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# SWAN: An Online Education Guide for the Saratoga Lake Watershed

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The Saratoga Watershed Awareness Network (SWAN) is a new online education guide to inform local stakeholders about the threats to the Saratoga Lake Watershed. The website is a synthesis of past Skidmore capstone research and will continue to be updated with future studies. Current pages include information concerning development and impervious surfaces, water shortages, and septic systems.

ES 375 Case  
Studies in  
Sustainability

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## INTRODUCTION

Water is used globally for drinking, washing, cooking, irrigating crops, and other life-sustaining tasks. Many people also enjoy the opportunity for recreation that lakes and streams provide due to their beauty and for the prospects of boating, fishing and swimming. Watersheds are necessary to support habitat for plants and animals; they transport nutrients, filter waste naturally, regulate microclimates, as well as promote biodiversity. The quality of life as we know it depends on water. With so much dependence on water, it is crucial to understand how land use in the watershed impacts local bodies of water - and subsequently people's drinking water.

Awareness of the global importance of preserving water for ecosystem services has only recently emerged during the 20th century as more than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems (CCA 2010). With less than one percent of the world's freshwater readily accessible and located in the lakes, rivers and streams that cross populated continents, uncontaminated fresh water is becoming an increasingly threatened resource (CCA 2010).

Water pollution spans a wide range of chemical, physical, and microbial factors, but over the years the balance of major pollutants has shifted markedly in most industrialized countries. One hundred years ago, the main water contamination problems were fecal and organic pollution from untreated human waste and the byproducts of early industries. Through improved treatment and disposal, most industrialized countries have greatly reduced the effects of these pollutants, with consequent improvements in water quality. Pollution laws and pollution control technologies have succeeded especially well in cutting emissions from concentrated "point sources" like factories and sewage treatment plants. For example, from 1972 to 1992 the amount

of sewage treated at wastewater treatment plants in the United States increased by thirty percent, yet the organic pollution (measured as the Biological Oxygen Demand) from these plants dropped 36 percent (CEQ 1995). Unfortunately, a new suite of contaminants from intensive agriculture and development activities in watersheds has kept the cleanup from being complete. In general, national water clean-up programs have not been effective in reducing "nonpoint" pollutants such as nutrients, sediments, and toxics that come in the form of runoff from agriculture, urban and suburban stormwater, mining, and oil and gas operations (NRC 1992; EEA 1999). Meanwhile, in most developing countries, the problems of traditional pollution sources like sewage and new pollutants like pesticides have combined to heavily degrade water quality, particularly near urban industrial centers and intensive agricultural areas (Shiklomanov 1997; UNEP/GEMS 1995). An estimated ninety percent of wastewater in developing countries is still discharged directly to rivers and streams without any waste processing treatment (WMO 1997).

The Environmental Protection Agency conducts regular surveys assessing the health of most of the lakes, rivers, and estuaries within the borders of the United States. According to their 2004 report to congress, 64% of our lakes are critically impaired, as are 44% of our rivers and 30% of our estuaries (EPA 2004). There is strong evidence that converting forests to intensive agriculture and urban development contributes to conventional water pollution in the United States. A one percent increase in cultivated cropland increases the number of samples in exceedence of the national reference by 0.22 percent in an average watershed, while a one percent increase in developed land increases the number of samples in exceedence by 0.05 percent (Hascic and Wu 2006). Converting forestland to pasture also increases the number of samples in exceedence of national standards of conventional water pollution as much as 0.07

percent per one percent increase in pastureland (Hascic and Wu 2006). The quality of our water supplies in the future depends on conservation efforts and mindful management.

Humans and the organisms that they coexist with are the ones who ultimately suffer from excess pollution. The Environmental Working Group conducted an analysis of drinking water quality using over 20 million records, and their results are far from comforting. Since 2004, 316 water pollutants have been found in the tap water Americans drink (EWG 2009). More than half of these aren't subject to drinking water regulations. The government spends nearly nineteen times more money on chemically treating polluted water than they do on protecting our water bodies from contamination (EWG 2009). If more resources were spent in keeping surface and ground waters clean, then the government wouldn't have to invest nearly as much time and money in sanitizing it for use.

One way in which the government has sought to reduce pollution is the establishment of the Clean Water Act in 1972. The overall purpose of the act is to restore and maintain the physical, chemical, and biological integrity of the nation's waters by preventing pollution, assisting in wastewater treatment, and protecting wetlands. It sets standards of regulation for biochemical oxygen demand, suspended solids, fecal coliform, pH levels, as well as a wide range of toxic chemicals (EPA 2004). Recently, the New York Times conducted a survey of Clean Water Act violations in every state, and they found that more than 20% of regulated facilities violated CWA standards. Unfortunately, fewer than 6% of these violations resulted in fines or punishment (Duhigg 2009). The aim of the Clean Water Act is to protect our water sources for present and future use, but thus far has not proven to be entirely effective. At this point, it is becoming more necessary for local councils to assess the health of their drinking source, as well as the overall state of their watershed.

How we interact with our entire local ecosystem determines the health of the area's watershed, which is a land area that drains water into a creek, river, lake, wetland, bay, or groundwater aquifer. Watersheds are dynamic and are unique to their geographical area. Mountain ranges, microclimates, and the latitude in which an ecosystem is found all impact the natural cycles in an area and the functions that a watershed can perform. They are complex webs of natural resources - soil, water, air, plants and animals. Yet, everyday activities can impact these resources, ultimately impacting the well-being and economic livelihood of the humans that live in the area. Pollutants or runoff dumped on the ground will eventually find their way to a water route, carrying contamination throughout the larger environment and degrading water sources downstream. While watersheds in a particular region can be similar, individual drainage basins contain distinct geology and habitats. Conservation efforts need to be tailored to fit the requirements of each watershed in order to maximize their effectiveness in keeping the area pristine. Whether viewed as resource or commodity, water is the basis of our agricultural, municipal, industrial, environmental and aesthetic well-being.

The Chesapeake Bay Program has been working to protect their watershed for over 25 years. As of March 2009, their assessment of the area addresses the main threats to the bay and its river tributaries. They have determined pollutants, land use, natural factors, and other pressures such as climate change, invasive species, and fisheries harvests as the main threats to local water quality (Chesapeake Bay Program 2010). In an effort to educate to the residents about the health of the local environment, they have used this data to set goals for a reduction of anthropogenic impacts by creating a publically accessible website that outlines the threats of Chesapeake Bay in layman terms. By reaching out to local stakeholders, they hope to link

personal habits to larger consequences and encourage inhabitants to take individual action to safeguard the bay from anthropogenic degradation.

Watershed management like the Chesapeake Bay Program, which conserves fundamental resources while providing for the needs of people and ecosystems, is something that can be applied to our own New York region. The Saratoga watershed, which is a 240 square mile area that includes 11 townships, cumulates in Saratoga Lake, a 5.8 square mile body of water (SLIPID, 2002). Over the last 20 years, Saratoga County has been the fastest growing county in New York State, with extensive residential and commercial development (Kleppel 2002). Since the lake is fed primarily by Kayaderosseras Creek, a surface water route that runs through both agricultural and residential land, the lake may be particularly prone to the negative effects of development (SLIPID 2002; Aldrich and Wyerman 2006). With an increase in development, the threats to local waters can be severe. Saratoga Watershed is part of the larger Hudson watershed, and low qualities at home will have an effect on the quality of the greater environment as pollutants are carried to the Hudson River from Saratoga Lake via Fish Creek. Moreover, the city of Saratoga Springs, a township within the watershed, is currently deliberating on the possibility of drawing water from Saratoga Lake to supplement its current reservoirs at Loughberry Lake, Bog Meadow Brook and the Geyser Crest Well Field due to increasing population and water use (CDRPC 2006). However, if Saratoga Lake is damaged too thoroughly by the effects of human development, expensive water treatment will have to be considered (Aldrich and Wyerman 2006). Apart from drinking water, Saratoga Lake plays a large role in the local economy due to its recreational use and draw for tourism. All these roles are dependent on shielding the lake—and thus the watershed—from the consequences of over-development and lax pollution laws.

Analysis of all the problems facing the Saratoga Lake watershed is the first step towards creating a solution. The next step is to promote awareness, which can be heightened in this region by forming a website for the Saratoga Watershed modeled after the Chesapeake Bay Program called Saratoga Watershed Awareness Network (SWAN). The beginning of the website will highlight three areas seen as a major consequence to population growth in the Saratoga region: water shortages, faulty septic systems, and changing land usage. If residents have a user friendly and easily accessible source of information about their environment, optimistically, more intensive local action can be implemented to help protect it.

## WEBSITE DESIGN

With the creation and expansion of the Internet, most people now gather knowledge from various websites that specialize in certain subjects. The Saratoga Watershed Awareness Network (SWAN) is unique in that it aims to make use of the Internet's accessibility and flexibility to inform the general public about the Saratoga Lake Watershed and the variety of threats that it faces in one place. To do so, we are condensing and clarifying research and data from Saratoga Lake related websites and previous student capstones included on Skidmore's Water Resources Initiative site (<http://hudson2.skidmore.edu/academics/wri/projects.htm>) to provide an education tool modeled after the Chesapeake Bay Program (<http://www.chesapeakebay.net/>) for those who wish to know more about the Saratoga Lake Watershed. SWAN is a means for providing that information to the general public and informing them on how land and water use impact the quality and beauty of the Saratoga region.

The focus pages target specific threats we recognize as a threat to the watershed. We chose to highlight development and impervious surfaces, water shortages and flooding, and

leaking septic systems. These are all areas of concern for the watershed with useful information described in previous capstones. Each capstone contains a fantastic amount of thorough research, tables, and figures. To keep the website succinct and user friendly we chose not to include every conclusion from the reports and only outline the most relevant facts to clarify important information. Supplement resources were used in cases when capstone research was insufficient to cover the breadth of material we wanted to cover. Information about the Saratoga Lake Watershed is scattered across multiple websites and publications. By condensing available information from these multiple resources in SWAN, we are creating a comprehensive educational tool accessible to interested parties.

The *Main Page* and its extension, the *Watershed Page*, serve as the primary educator on general information about the Saratoga Lake Watershed and introduce the purpose of SWAN to website visitors. The *Main Page* briefly outlines how dynamic watersheds are, but its main function is to take the part of a site map by organizing and linking to the focus pages in an easily understood format (Appendix A). The purpose of the *Watershed Page* is to pull together general information about the watershed at one location for the general public (Appendix B). It expounds on the *Main Page*, setting the context of SWAN in the Saratoga Lake Watershed as well as giving a more detailed description of how watersheds work and how they provide necessary services to human populations. General information concerning the location of the watershed and the municipalities within comes from the Saratoga Lake Watershed Plan. Information about the area's geologic foundation is taken from Conor Taff's 2005 capstone "Geologic History of Kayaderosseras Watershed." The *Watershed Page* clarifies the boundaries of the watershed and the population that would find SWAN the most useful. While the *Main Page* outlines SWAN's objective, the *Watershed Page* connects citizens to their surrounding area.

In the first focus page, *Development and Impervious Surfaces*, we included descriptions of the types of pollutants found in the water, while stressing the risks blacktop has on the watershed (Appendix C). The *Development and Impervious Surfaces Page* includes the capstones: “Potential Development in the Saratoga Watershed” by Betsy Quentin and Leigh Siegwarth (2008), “Kayaderosseras Creek” by James Caris and Laura Wittman (2005), “Economic Impact of Recreation on Saratoga Lake and Threats to its Long-Term Vitality: The Perspective of Local Businesses” by Jon Clarke and Peter Suneson (2007), and “Land Conservation and Quality in the Saratoga Lake Watershed” by Doug Morin (2007). The page describes the risks impervious surfaces and land development pose to the Saratoga Lake Watershed in addition to various pollution sources, economic concerns, and mitigation efforts. Definitions are given for many key terms that are vital to understanding watershed threats, including eutrophication, nonpoint pollution, and point pollution. Currently, there are short descriptions of economic variables and mitigation efforts on the page, yet there is room for others to expand them in the future. For example, there is currently a capstone being created on the importance of rain gardens in the Saratoga Watershed. The *Development and Impervious Surfaces Page* would be an appropriate place to add this research.

Since water shortages as well as flooding are both serious threats to the overall wellbeing of Saratoga County, we felt it necessary to include a focus page describing the dangers of these natural hazards on the *Water Resources Page* (Appendix D). The capstone “What to Do About a Bout of Drought: Understanding Drought in a Water-Rich Region” by Andy Hart and Kate Stevens was used to describe the risk of water shortage. Their research came up with many important conclusions about the likelihood of drought in this region. Specifically, we outlined that the main reasons for water shortages in the area are overpopulation, shortage of rainfall,

water use, and Loughberry Lake's storage capacity. There were no capstones available to describe the threat of floods, so we used a risk assessment report on flooding done by Saratoga County. The report outlined the likelihood of floods in this area, which areas are most likely at risk, incidents of flooding in the past, and efforts at mitigation.

While proper water management is crucial for regulating water supplies, leakage from septic systems has a direct impact on water and land quality. Disease and excess nutrients such as phosphorus and nitrogen from sewage discharge contaminate the surrounding area, killing both land and aquatic life. Information from Dante Petri's 2008 capstone project, "What Goes in Must Come Out; Septic Systems in the Saratoga Lake Watershed" lays the foundation of the *Septic Systems Page* (Appendix E). Information concerning the general dangers of system leakage, as well as how individuals can identify and fix breaks, is taken both from both Petri's work and phone interviews conducted with six different septic tank agencies within the Saratoga Lake Watershed (Appendix F). Information on the website is organized to best highlight how citizens can take initiative in minimizing the threat of tank leaks before drastic renovation is required. The page serves as an educating device to teach the public on how septic tanks work and recognize how proper maintenance preserves drinking water supplies and land quality.

Information on each site is organized to best convey potential threats to a population that does not specialize in these particular areas. Capstones on the Water Resources Initiative site range from arts and literature, community perspectives, to public policy and much more. There is potential to utilize all these sources to expand SWAN and create more depth of content available to the public. Information about the Saratoga Watershed is scattered in a variety of publications, websites, and Skidmore student capstones; SWAN aims to make it available and understandable for the population at large. If anyone wishes to access and build upon the current list of resources

SWAN uses, please visit the *Works Cited Page* (Appendix G) provided in the *About Page* (Appendix H).

\*\*appendices include original print outs of web pages.

## CONCLUSION

We chose to focus on risks that are well researched and determined as areas of concern to the health of the watershed; however, there are many more sections and topics that could potentially be added to the website. Other possible pages could include the threat of invasive species, pharmaceutical contamination, and nutrient runoff from agriculture, as well as the potential benefits of rain gardens. There is also room to expand and detail modules already provided on the website to present a more complete picture of the Saratoga Lake Watershed and its future. These are all very important areas of discussion and will be ideally included in the coming years as more research is conducted. The potential for expansion is nearly limitless, so any current or future Skidmore student can add what they see fit. As SWAN grows, its usefulness will increase in educating the public about the unique traits of the Saratoga Lake Watershed and the threats that risk its health.

## Appendix A

### Main Page



Life in the water. Environmental Studies student, Class of '09: studying macro invertebrates in the Saratoga Lake Watershed

A [watershed](#) is dynamic and unique to its geographical area. Watersheds are complex webs of natural resources - soil, water, air, plants and animals. With so much dependence on water, it is crucial to understand how land use in the watershed impacts local bodies of water - and subsequently people's drinking water.

How we interact with our local ecosystem determines the health of the Saratoga Lake watershed and beyond. In the case of the Saratoga Watershed, it is part of the larger Hudson watershed. Low qualities at home not only deteriorate local surroundings, but also negatively impact the greater environment.

### Getting started

Watershed management that conserves fundamental resources while providing for the needs of people and ecosystems is vital and starts with analyzing current and potential problems facing the Saratoga Lake region. SWAN is committed to informing the public about these threats and to supporting general environmental awareness.

**[About the Saratoga Watershed Awareness Network:](#)** Learn more about the purpose of SWAN and its creation as an educational tool for Saratoga Lake Watershed residents.

**The Saratoga Lake [Watershed:](#)** The Saratoga watershed stretches a 240 square mile area and cumulates in Saratoga Lake. It dictates our local environment and is essential to transport nutrients and filtering out water naturally.

**Land and People:** Saratoga County currently has the fastest population growth in New York state. Below are consequences if appropriate measures are not taken to plan for future expansion.

**[Development and Impermeable Surfaces:](#)** As more people move into the watershed, development of new homes, roads and businesses continues. Changes in land use can have severe impacts on the health of our streams and Saratoga Lake.

**[Septic Tanks:](#)** Installation of new septic tanks in addition to improper maintenance relate to an increasing amount of leaks and water contamination.

**[Water Resources:](#)** Floods are amplified by impervious surfaces-such as parking lots-while water shortages are related to increasing demand for water and droughts.

**Stakeholders:** Organizations within the Saratoga Lake Watershed that are active in preserving the natural ecosystem.

WRI [\[1\]](#)

Saratoga PLAN [\[2\]](#)

Saratoga Lake Association [\[3\]](#)

Friends of the Kayaderosseras [\[4\]](#)

The Saratoga Lake Protection and Improvement District, Land to Lake Perspectives [\[5\]](#)

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## Appendix B

# Watershed



Photo of Saratoga Lake. Courtesy of Jonathan Betz

A watershed, also known as a drainage basin, is defined as an area of land that drains water into a particular body of water including a creek, river, lake, wetland, bay or groundwater aquifer.

Watersheds are dynamic and are unique to their geographical area. Mountain ranges, microclimates, and the latitude in which an ecosystem is found all impact the natural cycles in an area and the functions that a watershed can perform. They are complex webs of natural resources - soil, water, air, plants and animals. Watersheds are necessary to support habitat for plants and animals; they transport nutrients, filter waste naturally, provide drinking water as well as help regulate the local climate.

How we interact with our local ecosystem determines the health of the Saratoga watershed. Everyday activities can impact these resources, ultimately impacting the well-being and economic livelihood of the humans that live in the area, even if you do not live or work next to a body of water. Pollutants or runoff dumped on the ground will eventually find their way to a water route, carrying contamination throughout the larger environment and degrading ecosystems downstream.

The majority of information on this page is provided by Conor Taff's 2005 capstone [\[1\]](#).

## The Saratoga Lake Watershed

### Location



Location of the Saratoga Watershed and corresponding municipalities. Courtesy of Dante Petri

The Saratoga Watershed is part of the larger Hudson watershed and lays entirely within Saratoga County in New York state. The watershed stretches a 240 square mile area and covers thirteen municipalities: the Towns of Greenfield, Galway, Wilton, Stillwater, Saratoga, Providence, Milton, Malta, Corinth, Charlton, Ballston, the Village of Ballston Spa and the City of Saratoga Springs.

It cumulates in Saratoga Lake, a 5.8 square mile body of water primarily feed through Kayaderoseras Creek, which is subsequently feed by Glowegee Creek, Morning Kill, Gordon Creek, and Geyser Brook. Each of these waterways has its own watershed, which are sometimes referred to as "sub-watersheds" or "small watersheds" within the larger Saratoga watershed.

The Saratoga Watershed is part of the greater Hudson watershed. Saratoga Lake is connects to the Hudson via Fish Kill Creek.

## Geology & Land Use

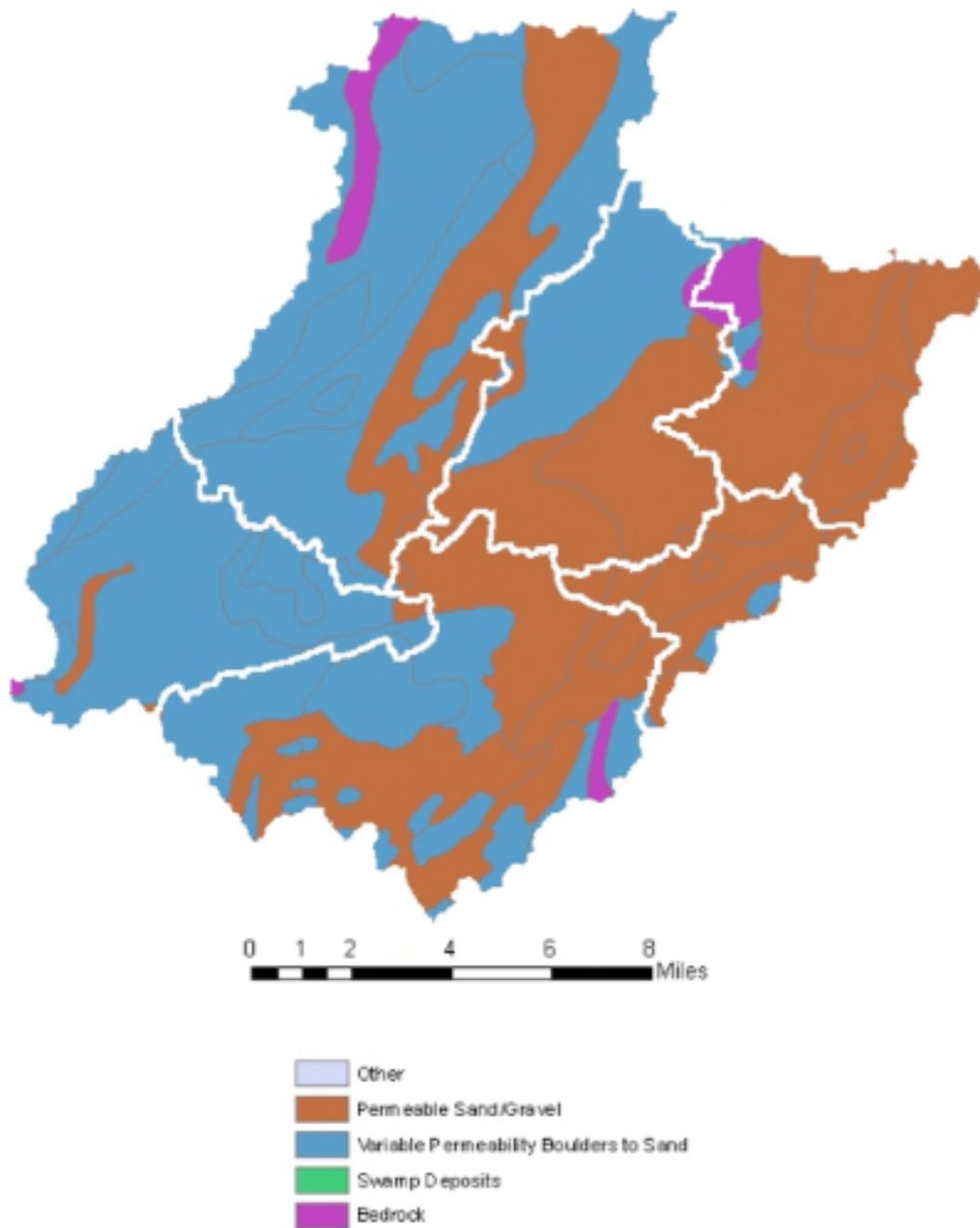
Geology is the science and study of the physical matter that constitutes the Earth. It dictates which natural resources are found in an area, how water moves underground, the prevalence of earthquakes, and how landscape shapes itself over the years. In all, geology can tell us the history of the Earth.

The Saratoga Lake Watershed straddles an interesting geological location. The north and west regions of the basin reach into the lower Adirondacks and are characterized by the bedrock geology of that region. The watershed is also characterized by a distinct north east trending fault which divides it. The eastern side is composed almost entirely of shale.

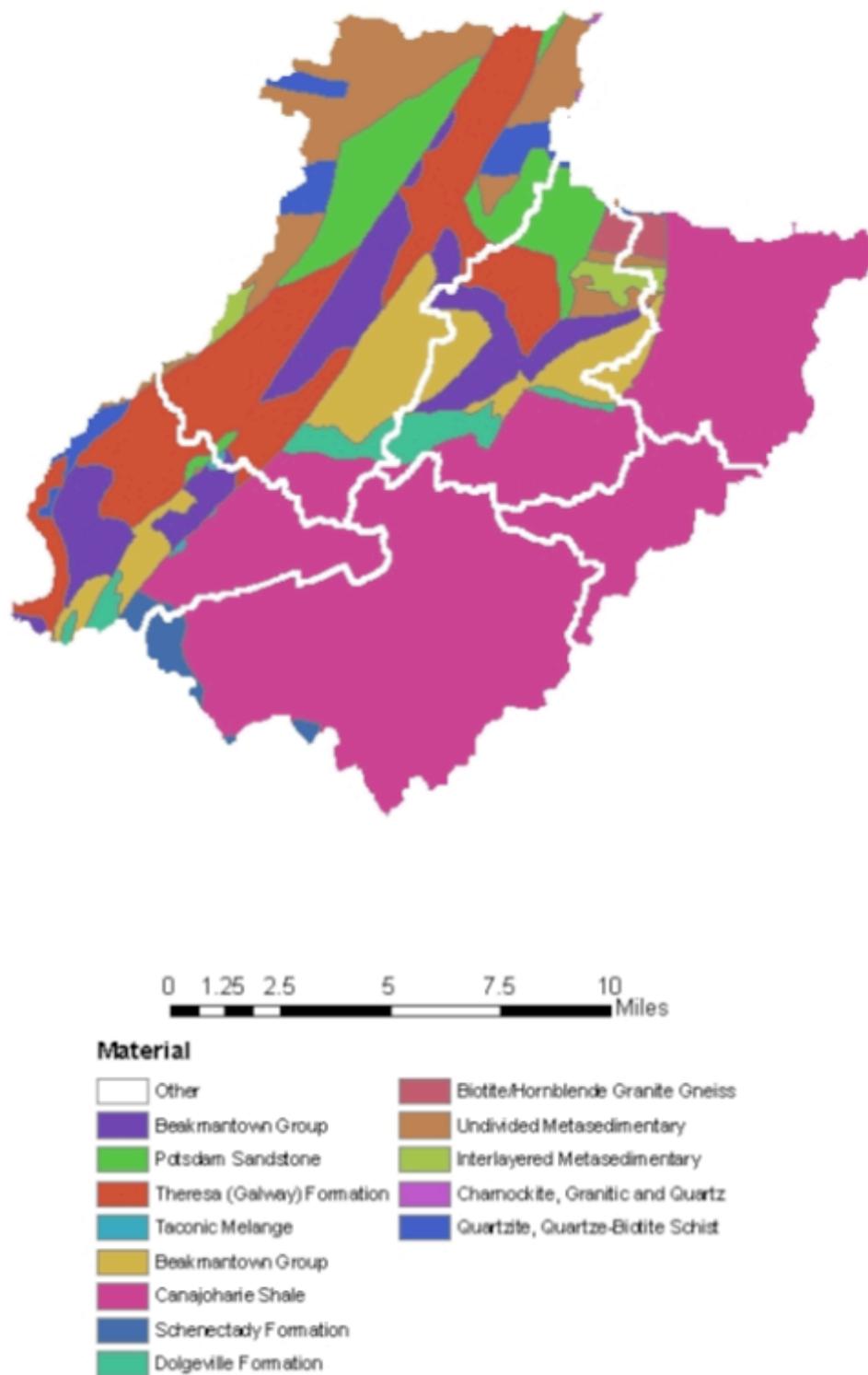
These characteristics of bedrock and surficial geology influence the drainage of the basin and alter the course of its streams. The underlying geology and mineral deposits are also the source of the famous mineral springs that draw tourists each summer. The physical nature of the land has shaped the opportunities for land use in the basin ever since settlement and has also influenced the impact that those land uses have on the environment.

Land use for the entire watershed is almost 70% forested. Agricultural practices make up 15% of the area while developed land contributes 9% and wetlands and water contribute 7%. The northern part of the watershed contains the highest percentage of forest. This is a hopeful sign for management of the watershed because this area encompasses the 10 headwaters of the Kayaderosseras and appears to be relatively free of pollutant sources. The Loughberry Lake sub-watershed contains the greatest amount of development due to the City of Saratoga Springs. Bedrock geology in the Kayaderosseras watershed is composed of 48% shale and 30% carbonate with all other categories of rock contributing less than 10% of the whole. Contact with carbonate containing rocks may provide an alkalinity buffer against acid rain.

Surficial geology shows the highest degree of variability across the sub-watersheds. The surficial geology of the entire watershed is characterized by 52% variable permeability and 45% permeable sand and gravel. The Glowegee sub-watershed has the highest amount of variable permeability material at 95% and the least permeable sand and gravel at 5%. In contrast, the Loughberry Lake sub-watershed has the lowest variable permeability material at 4% and the highest amount of permeable sand and gravel at 89%.



Surficial geology of the Saratoga Watershed. Courtesy of Conor Taff



Bedrock geology of the Saratoga Lake Watershed. Courtesy of Conor Taff

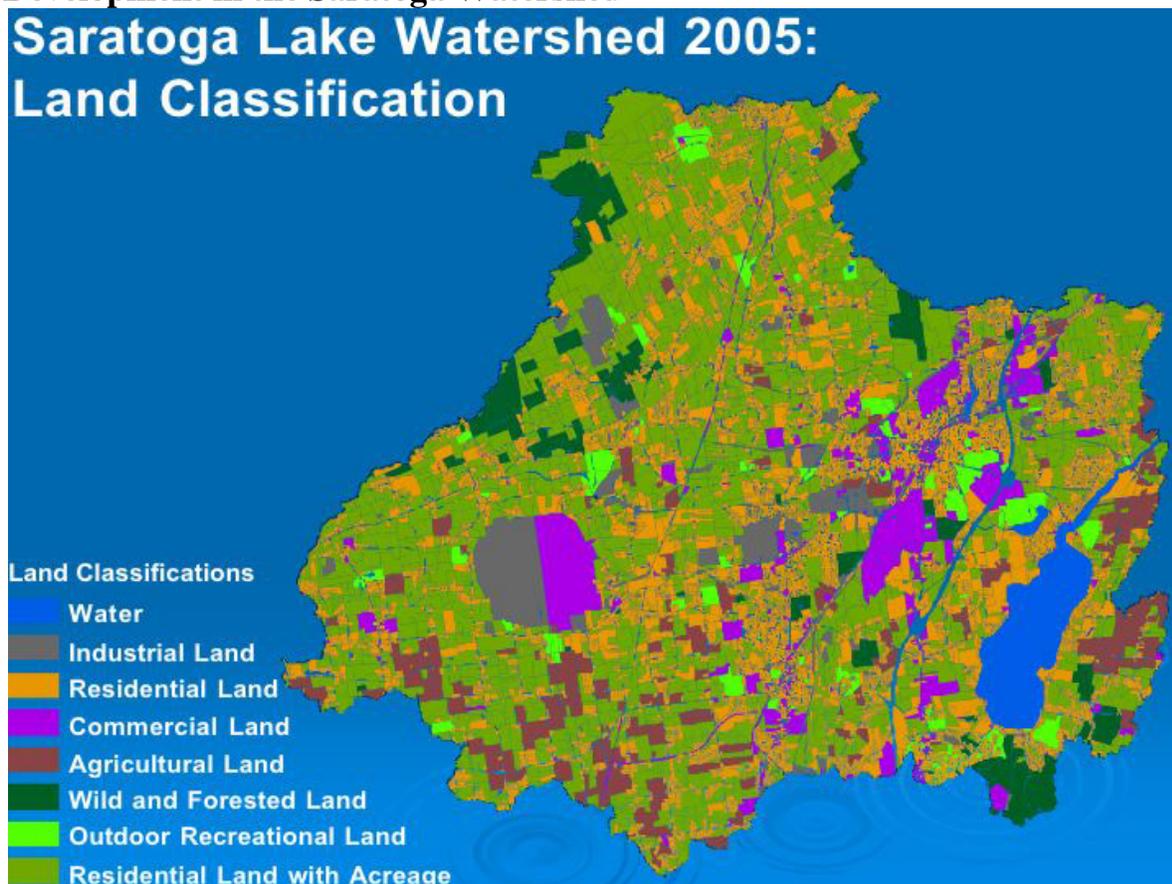
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## Appendix C

# Development and Impermeable Surfaces

Urbanization and development in an area such as the Saratoga Watershed can cause extensive harm to the health of an ecosystem. Aside from adding to the amount of waste and nutrients flowing into the lake, increased urbanization also decreases the watershed's ability to filter. Groundwater is a very effective buffer, and water that has flown through the soil is typically thoroughly cleansed. However, when you pave over the sand with concrete and asphalt to create a residential area, you are decreasing the amount of water that can infiltrate the ground. Instead, water flows along the surface and adds to stream discharge. Therefore, urbanization can be considered one of the main contributors to the increase in stream flow and decrease in groundwater flow seen over the past twenty years.

### Development in the Saratoga Watershed



Development in the Saratoga Watershed; Source: Cortland Toczykowski and Katie Bronson

### Potential Development in the Saratoga Lake Watershed

Environmental well-being relies heavily upon land development and zoning regulations. In a 2007 capstone by Betsy Quentin and Leigh Siegwarth entitled, "Potential Development in the Saratoga Lake Watershed," they explain how land use and population growth is directly correlated with the water quality in the Saratoga Lake Watershed.

#### Risks for Water Quality

1. *Impermeable Surfaces*: An increase of surfaces like rooftops and paved lots is an indicator of watershed health. Blacktop cover and concrete causes water to flow over the surface rather than as groundwater, allowing much more pollution to enter the watershed. A decrease in permeable land can also put the land at risk for floods. Experts studying

hurricane Katrina admit that had Louisiana been less over-developed, the impact of the flood would have been much milder.

2. *Types of Pollutants in the Watershed:* Construction site sediments, nutrients from fertilizers, and bacteria from animal waste, road salts, floating aquatic litter. Also metals like lead, zinc, copper, and calcium may be present in runoff making degradation even worse.
3. *Increased Development:* Development can increase local temperatures and in turn change climate as well. It also reduces riparian vegetation and degrades the riparian zone as a flood plain as well as a filter against nutrients and sediments. The watershed is given an increased number of sediments and nutrients, which can speed up the process of [eutrophication](#).

**Soulution:** Thoughtful Zoning Regulations!

### **Kayaderosseras Creek**

The Kayaderosseras Creek is a prime example of the fragility of water sources in Saratoga County. Increased commercial demands and use of the Kayaderosseras could pose a possible threat to both the environment and citizens of Saratoga County.



Kayaderosseras Creek; Source: [farm4.static.flickr.com](http://farm4.static.flickr.com)

Skidmore students James Caris and Laura Wittman wrote a capstone project in 2005 examining the land use patterns and point and nonpoint pollution trends at the Kayaderosseras Creek in Northwestern Saratoga County. This examination comes to the conclusion that the evolution of land use patterns is the first step in creating environmentally stable watershed policies. Development patterns and Pollution sources must be closely monitored in order to maintain water health. This healthy flow of water depends heavily on the pooling of ideas between citizens, watershed communities and local, state, and federal agencies.

### **Potential Dangers**

The Saratoga watershed, which covers approximately 490 square kilometers, was originally used for agricultural purposes. However, increased development pressure has led to increased use of forested land use and use of the watershed. According to The Land Trust of Saratoga Region (LTSR), Kayaderosseras is a highly erodible stream. The increased development in this fragile area has increased the potential for point and nonpoint source pollution.

The dangers are not specific to just the stream, however. The Kayaderosseras creek feeds directly into Saratoga Lake, a possible drinking source for Saratoga Springs.

- *Point Source Pollution:* Point source pollution is defined as a localized source of pollution. Despite existing environmental controls, three out of the four point source pollutants in the creek measured in 1983, still exist today. There are currently eight facilities that handle, use, or transport at least one toxic chemical in the water. Data from this particular capstone suggests that many of the industrial facilities in the Saratoga region handling hazardous materials increase proportionately with development.
- *Nonpoint Source Pollution:* The New York ECL defines Nonpoint pollution as, “any source of water pollution or pollutants which is not a discreet conveyance or point source” (ECL 1972 Appendix B) The Kayaderossera Creek is of interest because of the existence of land use types that contribute to nonpoint pollution.

### Pollution Policies

In order to protect both the environment and its inhabitants, several environmental policies were put in place that have proven to be significant for the healthy preservation of the Kayaderosseras Creek. After the Clean Water Act in 1972 (CWA), reducing point and non-point pollution became a national concern. The following regulations were implemented: National Discharge Elimination System (NPDES), the Environmental Conservation Law (ECL), the State Pollutant Discharge Elimination System (SPDES), the Toxic Release Inventory (TRI), and the Environmental Quality Review Act (SEQR). However, despite these policies, pollution of the water remains a pertinent issue that needs to be addressed.

### Saratoga Lake



Saratoga Lake; Source: Skidmore College Water Resources Initiative

Not only is the healthy preservation of Saratoga’s Water sources important, but so is the health of the local economy. The 2007 senior capstone project by Jon Clarke and Peter Suneson entitled, “Economic Impact of Recreation on Saratoga Lake and Threats to Its Long Term Vitality: The Perspective of Local Businesses” explores said balance between environment and economic capital in regards to Saratoga Lake.

### Recreation Economy

The recreation economy on Saratoga Lake is most affected by boating, regattas, and bass fishing. Based on calculations by Jon Clarke and Peter Sunenson, these industries generate about \$20.2 million . In addition to those activities, the three most affected local businesses are Allerdice Hardware Store, Barrymore’s Liquor Store, and Stewarts Markets. These three stores depend partially on recreational oriented customers for a total of \$1.58 million, annually.

### Environmental and Economic Concerns

The most common threats to the Saratoga Lake from the perspective of businesses in order from most to least are development, overuse, seasonal property owners, drinking water source, public access, governmental jurisdictions, reckless boat users, and water pollution. A whopping 100% of recreation-based businesses cite overdevelopment of Saratoga Lake as a major concern. However, only 38% of respondents believed that an up and coming drinking water plan was a problem. Regardless, most recreationally oriented businesses assert that a micro-chip plant will be built and that the Hudson River will have to be Saratoga's future water source.

### Land Conservation and Quality in the Saratoga Lake Watershed

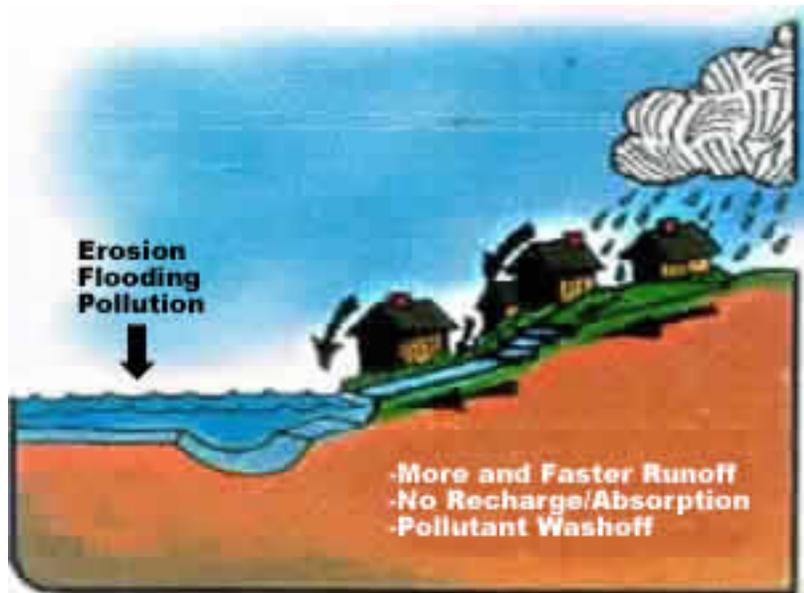
Land conservation has a potential impact on water quality within the Saratoga Lake Watershed. In a 2007 capstone by Doug Morin entitled, "Land Conservation and Quality in the Saratoga Lake Watershed," he comes to the conclusion that Saratoga water is unlikely to be in danger of degradation currently, but will require more extensive forest conservation to ensure it's quality in the wake of rapid development.

### Possible Dangers to Conservation and Water Quality

1. *Land Disturbing Activities*: such as agriculture and construction causes the addition of sediment to bodies of water. Runoff from agricultural lands can add nutrients, sediments, and toxic chemicals to water, and thereby reduce its quality.
2. *Urban Development*: runoff from urban development can cause runoff of nutrients and toxic chemicals to the water body. Increasing urbanization also leads to an increase of impervious surfaces like pavement and buildings. Impervious surfaces speed up runoff and causes more sediments, pollutants, and nutrients to be added to the water while increasing erosion and stream channel changes.



Source: cityofmenesha-wi.gov



Source: cityofmenesha-wi.gov

### Efforts to Mitigate Negative Effects

*Infiltration Ponds and Riparian Buffers:* These tools reduce water surges by absorbing some runoff and may even increase ground water infiltration. However, it cannot filter nutrients and toxins as much as natural vegetation can. Even though this proves helpful, riparian buffers and mitigation is less important for water quality than overall land use.

### Community and Water Needs

1. *Open Permeable Lands:* Even while not all open land spaces are valuable for preserving water quality (due to natural runoff) it is the most effective method for controlling the damages to water quality caused by urbanization.
2. *Biotic Communities:* Existing environmentally conscious communities must be protected for their value and services. This study defines conserved lands as, “those with permanent protection from conversion to human use and development, and management practices intended to preserve natural system functioning.”

### Present Water Quality of the Saratoga Lake Watershed and Future Predictions

After examining certain factors affecting the Saratoga lake Watershed, Doug Morin found that the current threat to water quality is low because of low urban land cover and high forest cover. These results indicate that the low level of urbanization and the high level of forestation means Saratoga water is not compromised on a watershed scale. However, Saratoga water quality is at high risk of degradation in the future. There is a high rate of urban growth (at the fastest growth rate in the county) and lack of conserved lands within the watershed.

### How to Protect the Saratoga Lake Watershed from Future Degradation

1. *Mitigation Efforts:* such as storm management, riparian vegetation, detention ponds, and infiltration ponds should be used.
2. *Forest Conservation:* To conserve forests from human development as disturbance the government can do things like turn the land into a national park or individuals and land trusts can increase the number of conservation easements.
3. *Private Property Restrictions:* In case previously owned land has not been conserved beforehand.
4. *Further Environmental Research!*

- This page was last modified on 6 May 2010, at 18:52.

## Appendix D

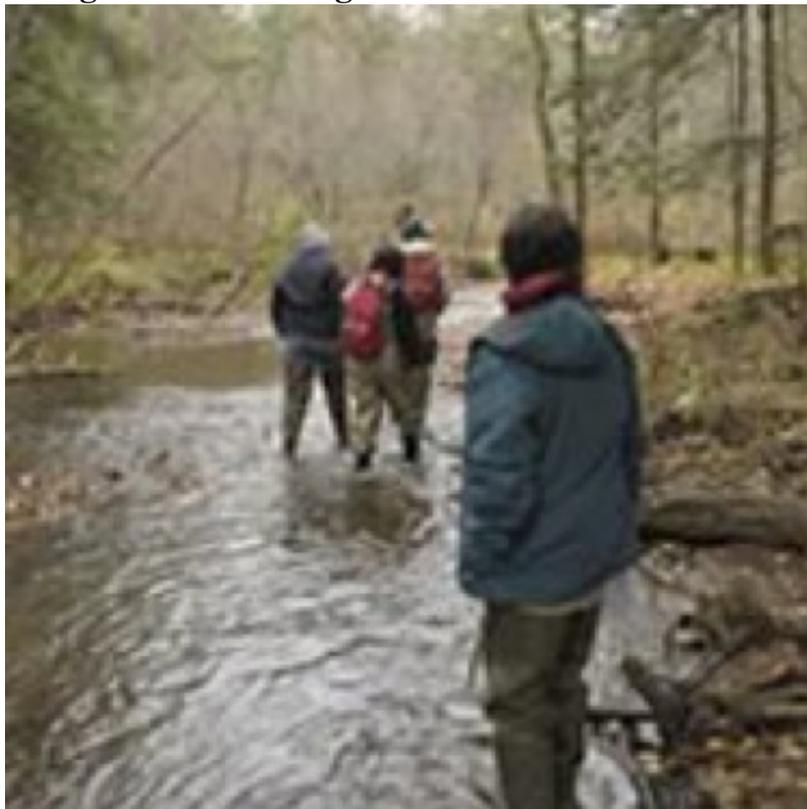
# Water Resources

### From Saratoga Water Awareness Network

Jump to: [navigation](#), [search](#)

The amount of water available to any given community is of vital importance. Not enough rain can lead to drought, whereas too much can lead to flooding. The abundance of rainfall a region receives is determined by the climate in the area. The Saratoga Watershed usually gets a healthy amount of rain per year, yet the threat of both drought and flooding is always a potential danger. As the climate changes worldwide, it is important to understand the implications either event would have on this region.

### Drought in the Saratoga Watershed



Source: Skidmore College Water Resources Initiative

Saratoga Springs is a region with an abundant rainfall average per year. New York State generally averages forty-two inches of rain per year, and Saratoga Springs usually gets an inch more than that annually. Yet, in Saratoga there are other factors that could potentially cause a shortage of water. According to Saratoga's Public Works officials, a drought could be caused by lack of precipitation, high levels of water consumption, and Loughberry Lake's reservoir storage ability. Skidmore students Andy Hart and Kate Stevens researched the likelihood and implications such a water shortage would have on the region in their capstone "What to Do About a Bout of Drought: Understanding Drought in a Water-Rich Region."

### Water Use and Population Growth

Saratoga is facing pressure from a growing population. From 1990-2006 there was a 14% increase in population, with 28,499 people in 2006. Undoubtedly, the busiest months of the year are May through September, when tourists and summer residents come to enjoy the racing season and warm weather. Yet this high increase in activity means that the city is pumping nearly double the amount of water than in winter. In August, the average is 159 million gallons being pumped. Water use has been increasing over the past six years, yet the city's water use has not

matched the population increase. Saratoga Springs faced a huge water shortage in 1964 due to lack of precipitation. If another such drought were to occur, twice as many people would be affected – at least 28,000 people would be left without water.

### Loughberry Lake's Reservoir Storage Ability

Loughberry Lake has a storage capacity of 260 million gallons of water, and any excess water generally flows into Saratoga Lake. Since it can only hold so much water, there is about 9,000 gallons for each resident. That number drops to 3,500 gallons per resident in the summer months. As a comparison, there is enough storage capacity in New York City for each resident to use 66,000 gallons of water. Since Loughberry Lake is so small, water shortage for the residents of Saratoga is a constant threat, despite the abundance of rainfall.

### Drought Management

There is no real long-term management plan in Saratoga to decrease the city's vulnerability to drought. In times of water stress, the Department of Public Works is notified of low water levels and certain actions are put in place. The Public Works has the right to implement restrictions on water use, which include unnecessary outdoor water usage such as watering lawns and sidewalks. Such actions could result in a fine of up to \$250,000, and have generally been effective. The Public Works Department has also taken action by approaching large water users such as Skidmore College and the Race Track. Skidmore has recently implemented measures to reduce their water consumption, such as installing low flow water technology. Yet if all else fails, there are a few supplementary water sources the city can utilize in times of water shortage. These include Bog Meadow Brook and the well fields at Interlaken and Geysers Crest.

### Floods



Flooding in Balston Spa, 1936; Source: Saratoga County Historical Society, Date Unknown  
 Flooding is an area of concern for many water-rich regions. The FEMA definition of flooding is “a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or two or more properties from the overflow of inland or tidal waters or the rapid accumulation of surface waters from any source.” They can be caused by heavy rainfall, thunderstorms, coastal storms, or snow thaws. Such natural hazards have the capacity to wreak havoc on nearby land and homes, and be economically devastating for affected communities.

Since Saratoga has a high amount of annual rainfall, it is important to understand what the risks are for floods in this region.

### Sources of Floods

According to the DMA 2000 Hazard Mitigation Plan for Saratoga County, this is the 23rd most vulnerable area for floods in the New York state. This is due in part to our connection to the Hudson River Basin and the Mohawk River Basin, both of which experience frequent floods. Tributaries from the Mohawk River have caused excess water inundation in streams within the Saratoga Watershed, including the Stony Creek, Mud Creek, Kayaderoseras Creek, Alplaus Kill, Balston Creek, and Dwaas Kill. According to the 1995 Flood Insurance Study, Saratoga County floods are principally caused by heavy spring rainfall, aggravated by snowmelt and ice jams. In the summer and fall, floods are usually caused by hurricanes and frontal storms.

### Highest Water Heights in Saratoga County

USGS Water Gauge		Hudson River at Hadley	Hudson River at Waterford	Sacandaga River at Sacandaga Reservoir	Sacandaga River at Stewarts Bridge
Flood Categories per Gauge	Major Flood Stage (ft):	19	37	774	12
	Moderate Flood Stage (ft):	17	35	773.5	11
	Flood Stage (ft):	14	34	773	10
	Action Stage (ft):	8.5	33	768	8
Historical Crests		23.00 ft on 03/27/1913	36.38 ft on 05/30/1984	773.55 ft on 04/21/2008	12.36 ft on 03/28/1913
		21.21 ft on 01/01/1949	35.59 ft on 05/04/1983	773.53 ft on 06/30/2006	9.68 ft on 05/04/1983
		19.71 ft on 04/12/1922	34.76 ft on 05/13/1996	773.29 ft on 05/04/1983	9.54 ft on 07/01/1968
		19.59 ft on 03/18/1936	34.38 ft on 05/22/1990	772.11 ft on 05/22/1990	9.37 ft on 04/28/1993
		17.49 ft on 04/02/1976	34.36 ft on 04/23/1993	771.26 ft on 04/26/1993	9.32 ft on 05/23/1990
		17.32 ft on 06/04/1947	34.15 ft on 12/02/1996	770.52 ft on 05/14/1989	9.15 ft on 04/26/1977
		17.08 ft on 01/10/1998	33.93 ft on 04/17/1994	770.32 ft on 05/14/1996	9.15 ft on 04/01/1976
		16.68 ft on 03/28/1953	33.70 ft on 11/11/1990	770.17 ft on 05/06/1997	8.84 ft on 10/01/1986
		16.14 ft on 05/05/1972	33.70 ft on 05/07/1989	769.81 ft on 05/06/1992	8.75 ft on 05/10/1989
		-	-	769.15 ft on 05/02/1994	8.71 ft on 06/24/1972

AHPS Water Gauges in Saratoga County; Source: DMA 2000 Water Mitigation Plan, Saratoga County, NY, 2009

### Management

There is some flood protection provided for Saratoga County by dams in the Great Sacandaga Lake and Indian Lake. There are several dams in other water bodies, yet many, including those in the Mohawk River Basin, don't provide flood control. According to the FIS, the town within the Saratoga Watershed that is at the most significant risk for flooding is the Village of Waterford, due to its position along the convergence of the Erie and Champlain Canals, as well as its proximity to the Mohawk and Hudson Rivers. In 2002 the government enacted the National Flood Insurance Program (NFIP), which is comprised of three main components: flood insurance, floodplain management, and flood hazard mapping. Communities that choose to participate in this plan receive flood insurance for homeowners, renters, and business owners. In Saratoga County, all but two municipalities are a part of this NFIP plan. The towns without insurance are the Town of Edinburgh and the Village of Galway (DMA, 2009).

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## Appendix E

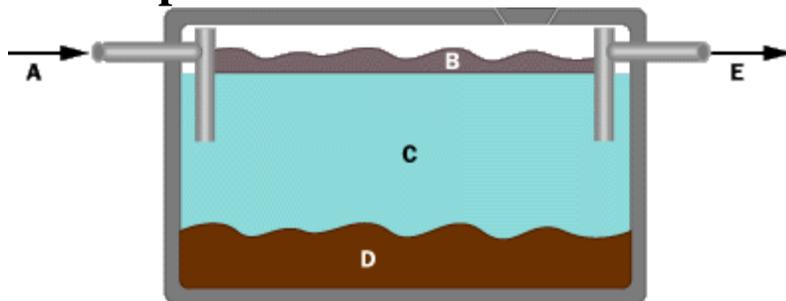
# Septic Tanks

Septic tanks, also known as onsite wastewater treatment systems, onsite sewage disposal systems, or wastewater infiltration systems, are an effective means of treating wastewater of a household or development in an unsewered area (U.S. Environmental Protection Agency Office of Water Office of Research and Development 2003: 7).

While septic systems are a safe alternative to sewer lines for treating a residence's effluent, they have the potential to seriously impact the health of the [watershed](#) if not properly maintained. They are prone to failure and may leak diseases and unwanted nutrients into wells, streams, and lakes.

The majority of information on this page is provided by Dante Petri's 2008 capstone [\[1\]](#). Additional sources are six anonymous interviews conducted with septic cleaning agencies within the Saratoga Lake Watershed in Spring 2010. A link to the questions asked during the interviews and the full works cited are provided on the [About](#) page under the "Information within SWAN" subheading.

## How Septic Tanks Work



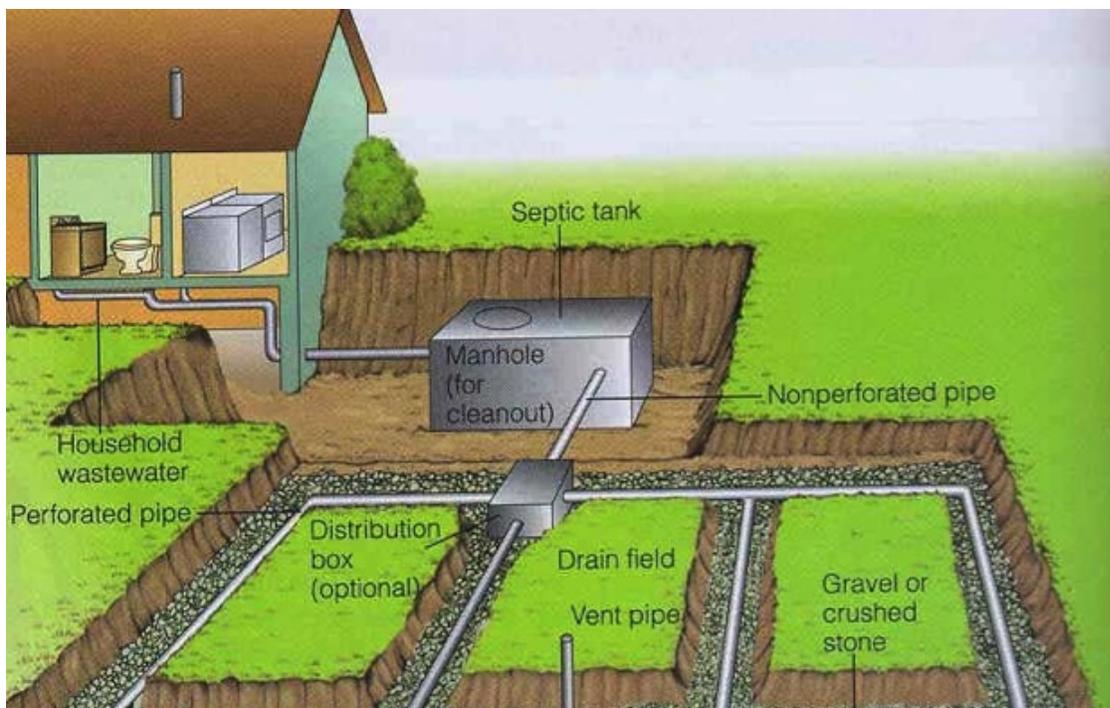
Septic Tank Diagram. Shows the 3 layers within a septic tank. A-Wastewater in. B-Scum Layer. C-Water. D-Sludge Layer. E-Moving to Drain Field. Courtesy of Marshall Brain

In essence, a septic tank is a large concrete or steel tank buried in the yard for the purpose of holding and treating waste. A tank can hold up to 1,000 gallons (4,000 liters) of water. Wastewater flows into the tank at one end and leaves the tank at the other. Anything that floats rises to the top of the tank and forms a layer known as the scum layer. Anything heavier than water sinks to form the sludge layer. In the middle is a fairly clear water layer. This body of water contains bacteria and chemicals like nitrogen and phosphorous that act as fertilizers, but it is largely free of solids.

A septic tank naturally produces gases caused by the bacteria breaking down the organic material in the wastewater. Sinks therefore have loops of pipe called P-traps that hold water in the lower loop and block the gases from flowing back into the house.

As new water enters the tank, it displaces the water that's already there. This water flows out of the septic tank and into a drain field. A drain field is made of perforated pipes buried in trenches filled with gravel. A typical drain field pipe is 4 inches in diameter and is buried in a trench that is 4 to 6 feet deep and 2 feet wide. The gravel fills the bottom 2 to 3 feet of the trench and dirt covers the gravel.

The water is slowly absorbed and filtered by the ground in the drain field. The size of the drain field is determined by how well the ground absorbs water. In places where the ground is hard clay that absorbs water very slowly, the drain field has to be much bigger.



Septic System Diagram. Shows the flow of wastewater through a conventional septic system. Courtesy of Dante Petri

A septic system is normally powered by nothing but gravity. Water flows down from the house to the tank, and down from the tank to the drain field. It is a completely passive system.

## Environmental and Homeowner Impact

The potential impact of pollutants on the health of the watershed is dependent on where they are being released. While all pollutants will eventually find their way to waterways, there is a greater immediate impact in areas where the density of septic systems is concentrated, systems are installed close to streams and lakes or in areas with a high water table, and where tanks are installed on unsuitable soils.

All septic tanks have a limited lifespan. As treated waste is released to the soil, it slowly reduces the soil's ability to filter and clean the remaining nutrients in the wastewater. The average system can only remove 28% of nitrogen and 57% of phosphorus from wastewater. These two nutrients have a negative impact on land and water quality in excessive amounts, [eutrophing](#) waterways and poisoning the soil (SMRC).

It is estimated that 10-15% of all septic systems are visibly failing (EPA 2004). Visibly failing systems are easy to identify because of their tell tale odor and back-up events. In this scenario, systems are releasing raw sewage into the environment.

Another type of failure is treatment failure: when the system is no longer properly treating sewage and may be releasing the untreated sludge into the surrounding area. There is no visible way to spot treatment failure and may happen unbeknown to residents. Currently, 40% of all septic tanks have treatment failure. This means that most systems in the watershed have reduced treatment capabilities, raising their potential to impact ecosystem health. Contractors framed system failure as issues occurring due to poor maintenance habits on the part of homeowners as a large percent of septic tank owners do not schedule regular checkups. Poor maintenance is mostly due to the fact that septic tanks are underground, promoting an out of sight, out of mind state of mind. If they are not causing obvious problems such as smell and/or backing up into the home, they are unlikely to receive proper attention. Other causes of failure include damage due to use of heavy machinery on the [leachfield](#) or above the pipes that connect to the home. Plants other than shallow root plants can harm the system. Even parking a car over a system can destroy tank parts and render the system less effective.

## Proper Maintenance



Maintenance of a septic tank. Courtesy of Dante Petri

Once constructed, the long term effectiveness of the system is dependent on the homeowner. It requires proper maintenance to prevent leakage and pollute the landscape.

To keep a septic system functioning properly, the tank must be pumped out every two to five years, or more frequently if necessary. Failure to do so will cause sludge and scum to escape the tank and enter the [leachfield](#) and form a thick biomat over the visible area. An excess of amount of biomat causes the system to “back-up” or “blow out.”. A backup results in wastewater backing up into the home via the drain pipes. Blowouts occur when wastewater forces its way out of the tank and into the soil and is sometimes visible in surface pooling.

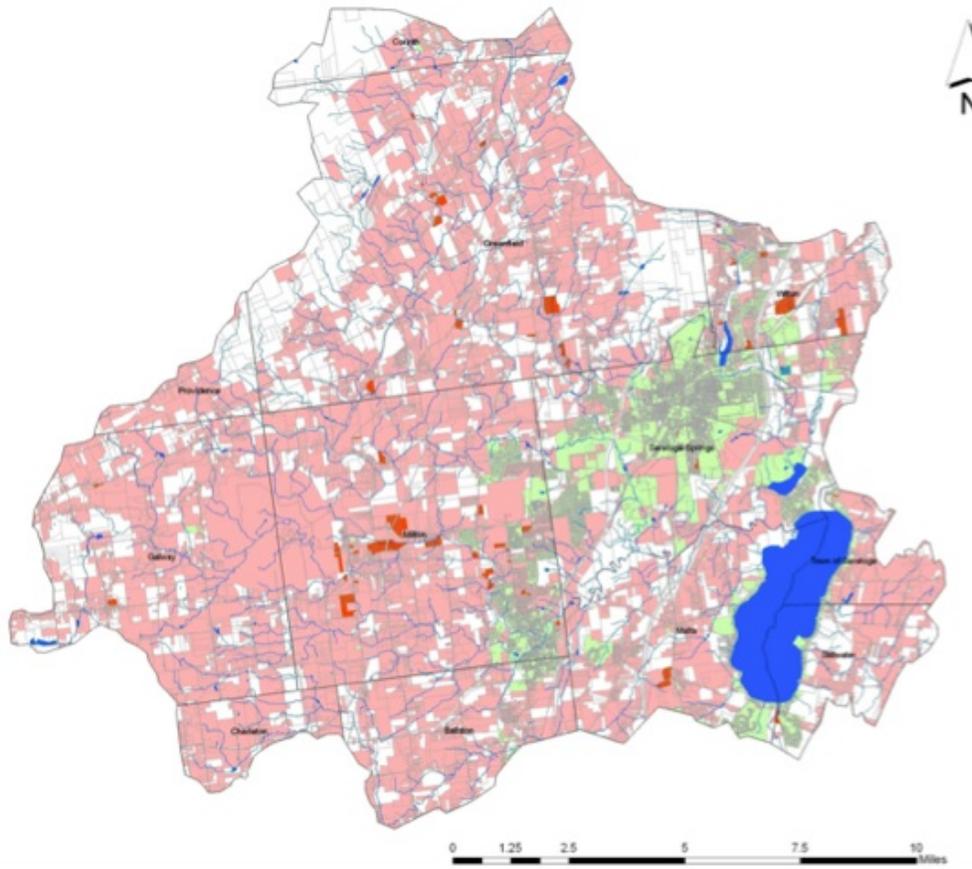
Most homeowners go 5-20 years between checkups even though the average lifespan of a tank is 15-25 years. If properly maintained, contractors say that the lifespan of a tank could double to around 40 years.

The cost of replacing a system costs around \$5,000, however, that price may increase to as much as \$50,000 depending on if the area is suited for one. Maintenance costs approximately \$100-200 per pump out in the Saratoga Lake Watershed, matching national averages.

**It is less expensive to pay the cost of proper maintenance than waiting for a blowout**, but many owners remain unaware.

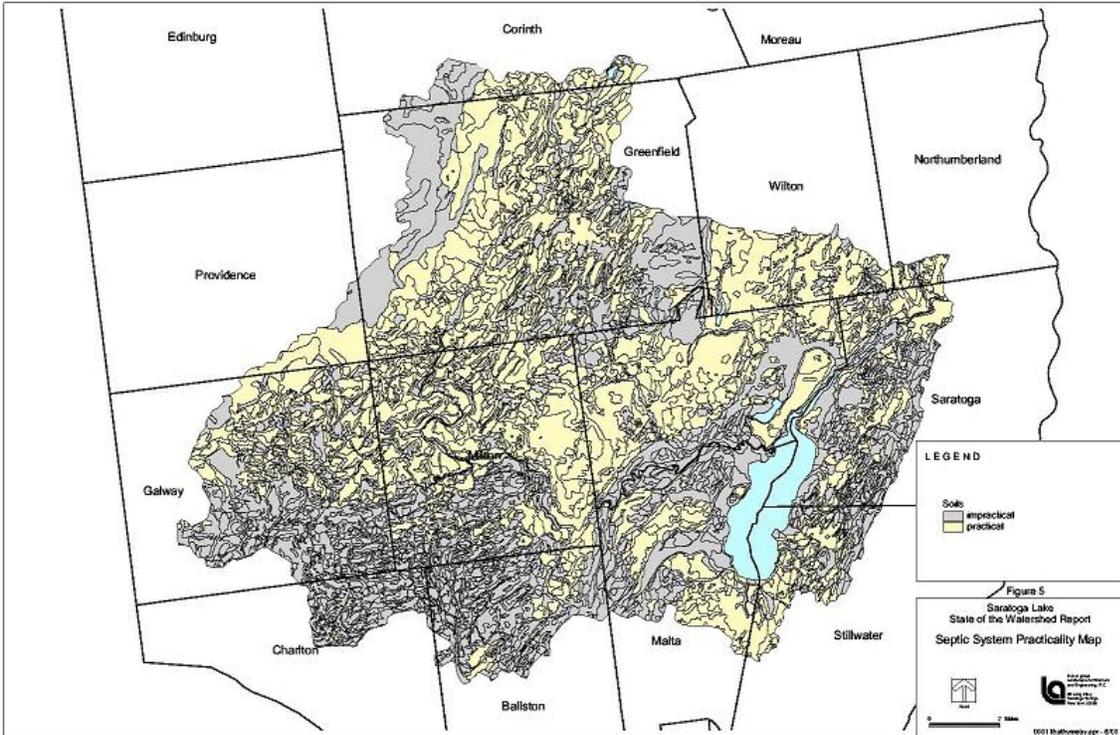
## Septic Systems in the Saratoga Lake Watershed

With a fast growing population in Saratoga County (Census. 1970 1990 and 2000), the watershed is impacted by the environmental challenges associated with sprawl. This includes the heavy reliance on septic systems to treat waste from homes and developments lacking access to a public or private sewer system. There are an estimated 10,000 septic systems in the watershed as of 2008 and new homes constructed in the area without access to sewers must incorporate a septic system.



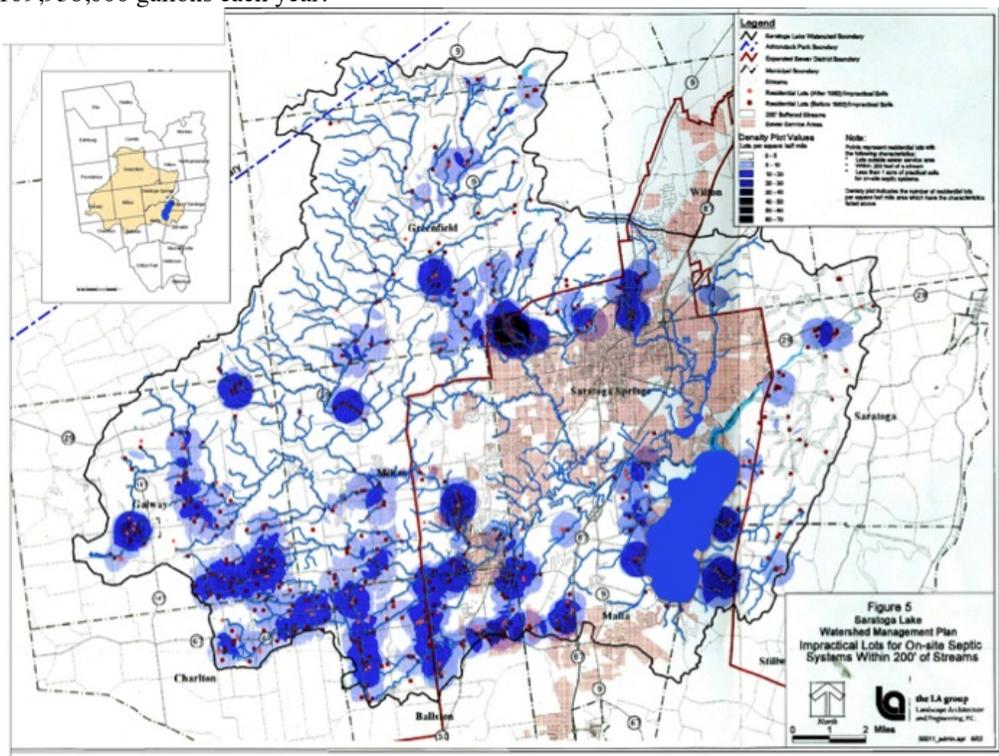
Current Locations of Septic System Map for the Saratoga Lake Watershed. Green indicates sewered areas. Light Pink indicates areas slated for septic systems. Orange indicates mobile parks. Courtesy of Dante Petri

Approximately 500-1,000 septic systems are maintained per year in the Saratoga Lake Watershed. This implies that only 5-10% of the estimated 10,000 systems see yearly maintenance. Around 60-80% of the pump outs septic service companies perform are "emergency" or "semi-emergencies" where the tanks have reached capacity and in danger of backing up into homes. Only 10-15% of the pumpouts could be considered scheduled maintenance, suggesting only 50-150 tanks out of 10,000 see bi or triennial maintenance.



Septic System Practicality Map for the Saratoga Lake Watershed. Yellow indicates suitable geology for septic tank installation. Grey indicates impractical locations. Taken from land to lake perspectives [www.sara-lake.org]

Of the approximately 10,000 septic tanks in the watershed, and estimated 1,500 are currently visible failing. That correlates to 301,200 gallons of raw sewage being released into the Saratoga Lake Watershed every day or 109,938,000 gallons each year.



Areas of Potential Septic System Failure Map. This map illustrates what systems may have the greatest impact on watershed health. The blue hot spots show high concentrations of septic systems located in unpractical soils within 200 feet of a stream. The red dots you see are developments constructed prior to 1980, the pink afterwards. Older systems, or systems in unpractical soils are the most likely to cause negative impacts. Created by the LA group as part of the Lands to Lakes Perspective in 2002. Courtesy of Dante Petri

## **Tips for Maintaining a Septic System**

- Schedule regular check ups every two to five years with a qualified technician to minimize treatment failure
  - Be careful whom you hire to clean or install a system - New York state does not require contractors and installers to have a license to maintain tanks
  - Do not park cars or any heavy machinery over pipes or system
  - Only plant vegetation with shallow root systems over the leach field and pipes
  - Keep an eye out for dieing grass or vegetation above the leach field - this may be a sign of treatment failure
  - If available, connect to a public or private sewer line
- 
- This page was last modified on 7 May 2010, at 13:34.

## Appendix F

### **Interview questions asked by SWAN to anonymous septic cleaning agencies within the Saratoga Lake Watershed-Spring 2010**

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Which municipalities in the area do you service most? How many homes in each?

How many septic tanks do you empty every week? How many trucks does this amount to? How many gallons can a truck hold?

How much do you charge to empty a tank?

About how often should septic tanks be emptied, serviced, repaired, and inspected? How long is the average lifespan of a tank?

How does a tank's age impact the maintenance it needs? Does age affect its functionality?

About how many septic tanks do you repair in a year? About how many do you think leak per year?

In what town do you find the highest percentage of leaky systems?

Are there any environmental conditions that make a septic tank more susceptible to leakage?

How easy is it for an inspector to spot treatment failure?

How aware can a homeowner be if their septic tank is leaking? Are there any obvious signs?

How much does cleaning up a leaking tank cost?

What action should a septic tank owner perform to maintain a well performing tank? What percentage of homeowners do you find maintain their septic tanks properly?

What additional information would change behavior towards septic tanks? Who needs to learn it?

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- This page was last modified on 7 May 2010, at 13:55.

## Appendix H

### About

Water is used globally for drinking, washing, cooking, irrigating crops, and other life-sustaining tasks. Many people also enjoy the opportunity for recreation that lakes and streams provide due to their beauty and for the prospects of boating, fishing and swimming. Watersheds are necessary to support habitat for plants and animals; they transport nutrients, filter waste naturally, regulate microclimates, as well as promote biodiversity. The quality of life as we know it depends on water. With so much dependence on water, it is crucial to understand how land use in the watershed impacts local bodies of water - and subsequently people's drinking water.

Awareness of the global importance of preserving water for ecosystem services has only recently emerged during the 20th century as more than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems (Hoekstra, 2006). With less than one percent of the world's freshwater readily accessible and located in the lakes, rivers and streams that cross populated continents, uncontaminated fresh water is becoming an increasingly threatened resource (Hoekstra, 2006).

### The Saratoga Watershed Awareness Network (SWAN)

#### Purpose of SWAN

The purpose of SWAN is to design an easily accessible educational tool for Saratoga Lake Watershed residents that promotes awareness about the watershed and how threats to it, mainly human action, impact the quality and beauty of the Saratoga region. It is intended to be a unbiased and nonpolitical affiliated website that serves the community by providing condensed and clear cut information provided within, but not limited to, Skidmore students' Environmental Studies capstones.

#### Origins of SWAN

The Saratoga Watershed Awareness Network was created in the Spring of 2010 by Mel Ausanka-Cruces and Stephanie Mcgurk for the purpose of fulfilling their Environmental Studies senior capstone requirement at Skidmore College. Both students were guided to the idea of forming an educational website by Karen Kellogg, current Director of the Environmental Studies Program. Josh Ness, Assistant Professor of the Biology Department, assisted Stephanie and Mel with the creation and content of SWAN. The concept of designing such a resource first originated from Bob Jones, Chair of the Economics Department at Skidmore College and affiliated faculty member of the Environmental Studies Program.

SWAN is loosely based off of the Chesapeake Bay Program<sup>[1]</sup>, which is a regional partnership that has lead and directed the restoration of the Chesapeake Bay since the 1980s. The Chesapeake Bay was the nation's first estuary targeted by Congress for restoration and protection. Bay Program partners, which include multiple states and federal agencies, have signed several agreements to reduce pollution and have worked together to spread information about the Bay to concerned citizens.

The synthesis paper that Mel and Stephanie created to synthesis their project can be found here:

[File:Final Capstone SWAN.pdf](#)

Created by Mel Ausanka-Cruces and Stephanie Mcgurk. Spring 2010

#### Information within SWAN

The majority of facts and figures within SWAN come from capstones from Environmental Studies alumni<sup>[2]</sup>, however, multiple resources have been utilized to provide a more complete picture of the current and future state of the Saratoga Lake Watershed. A complete [works cited](#) page is provided as well as the [interview questions](#) asked to eight anonymous septic cleaning companies that provided crucial details for the [Septic Tanks](#) page.

#### List of Site Managers

Mel Ausanka-Cruces (Head Site Manager) - Created [Main Page](#), [About Page](#), [Septic Tanks](#) Page, and [Watershed](#) Page

Stephanie Mcgurk (Head Site Manager) - Created [Water Resources](#) Page and [Development and Impermeable Surfaces](#) Page

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For rights to modify SWAN please email **Josh Ness** at [jness@skidmore.edu](mailto:jness@skidmore.edu) or **Karen Kellogg** at [kkellogg@skidmore.edu](mailto:kkellogg@skidmore.edu)

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