The History of Domestic Water Use at Colgate University

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Executive Summary

This report assesses the domestic use of water at Colgate University since its founding in 1819. As a higher education institution, Colgate has the opportunity to train the world's new leaders to have a responsible mindset towards water and even provide a laboratory to practice sustainable water management. In order to progress for the future, this report fulfills a necessary

Introduction

Since Colgate University's formation in 1819, there have been many changes in the way that members of the campus community live. Some of the most drastic differences between the university today and the university in the past are the ways in which people utilize water in a domestic setting. Along with innovations in technology that have dramatically altered the way that water is distributed to people and how much water people use in a typical day, the conceptualization of sustainability has also become a much more formal and pressing concern surrounding all manners in which freshwater is utilized. This creates questions about the ways in which water and water resources were both used and managed for longevity before the inception of the term sustainability. As Colgate University approaches its bicentennial in 2019 with a carbon neutrality goal attached to that date, it is important to measure how far the university has come in relation to sustainable water use. In this project, we have addressed the following research question: How has domestic water use at Colgate University changed over time and to what extent have the priorities for water use aligned with current definitions of sustainability?

In this report, we address the history of domestic water use at Colgate University. To do this, we pay specific attention to major changes in the way that campus community members have been able to use water in the residential halls and academic buildings over time. We also look for mention and measurements of water quantities, of water quality, and amounts spent on water throughout the history of the university. In doing so, we assess how decisions regarding water sourcing, use, and provision align with our definition of sustainability and a set of criteria under which we measure sustainability.

To collect data to answer our research question we utilized a multi-faceted approach. Since this is a historical analysis of water use at Colgate University, our main source of data is the university special collections and archives. Along with the research in the physical archives we also briefly surveyed the digitized records of student newspapers. To supplement the archival data, we conducted interviews with key stakeholders. The stakeholders we interviewed included

Literature Review

Water is one of the ultimate public goods, a substance crucial for life that must ultimately be shared by all. Yet, in today's world, it is also seen as a private good and economic commodity. Water is not just necessary for life, it carries cultural values, social implications, and recreational uses (Gleick, 1998). This considered, there is a diversity of competing interests that make water a complicated resource to manage.

Globally, water is crucial for both considerations of well-being and wealth. On one hand, water is critical for good health and fighting disease. On the other, it is central to production and preservation of goods and services. According to the United Nations Water for Life program website, more than 1.7 billion people are currently living in areas where water sources from river basins are depleting. If this continues, two-thirds of the world's population will be living in water-stressed countries by 2025. As of 2015, after a concerted effort made by the UN to tackle water problems for a whole decade, still around 748 million people did not see an improvement in source of water and 2.5 billion people did not see an improvement in sanitation ("International Decade for Action 'Water for Life' 2005-2015," n.d.).

While global warming and its impact on the water supply has dominated the conversation around climate change, much less attention has been given to how human behavior influences the terrestrial water cycle (Vorosmarty, Green, Salisbury & Lammers, 2000). Water use comes in a variety of forms. In its most simple sense, water is used to meet basic needs, but it is also used for aesthetic, luxury and entertainment. According to Peter Gleick (1996), the basic water requirements (BWRs) can be defined "in terms of quantity and quality of four basic human needs: drinking water for survival, water for human hygiene, water for sanitation services, and modest household needs for preparing food (p. 83). The difficulty in determining what goes beyond BWRs comes in the fact that different parts of society use water for different purposes such as drinking, growing food, producing and using energy, removing and diluting wastes, using energy, etc. To define what the quantities for each country, let alone each location within a country, is difficult when the diversity of interests are considered. When there are hundreds of millions of people who like the water required to meet their basic needs, it proves tricky for societies like the United States to determine what is a responsible amount of water use.

While water can be discussed at many scales, the university setting proves to be a vital one. In fact, although water consumption is very high in higher education institutions, few universities have determined the optimization of their water systems (Gao, Zhang, Zou & Zhang, 2014). As sustainability develops nationally, water is an ever more important component of environmental management for higher education institutions (Rauen, Lezana, & da Silva, 2015).

However, with the rise of consumerism in the past century, water has become increasingly viewed as a product on the consumer market. It has led to people, including students, to desire ownership over their water. The result has been a widespread use of personal water bottles and a decreased use of communal water fountains. This individualistic consumption of water, unfortunately, has led to an increase in environmentally harmful products like plastic water bottles. Yet, there have been moves to combat the negative impacts that come with the commodification of water. Recent national college campus competitions focused on conserving water have changed student behavior and how people think about water (Petersen, Frantz, Shammin, Yanisch, Tincknell, & Myers, 2015). While social initiatives started by students are

used, and by whether there has been evidence of water source depletion at any point in the university's history. Our second environmental sub-question is whether Colgate has ever been responsible for polluting the water source when drawing it from the village supply. This is measured by the presence of contaminants in the water supply at points of testing. The third sub-question is whether Colgate has maintained water quality throughout domestic use including stages of filtration processes and the actual use of the water. This is measured by Colgate's adherence to state water quality standards. These criteria are informed by and adapted from Gleick (1998) and Theis & Tomkin (2012) who stress the importance of quantitative measurement of water use and pollution in the long-term water planning and management that leads to sustainability.

For the economic component of sustainability, we considered how economic considerations have been included or prioritized in the decisions the university has made regarding water use and water distribution technologies. This is measured and quantified by three questions: How much domestic water is being used per capita? How much money is being spent on domestic water per capita? How does the money spent on water compare to the amount of money spent on other things? The last question is important to include because the value of the dollar has not been remained stagnant over time and we seek to find what proportion of Colgate's spending went to water at different periods.

For the social component of sustainability, we have focused on the relationship between Colgate University and the Village of Hamilton. Theis & Tomkin (2012) point to the importance of relationships between institutions and people as a fundamental aspect of social sustainability. Taking this into consideration we chose the relationship between the university and the village because the village represents both the university's water provider and all the members of the surrounding community. Within this context for social sustainability, we have two sub-questions: How has Colgate involved the Village of Hamilton in its decision-making process regarding changes to domestic water use? And has the university used water in a manner that is equitable to the village? To measure whether water use is equitable we aimed to compare how the percentage of water use by Colgate compares to the amount of space and people that the university represents within the community. These sub-questions speak to the importance of the relationship between Colgate and Hamilton and are trying to get at whether the university recognizes its place as a member of a community, includes the voices of relevant stakeholders, and respects the needs of that community outside of itself.

Archival Research

The first step we took to answer our research question and subsequent sustainability criteria sub-questions was to conduct primary research in the Colgate University archives. We looked in both the university's physical archives and the digitized student newspaper archives. We were looking for documents from throughout Colgate's history that reference how water was being used at certain time periods, what amount of water was being used and what amount of money was being spent on water, and information about the decision making processes behind big changes in water use. Since the Village of Hamilton is the university's water provider we also looked for documents from that side of the relationship that referenced how much water was being pumped out during a given time period, how water was being distributed to village residents, and how the water was treated prior to distribution.

The biggest limitation that we faced in conducting our archival research was the general

lack of data regarding water use and systems at Colgate over time. Textual references, photographs and publications relating to water use were rare and not centralized in any systematic way.

One collection in the Colgate University archives that proved particularly helpful for our project was the Building & Grounds collection which contains records for each of the campus structures. Within

the village began to be available in one building at a time" (p. 222). The Hamilton Water and Light department was incorporated in 1895 and marked the official beginning of the village providing domestic water to the university, as stated in a letter Howard Williams wrote to James Hughes on February 1, 1968. This is corroborated by our finding of a Rates and Regulations booklet published by the Hamilton Water & Light Department in 1895 (Colgate University, 1895). At this time, village residents were charged for water based on both amount used and the types of water use technologies present in their homes or number of livestock owned (Figure 1) (Colgate University, 1895). In addition to this, there were different rates charged based on the type of residence or business (Figure 1) (Colgate University, 1895). Within 20 years, the Village exhibited changes to the ways in which they billed residents for domestic water. In the 1913 Water Rates and Regulations, the Board of Water and Light Commissioners began charging all water users the same rate and required all water users t0 0 Tm[(th(i)0.2(re)0.2(d a)0.2eo (t)0. 570.96 cmBTp

(Colgate University, 1913).

The provisioning of water to residents whether by the Hamilton Water & Light Department of 1895 or by Hamilton Water Works now, has always fallen under the Hamilton Utilities Commission. The commission is a governing body that handles all the utilities provided by the village. It consists of an appointed board that holds the majority of the responsibility but the Mayor sits on the board at some points. Current Mayor Bob McVaugh estimates that 50% of his job as Mayor is focused on utilities (Bob McVaugh, personal communication, April 12, 2017).

Prior to the modern-day water sources for the Village of Hamilton, it cannot be said exactly how Colgate got its water. Interviewee Sean Graham theorized that where Taylor Lake is, they would have had hand-dug wells. Over the years, the village found cisterns across from Whitnall Field, where the old administration building was located. Where the water came from, he doesn't know. It may have just been groundwater running in there but this could not be validated by any means. Sean Graham also said that every once in a while a car in the village will cave into the ground because it was parked on top of an old cistern that was hidden by grass grown over it. In addition, Mr. Graham explained that through the process of digging up and rebuilding roads, there has been some evidence of an older water main system attached to an unknown former water source:

> When we rebuild roads, every once in a while we'll find a wooden water main, and they actually used to have hollowed, they hollowed logs out and brought water down from the eastern portion of the village, which is up above the golf course. Now where it came from, I just don't know. But there was another source at one time besides Woodman Pond and the wells we own now (Sean Graham, personal communication, April 14, 2017).

In the archives, we found a letter written by Professor Whitnall to the Geologic Survey on May 18, 1936, asking if the fluorescein (used with a salt called uranin to trace underground water) had any health effects if consumed. The geologic survey replied that they have had no reason to think that fluorescein was a health hazard. They said that if the salt were poisonous, "there is little probability that anyone would drink enough of the colored water to produce any harmful effect." This was then sent to the Public Health Service (in the Treasury Department in Washington) which is the federal source of authoritative information on matters relating to health. The Public Health Service corroborated this and said that at the time, dyes and other agents besides common salts weren't used much (Folder 187- Box 5 in the Harold Orville Whitnall collection). This represents a potential instance in which the actions of representatives of Colgate University could have polluted the water source for the village but took the necessary precautions before acting on that potential.

In 1907 Colgate built a Central Heating Plant which changed the way that the university provided heat to its residence halls and academic buildings. The Central Heating Plant functions by burning something (initially coal) to boil water which is then pressurized and pushed through steam pipes going into every building (Figure 3) (Representative from Facilities, personal communication, April 21, 2017). Once in the buildings, fans blow hot air off the steam pipes and into specific rooms (John Pumilio, personal communication, April 21, 2017). The Central Heating Plant represents a major use of domestic water on campus and the university uses the same methods for heating buildings today, though they now burn wood and natural gas

(Representative from Facilities, personal communication, April 21, 2017). Today the Central Heating Plant is 90% efficient at capturing and reusing water that has been turned into steam to heat the buildings and then recondensed (Representative from Facilities, personal communication, April, 21, 2017). Despite this efficiency, the plant still uses between 3,000 gallons of water a day in the Summer and 10,000 gallons a day in the Winter (Representative from Facilities, personal communication, April, 21, 2017).

Figure 3: Map of steam pipelines on Colgate University campus associated with the building of the Central Heating Plant in 1907 (Colgate University, n.d.)

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Pertaining to the costs of water, rates are determined by the number of “units” used. A “unit” refers to 100 cubic feet or 748 gallons of water. For 748 gallons, an amount equivalent to about 3000 bottles of water, ratepayers pay a rate of $3.02, which is a drastically less expensive

Looking to the Future

When John Pumilio was hired by Colgate University in 2009, the rates for water were more expensive and Colgate was using more water than we currently are (John Pumilio, personal communication, April 11, 2017). When discussing what water use looked like in this time period John said:

> There wasn't a campus-wide or university-wide water conservation program. No one was really paying attention to how much we used on campus or even how much we spent on campus with what. Because, you know, each building gets its own bill. So while the buildings would get billed, we didn't have a good sense overall of how much we were paying for that...The whole thing of you manage what you measure, we began to measure and report that. (John Pumilio personal communication, April 11, 2017).

In this discussion, he was getting at the fact that because the university was paying for water for each building individually and did not get a single bill for the entire water usage, there was no measure of how the university was doing in relation to water usage. He also points to taking the next step and measuring total water usage as a precursor to managing the amount of water we were using.

In terms of projections for the village water department, there is an efficiency project in the works: considering installing an AMI (automated meter infrastructure). Each house would replace their current meters with AMI which would notify the residents and the town about a spike in water usage above any of their averages. This notification system is important for catching potential leaks before it is too late and the homeowners have a bill that could be as high as $30,000 from water leaks (Sean Graham, personal communication, April 14, 2017).

Discussion

As the results section showed, there are multiple changes in water sources, water systems, and water use throughout Colgate's history (Figure 5). In this analysis section, we will attempt to bring the most important results of our research to the surface and point to how they have symbolized thinking that has lined up with sustainability thinking or other important considerations for the future.

Figure 5:

whether there were any discrepancies in they ways that they viewed their relationship. We asked probing questions that would hopefully reveal any opposed perspectives if they did indeed exist. From their responses, neither groups, those representing the university nor those representing the village mentioned anything negative about their relationship. This makes it seem like the relationship is based on respect and that each party is satisfied with it. We also asked about the extent to which the university involves the village before there is a major change in water use and both parties indicated that this involvement was present. From this, we conclude that the university is exemplifying democratic decision-making between themselves, their provider, and their neighbors regarding domestic water use. The inclusion of the Village of Hamilton in the university's decision-making processes is representative of procedural justice (Walker, 2012). We asked stakeholders from the village and from Colgate a question using the word equitable and both parties relayed the message that everything has gone smoothly regarding the use of water and both parties understand that there will be an inequality in water use between the university and other residents because it is such a large consumer but don't think that it is disproportionate or inequitable. This is representative of distributive justice which along with procedural justice is a key component of social sustainability (Walker, 2012).

Economic Sustainability

Our criteria for determining economic sustainability questioned how economic considerations impacted water use decisions and consisted of three sub-questions: How much domestic water is being used per capita? How much money is being spent on domestic water per capita? How does the money spent on water compare to the amount of money spent on other things? From the data we collected, particularly from the interviews with Sean Graham and the utility staff at Colgate, it appears that Colgate has made decisions throughout its history based on economic principles. While Bob McVaugh and Sean Graham both mentioned water as a natural resource, they focused on water as a utility, in other words, a product that can be bought and sold. This lines up with Peter Gleick's (1998) thought that in this world, water carries an important identity as a private good which sometimes overpowers its identity as a shared resource. However, the Village of Hamilton's position as a government that is providing water to its residents complicates the notion that they are perpetuating the commodification of water. While they are selling the water to their residents, they are attaching a price to the water because they are providing the water and the treatment of water as a service to their residents. The cost for the water could also be considered a tax that the village's residents pay. John Pumilio corroborated that water today is often managed with an economic motive. As he told us about water conservation on campus, "We're getting to more awareness. Not for environmental reasons, but because for economic reasons. We want to conserve water "to save money and be better stewards of our operating dollars" (John Pumilio, April 11, 2017).

A concern towards economic sustainability is the lack of water meters that are currently in buildings on campus. The goal for Colgate utility staff to put meters in all the buildings is a

et al. (2000) show that this area has populations that are much lower than the threshold to cause water stress. However, there is also a projection for increased water stress in the future as a result of climate change and population increases (Vorosmarty et al., 2000). Keeping these projections in mind will be important for providing economic justifications for water conservation in the future.

Recommendations

In closing, we present some final recommendations to Colgate University for sustainable water use that ensures the campus is viable for another 200 years. These recommendations include continued prioritization of the relationship between the university and the village, increased prioritization of water conservation, increased student engagement in water conservation efforts, and widespread installation of water efficient technologies.

Continued Prioritization of Colgate-Hamilton Relationship 2(s)-02(e)02(re)a02(a)02(t)02(e)02(c)02(o)n2(o)n2rrna)02(t)02

pressing. One possible way to achieve this is through the implementation of a program similar to Colgate Unplugged or RecycleMania, which are existing competitions that encourage students to decrease energy usage and increasing recycling rates, respectively. A water conservation competition would provide the opportunity to both educate and engage students in water conservation efforts.

Widespread Installation of Water Efficient Technologies

Our final recommendation is a more widespread installation of more water efficient technologies. The installation of low-flow shower heads saves the university more than $100,000 a year despite an upfront cost of only $17,000. Not only do these showerheads save water, they also save the university money. It is because of this that we recommend Colgate implement more water efficient technologies such as dual-flush toilets with two settings, one for liquid waste and one for solid waste. These dual-flush toilets have already been installed in a select few buildings on campus. With a wider integration of these toilets, the university could save .5 gallons of water for every flush of liquid waste which would add up to a large number of gallons saved over one year.

[Untitled photograph of water meter records]. (1913). Hamilton Water and Light Department Rates and Regulations (Folder 715). Colgate University Special Collections & University Archives, Hamilton, NY.

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Appendix A: Consent Forms

Certificate of Informed Consent – Colgate University
Sustainability of Water Use throughout Colgate's History - Staff Interview

Overview and Procedure: We are a group of students at Colgate University who are studying the domestic water use and systems at our university both in the past and in current times as a contribution to the Colgate Bicentennial Project. We would like to ask you questions concerning these topics in order to understand how they relate to present day understandings of sustainability. The interview will take about 45 minutes of your time.

Risks: Your participation in this project is low risk, as we merely seek accurate explanation of Colgate systems and priorities.

Confidentiality: While the student researchers for this project will be the only persons with access to the original data, this project includes making a video project that will be published on Colgate's YouTube page and a final report to be presented to Colgate administrators. The intention is to use images and/or quotes from this interview in either of these two components of the project. Results from this study will be made available to you should you desire

Compensation: There is no compensation involved in completing this interview.

Your Rights: As your participation is fully voluntary, you have the right to withdraw from this study at any point or decline to answer any question.

Contact Information: If you have any questions about this study or your rights please contact the principal investigator: Dr. April Baptiste (abaptiste@colgate.edu; 315-228-6740). You can also contact the Chair of the Institutional Review Board of Colgate University (IRB_Chair@psych.colgate.edu; 315-228-7354).

Please circle the appropriate choice for each of the following:

Yes or No: I give permission for my voice, image, name etc. to be used for your video component of your class project

Yes or No: I give permission for my quotes to be used in your project

By signing below, you are agreeing 1) to participate in this study, 2) to allow the researcher to use your responses either in full or part for reporting the results of this interview and 3) that you have read and understand all of the information provided on this form.

_____	_____
Participant Name (please print)	Researcher Name (please print)
_____	_____
Participant Signature	Researcher Signature
_____	_____
Date	Date

Bob McVaugh Interview Questions:

1) Where does Colgate get its water now? Where has the university historically gotten its water from?

2) How does Colgate's position as a major water consumer affect the dynamics of water resources and price for the village?

Sean Graham Interview Questions

12) What are the priorities when making decisions about water in Hamilton in general? For example, do the major considerations involve money spent on water, using water efficiently, or