200,000 per day. When multiplied by the days in a year, Lake Champlain provides about \$75 million worth of public water annually. If the water from the Lake becomes unsafe to consume, the state is going to have to find another source to compensate for this loss, or spend additional funds to purify the lake's water.

The problem of algal blooms is not specific to Lake Champlain. Many lakes risk high levels of contamination as a result of excess phosphorous pollution. Much like Lake Champlain, Lake Erie suffers from periodic algal blooms as a result of elusive non-point sources. In 2014, the pollution in Lake Erie left over 400,000 residents of Toledo, Ohio without drinking water. The levels of microcystins had become so elevated, that it would have been dangerous to ingest the water. A similar fate may await Lake Champlain and the State of Vermont, should Lake Champlain's water quality be ignored.

### *3.4 Tourism and Recreation around Lake Champlain*

The Lake Champlain Basin's economy depends on a healthy lake to stimulate commerce and attract tourism. The Lake's abundant and diverse natural resources draw in visitors and residents alike, and the success of the regional economy depends on access to these resources. The tourism and local business that is generated by activities such as fishing are extremely important. Non-consumptive activities, such as boating and hiking around the Lake, are greatly enhanced by excellent water quality and abundant wildlife.

#### *3.4.1 Various Kinds of Tourism Drive Spending Around the Lake*

Lake Champlain is one of the top tourist destinations in Vermont, and its tourism industry has a significant economic impact on the region. According to a 2013 Tourism Benchmark study, Vermont receives \$2.5 billion in tourism spending each year. The Agency of Commerce and Community Development stated that "approximately \$300 million was spent in and around Lake Champlain."<sup>28</sup> Lake Champlain tourism also provides both skilled and unskilled employment opportunities to the State of Vermont. University of Vermont professors Jon D. Erickson and Brian Voigt found that the four lakeside counties of Vermont generate "an additional \$72.75 million in spending and nearly 1,070 jobs."<sup>29</sup>

However, if the water clarity of the Lake continues to be affected by algae-pollution, these numbers could suffer. Out-of-state visitors would likely choose a different destination to enjoy their lakeside activities, which could potentially take millions of dollars of spending away from the Vermont State economy. Erickson and Voigt developed a regression model which estimated a \$2,303 decrease per average lodging unit per meter of water clarity decline in each town during the peak-summer months of July and August. They concluded that "a one-meter decline in water quality is expected

to lead to a \$110,544 decrease in room expenditures for the month of August,”<sup>30</sup> a crucial time for tourism around the Lake. Because July is similar to August in tourist popularity, this \$110,544 decrease likely applies to both months, translating to a \$221,088 decrease during peak tourism months. The University of Vermont professors also noted that employment rates would suffer, as a “one-meter loss in water clarity would lead to the loss of 195 full-time, equivalent jobs, a \$12.6 million reduction in tourism expenditures and a total economic reduction of nearly \$16.8 million.”<sup>31</sup>

Lake Champlain’s State Parks are perhaps some of the most popular spots to visit in the state, and many tourists flock to these parks in the summer months. In 2013, Lake Champlain State Parks brought in a camping and picnic rental income of \$629,000.<sup>32</sup> However, the Lake’s worsening environmental state is likely to affect attendance at the state parks that border it, which would cause the parks to generate less income.

### 3.4.2 The Fishing Industry Has a Large Economic Impact

Fishing in Lake Champlain catalyzes millions of dollars of spending around the Lake Champlain Basin. Table 3 below delineates values in different sub-categories related to fishing in the Lake. While these numbers apply to the whole of the Basin and not solely Vermont, much of this spending occurs in Vermont, as it holds 56 percent of the Basin.<sup>33</sup>

**Table 3. Fishing Spending on Lake Champlain**

<b>Total spending by anglers on Lake Champlain</b>	\$205 million/year
<b>Spending on nondurable goods such as tackle, bait, and refreshments</b>	\$100 million/year
<b>Spending on durable goods such as fishing rods and fishing boats</b>	\$105 million/year
<b>Number of fishing and fishing-related businesses within ten miles of Lake Champlain</b>	98
<b>Percentage of fishing-based income that owners of these businesses estimated were due to anglers fishing Lake Champlain</b>	78 percent of \$7.2 million (\$5.6 million)

*Source: Lake Champlain International, Inc. “Fishing: Economic Fa\$t Fact\$,” 2010.*

With a total spending of \$205 million per year for fishing in Lake Champlain, the economic significance of a clean lake and healthy fish population cannot be ignored. Fishing is one of Vermont’s most prominent sources of tourism, and Lake Champlain is the state’s largest venue for it. There are 98 fishing-related businesses in the Lake Champlain Basin that directly depend on that tourism to function, and their success translates into economic growth for the area, and more taxes being paid to the state. If the algae boom continues, and causes damage to the health of the fishing industry, these businesses may suffer, and could become an economic burden in their communities.

## 4. QUALITATIVE ANALYSIS

Beyond the quantitative economic value of the Lake, there is a less defined qualitative value to it as well. Lake Champlain's water is greatly valued to the Vermont population. This appreciation for the Lake's water quality stretches beyond the Lake Champlain Basin. A 2014 report released by Vermont EPSCoR, The University of Vermont, and the National Science Foundation found that more than 95 percent of respondents ranked water quality as either "moderately important" or "very important."<sup>34</sup> Perhaps even more notable is that the study's results indicate that proximity to the Lake does not affect the public's willingness to pay for the clean-up. This led one of the report's authors, Christopher Koliba, to state that: "Water issues are not just a concern for those living near Lake Champlain or the Lake Champlain basin...They have salience across the state."<sup>35</sup> Vermonters seem to believe that the water quality of the Lake holds value not only to those that live in the Basin, but for the whole state of Vermont.

In order to supplement the quantitative analysis of Lake Champlain's value, the authors of this report conducted interviews with local business owners in Burlington, VT. Burlington is the largest metropolitan area in the state, and also happens to border Lake Champlain. The goal of the visit was to grasp the effects of the Lake on the local economy and population. One of the largest questions that the authors had was whether or not water quality affected businesses around the Lake. Eight interviews with local business managers and the Lake Champlain Regional Chamber of Commerce were conducted, and five main takeaways regarding the general impact of Lake Champlain on the local economy were identified:

1. Residents believe that Lake Champlain is one of the defining features of Burlington
2. Business managers are not sure of how much water quality affects their businesses, if at all.
3. Perception of the Lake's cleanliness is mixed among Vermont residents, but is slightly skewed towards a perception of uncleanness.
4. Residents are more aware of Lake Champlain pollution levels than tourists, and are likely more deterred from using the Lake than visitors.
5. Business managers in Burlington have mixed feelings about a property tax increase to help pay for the Lake clean-up.

### *4.1 Perceptions of Lake Champlain's Role to the City of Burlington and the State*

The first question that was asked in each interview was "Does your business benefit from the tourism and recreation generated by Lake Champlain?" The responses to this question were overwhelmingly positive. Of the eight managers interviewed, seven of them answered in the affirmative, with the eighth saying that, for him, the question was "really hard to answer." Most of the responses spoke of Lake Champlain's importance to Burlington's identity, and pointed to the large role that the Lake plays in the Greater Burlington community and its visitors. The manager at the local Patagonia outlet spoke

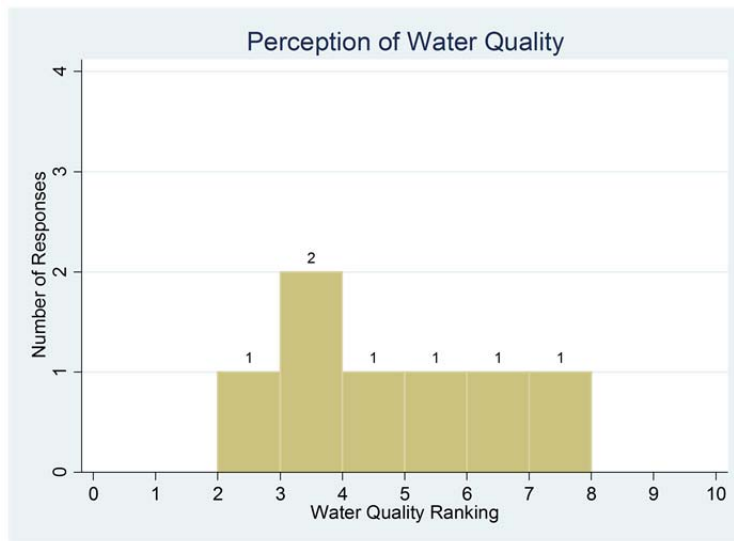
on the Lake: “It’s naturalistic beauty, for sure. With that said, if Lake Champlain were out of the picture, I think that this town...certainly the dynamic, would change a lot. I think the water lures a lot of people here.”

This perception seems to be magnified in the summer. When asked when the busiest time for businesses in Burlington were, everyone that was interviewed responded that the busiest season was summer. A manager of Sweet Waters Restaurant, which is located in Burlington’s Church Street Marketplace, summed it up when she stated: “summer is absolutely the busiest time...Church Street depends on the Lake for business.” When asked if she believes that the average customer that comes in for lunch is doing something related to the Lake, she estimated that “about half” of her customers were doing Lake-related activities. From these interviews, it is clear that the presence of the Lake is a keystone feature to Burlington, as it likely is in all of the Vermont cities and towns that border the Lake.

#### 4.2 Perceptions of Lake Champlain’s Water Quality and Its Effects

There was a more diverse range of opinions regarding the perceptions of the Lake’s water quality, as opposed to just the Lake itself. Each interviewed business manager was asked, “On a scale from one to ten, one being the worst and ten being the best, how would you rate the water quality of Lake Champlain?” The results are displayed on the next page with Fig. 4.

**Figure 4: Interviewee Water Quality**



The perception of the water quality among local business owners was roughly evenly distributed in the middle of the ranking spectrum. While it seems clear that residents perceive the Lake is polluted to some extent, the degree to which residents believe it is polluted varies. Some of the business managers that were interviewed have had very poor experiences while swimming in the Lake. A manager at Fjällräven told us that he got sick this summer from swimming in it, and had to deal with “an infection in [his] throat from

being underwater.” His co-worker added that “our vision of what’s floating around in there is not always the best,” and that her “other outer-towner friends perceive it as a little bacteria filled.” However, there are also those who do not see much of a problem with the Lake’s water quality. Vice President of Operations at the Lake Champlain Regional Chamber of Commerce Lisa Quinlan ranked the water quality at “seven or eight,” and told us that she has “never really been disgusted with the Lake at any point.” While there were variations in responses regarding the degree of severity, most interviewees communicated views that the Lake was polluted and that they were hesitant to enjoy the Lake with this in mind.

When asked if they thought that the water quality of Lake Champlain affects their businesses, almost every business manager answered negatively, with the qualification that it might only if the pollution got so bad that it created a terrible smell or some other nuisance. A book-shop manager answered that she did not think that changing water quality would have much effect on most local businesses, as “a lot of the tourists that may come for the Lake aren’t necessarily using it.” Ms. Quinlan did, however, express concern that several features of life in Burlington could suffer as a result of the pollution. She pointed to fishing, and in particular the health of the fish population in Lake Champlain, as an industry that is vulnerable to a decrease in quality due to the pollution. She also noted that if the presence of algae growths became more prevalent, beaches would close, and could potentially cause swimmers and animals to become sick, deterring people from coming to Burlington. “If our beaches, if our waterfront, starts looking bad, smelling bad, and beaches become closed...that’s not good. Not good in any way,” she explained. On the whole, however, most of the managers that were interviewed did not seem to believe that the water quality had any direct effect on their businesses.

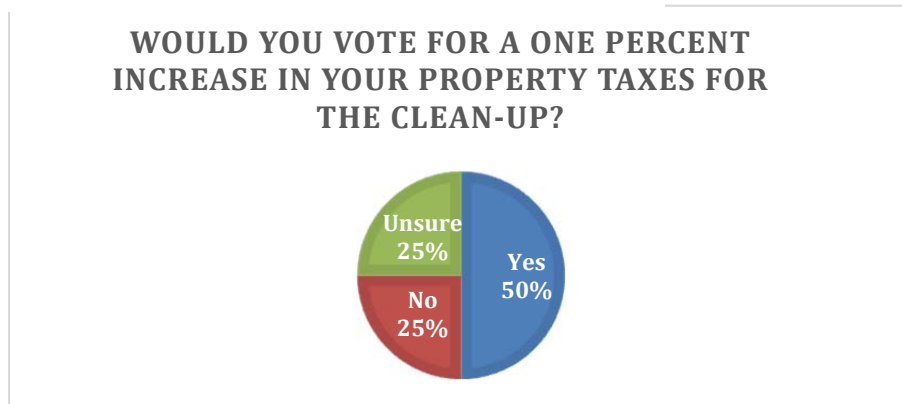
Some interviewees went on to describe the difference between local perception of the Lake and tourists’ perception of the Lake. The manager at Fjällräven described: “Most of the tourists that come up for the summer are from Jersey or Connecticut. This is way cleaner than what they have down there.” His co-worker continued: “They just see it’s pretty and they dip their feet in...I don’t think the tourists know. If [the pollution] was more visible, we’d definitely feel it.” Ms. Quinlan also described a similar outlook, saying: “I think, generally, tourists don’t think of Lake Champlain as a really polluted lake.” This disparity of views between residents and tourists may have implications for how a campaign to fund the Lake clean-up would go. If word regarding the Lake’s pollution became more widespread among tourists, they may decide to travel to cleaner lakes for their vacations. It is likely, therefore, that the best course of action to raise funds would involve specifically targeting Vermont residents, such as a direct-mail campaign.

#### *4.3 Feelings Regarding an Increase in Property Taxes to Fund the Clean-Up*

The final question in each interview was, “Would you vote for a one percent increase in your property taxes to support a clean-up of Lake Champlain?” “One percent” was used as an arbitrary benchmark value for the purposes of the question. The responses that we were given are displayed in Fig. 5 below:



**Figure 5: Responses Regarding Property Tax**



The results were generally mixed. Some found the proposition to be “very reasonable,” while others seemed more unwilling, pointing to Vermont’s already-steep tax-rates. “I think, I would love to support that, seeing as I love the Lake, but I don’t think that’s super feasible for Vermont seeing as our taxes are very high,” said a manager at Sweet Waters Restaurant. It is also worth noting that, while it is easy to consent to a hypothetical tax, there will likely be more opposition to a tax when it becomes a reality. Although Vermont State taxes are already relatively high, Ms. Quinlan believed that a tax increase would be worth it, while also qualifying that she spends much of her time on the Lake. When asked why those who do not necessarily spend much time around the Lake should care about the pollution, she responded with:

“I would say the overall economic health to the state, as well as...we want people to live here, we want students to stay here, so we want something that appeals to people. We want good jobs, we have to have quality of life, and that resonates throughout the whole state. If the largest metropolitan area in Vermont is suffering because our Lake is not up to par, everybody’s going to suffer. Everybody’s going to suffer.”

Despite this, even Ms. Quinlan noted that “there would be opposition” to such a tax. It is likely, if managers of businesses that border the Lake have mixed feelings regarding a property tax increase, that the majority of Vermont residents would be opposed to any increased tax rates.

#### *4.4 How Town Managers Outside of the Lake Champlain Basin View Lake Champlain*

Because the interviews prior to this section all took place in Burlington, a city which is closely linked to Lake Champlain, the authors of this report sought to hear the opinions of Vermont residents that are more removed from the Lake. Four town managers, from the towns of Norwich, Westminster, Bethel, and Wilmington, were interviewed about the importance of Lake Champlain and its water quality to their respective towns.

These town managers do not fail to see the importance of Lake Champlain to Vermont as a whole. When asked how he feels about the Lake’s importance to the State, Wilmington

Town Manager Scott Murphey stated: “To the overall State, I believe it is very important.” This opinion was unanimous among those interviewed. However, when attention was turned to each town manager’s particular town, outside of the Lake Champlain Basin, each one said that any impact that the Lake had was very little. Keith Arlund, of Bethel, noted that “what happens in Lake Champlain doesn’t really have a whole lot of impact on Bethel, or this side of the mountain.”

Although most of the town managers expressed opinions that the Lake’s water quality is suffering, they also expressed uncertainty about recent legislation enacted to mitigate water pollution in the State; in particular Act 64. Russel Hodkins, Westminster Town Manager, stated: “There is a need, and I can see it, but I think we’ve gone a little overboard with Act 64 and the town involvement in creating roads, etc.” He pointed to a new \$2,000 burden on each Westminster resident to comply with the Act and the “Lake Champlain Initiative.” He continued: “We’re getting penalized for it, and from the point of a taxpayer, it’s a burden that we can’t afford. Focusing on putting us all in a basket and saying that we’re all part of the same initiative is a whole other issue entirely.” Bethel’s Keith Arlund expressed similar feelings: “Yet another unfunded mandate, which is the way I look at it as municipal manager. Taking the steps that are required because of Champlain is going to be costly to the Town of Bethel, and every small town in Vermont.”

Residents in these removed towns, while they are aware of the pollution to some extent, do not seem to perceive it as impacting them in any significant way. When asked how he believes residents in his town view the pollution in Lake Champlain, Wilmington Town Manager Scott Murphey said: “I think they feel the same way about that as they do global warming, or something like that, where it’s a concern but it’s not an immediate concern to them.” The final question that was asked, as in Burlington, regarded if there would be support for a one percent increase in property taxes in each town. Mr. Murphey replied: “There would probably be 100 percent opposition to that. This town is overly property-taxed to death already....” Bethel’s Keith Arlund had a similar view, stating that Lake Champlain is “pretty far removed from us geographically so...[residents] would probably be reluctant to spend a lot of money on cleaning up Lake Champlain.”

While Vermont residents in areas outside of the Lake Champlain Basin are aware of the Lake’s need for a clean-up, they are far enough removed from it that they do not see it as an issue that necessarily impacts them. The town managers pointed to their local watersheds, such as the Connecticut River in Westminster and the White River in Bethel, as a higher priority for those residents. There is also expressed frustration in these towns that they are treated equal to municipalities that border the Lake in the eyes of legislation, such as Act 64. If any form of a tax increase is proposed statewide, there may be less opposition if the tax rate took proximity from the Lake into account. Although the economic impacts of the Lake may reach through the entire state, Vermonters outside of the Lake Champlain Basin have a hard time seeing its impacts in their day-to-day lives.

## 5. CONCLUSION

Lake Champlain is one of Vermont's most valuable assets. Other than being a tremendous source of pride for the state and its citizens, the Lake provides a plethora of economic benefits. Over the past couple of decades, the Lake has been put in a position of tremendous risk. Phosphorous from nearby dairy farms has overloaded and overwhelmed it. A lake with clear water and a safe environment has turned into a slush of green muck with unsafe, potentially toxic water. The State of Vermont will face several important questions over the next couple of years. What is the value of Lake Champlain to Vermont? Is the cost of cleaning Lake Champlain justified? These questions were approached on multiple fronts in this report. The state of Vermont must consider various components of the Lake when attempting to assess the "value" of Lake Champlain.

It is clear from these numbers that a significant amount of the value derived from the Lake comes from property values. Lakeshore properties are on average significantly more expensive than inland property, and access to the Lake and lakeside views are heavily valued in the housing market. Consequently, lakeshore property adds significantly to the tax base of certain municipalities. When housing prices decrease, this reduces the tax base in each community and reduces the amount of revenue. The municipality either must accept the reduced amount of revenue or increase the tax rate to meet previous amounts of revenue. Similarly, the state of Vermont faces the same choice with regard to two of its taxes: the statewide education tax and the real estate transfer tax. Both of these taxes rely on property values, and as such, a decrease in the value of lakeside properties would affect the entire state. As Lake Champlain continues to deteriorate, property values will be reduced significantly, affecting revenue for lakeside municipalities and for the state.

The Lake provides drinking water for 145,000 individuals in the Lake Champlain Basin. Twenty million gallons are pumped from the Lake each day. In economic terms, the Lake provides about \$75 million worth of water each year. Lake Champlain also serves as one of Vermont's most popular destinations for recreation. Tourists, boaters, and fishermen flock to the Lake and its state parks every year. Lake-related tourism is responsible for \$300 million annually, as well as approximately 1,070 jobs. Lake Champlain State Parks drives an additional \$629,000 worth of tourism each year as well. Furthermore, \$205 million is spent by anglers fishing on the Lake annually. These numbers, once aggregated have a significant impact on Vermont's economy.

Throughout this report, there have been several mentions of quantitative values associated with the Lake. These values have been collected and displayed on Table 4 on the next page:

**Table 4: Values Attributed to Lake**

<b>Aspect Related to Lake Champlain</b>	<b>Annual Value</b>
<b>Drinking Water</b>	\$75,000,000
<b>Tourism</b>	\$300,000,000
<b>Lake Champlain State Parks</b>	\$629,000
<b>Fishing</b>	\$205,000,000
<b>Current Estimated Total</b>	<b>\$580,629,000</b>
<b>Seasonal Property Value Increase if Cleaned</b>	<b>+\$183,000,000</b>
<b>Minimum Value of a Clean Lake Champlain</b>	<b>\$763,629,000</b>

When all of the values mentioned are considered, the Lake’s current value is estimated to be roughly \$580,629,000 on an annual basis. Once the possibility of a clean-up (improving water clarity by one meter) is considered, the increase in seasonal property value bumps the value of a *clean* Lake Champlain to an approximate minimum value of \$763,629,000. The word “minimum” is used because it is assumed that, if the water quality of the Lake improves, the values attributed to other aspects of the Lake, such as tourism and fishing, will increase. This table also does not account for the increase in value to single family dwellings that border the Lake, as the number of single family homes that border the Lake is not known. However, a water clarity improvement of one meter would increase the property value of each house by an estimated \$5,700, which would aggregate to a large sum if the potential number of single family dwellings is considered. It must be noted, however, that the sum of all of these values is inherently crude, and is only an estimate based on the sources that we have researched.

There is another side to this report as well, which details the potential losses that could come from a continuation of the pollution trends in the Lake. Table 5 details the *negative* values mentioned in this report that could hit the Lake if there is no effort to clean it up:

**Table 5: Decrease in Values Due to**

<b>Aspect of the Lake Affected by Pollution</b>	<b>Loss in Annual Value</b>
<b>Seasonal Property Value Decrease</b>	-\$159,000,000
<b>Recent Decrease in Georgia Property Values</b>	-\$1,850,000
<b>Lodging (one-meter water clarity decrease)</b>	-\$221,088
<b>Tourism (one-meter water clarity decrease)</b>	-\$16,800,000
<b>Total Decrease in Value of Lake Champlain</b>	<b>-\$177,871,088</b>

When all of these decreases are considered, continued pollution in Lake Champlain, resulting in a water clarity decrease of one meter, would decrease the Lake's value by an

estimated \$177,871,088. This would include a general \$18,871,088 decrease in value each year, and a \$159,000,000 decrease in seasonal property value. Similar to Table 4, Table 5 does not account for the decrease of property value in single family residences that border the Lake, which is estimated at -\$4,900 for each house. Although the number of single family dwellings that border the Lake is not known, it is likely that, if these values were aggregated and accounted for, that the total loss to Vermont's economy would be close to \$200,000,000. There is no question that this loss would be a noticeable hit to the state's economy and its population, most notably in and around the Lake Champlain Basin.

Although this report takes an economic approach to find a number to capture the "value" of Lake Champlain, this value cannot fully encapsulate what the Lake means to the countless people that it has touched. It provides a personal value to the thousands of residents and non-residents who enjoy using it, as evident by the interviews that were conducted for the qualitative section of this report. While boaters, fishermen, state parks, and property values provide sources of revenue for the state, the drivers of these industries are the citizens of Vermont who love and value Lake Champlain. That being said, Vermont residents outside of the Lake Champlain Basin do not feel as much of a direct connection with the Lake as those within. If any tax increase was imposed on Vermont residents to help pay for the clean-up, some system that takes proximity to the Lake into account may face the least opposition among taxpayers.

While the emotions tied up in the Lake cannot be ignored, nor can the costs of this clean-up. It will take a heavy investment into the Lake's future to reach the standards set by the EPA. To gain popular support for this clean-up, the citizens of Vermont have to be made aware of the potential costs, and the necessity to be proactive, lest they face the potential for economic loss throughout the whole state. However, it is likely in the state's best interests to keep awareness low for tourists, who seem less informed about the pollution in the Lake than Vermont residents do. Therefore, a direct-mail campaign to Vermont households would likely be the best option to promote awareness and gain popular support for the clean-up. The sooner that the people of Vermont are made aware of what is at stake, and the potential losses that could be incurred by one of the state's largest assets, the sooner that they will be able to prevent these losses from happening, and be able to enjoy a cleaner Lake Champlain.

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