

Katherine Burgos
April 16, 2012

Potential Landfill Leachate runoff into Seneca Lake

Introduction

The oldest forms of waste disposal are landfills and dumps. Unfortunately there are a lot of problems associated with the use of landfills and dumps. Water contamination due to liquid waste runoff causes a number of environmental problems and health issues, acid rain is associated with landfill runoff and toxic waste. Landfills were a big problem before 1980 before regulations were implied, there is a possibility that the same landfill runoff and toxic waste that was released into the groundwater system many years ago may still be accountable for current groundwater contamination. It is important to check the groundwater on the Seneca Lake watershed for possible toxic waste and landfill waste because reports from the inactive landfills have linked landfills to groundwater contamination, which can affect Seneca Lake's water quality. This is an issue because Seneca Lake is used for drinking water by many towns on the watershed.

History

For many years waste disposal was never thought to be an issue, it was normal to dispose of waste in wetlands, streams and lakes. It was not until the 1970's when the New York State Department of Environmental Conservation (NYSDEC) began regulating the dumps on the Seneca Lake watershed. Landfills were now limited by the NYSDEC on what type of waste they were able to accept. Operating the landfills became very expensive after the new regulations implemented by the NYSDEC, by the

1980's many landfills had to be closed down because they were unable to compete with the new regulations (GFLRPC). After these landfills were abandoned many were considered Hazardous waste sites. Hazardous waste is anything that is flammable, unstable or toxic. Many of the closed landfills were believed to have had hazardous waste dumped before the NYSDEC began the regulations. As a result, New York State was forced to evaluate each site and give it a classification code depending on how poorly it was closed. The Environmental Conservation Law describes the each hazardous waste site classification, the highest level being the most toxic. Sites with a classification code 1 require immediate action because they pose a threat to the environment and cause irreparable damage to both the environment and public health. A site with a classification code of 5 represent a site that is properly closed and there is no evidence of hazardous waste at that site.

Landfills

Similar to the hazardous waste site classification, landfills have their own form of site ranking. The purpose of landfill site ranking, just like hazardous waste site classification, is to identify the sites that leak because those sites are potential threats to human health. There are three major categories in the site raking process, first is contaminant generation, then contaminant transport and finally receiving waterbody. Contaminant generation focuses on the heavy metals and organic compounds that were once dumped in the landfills, and how this can create liquid landfill runoff called leachate. Groundwater flow and surface water flow are important in the next category, contaminant transport, which aids leachate spread, this category focuses on slope and distance to a waterbody. The last category is receiving waterbody, looking at figure 1 it

is obvious that Seneca Lake is the receiving waterbody for the hazardous waste released by the inactive landfills. For this project I chose to focus on five inactive landfills on the Seneca Lake watershed, from the five landfills in my project three of them were classified as hazardous waste sites, those landfills are located on Catherine creek, Geneva and long point sub-watershed. Hazardous waste sites cause environmental problems, acid rain and water pollution are some of these problems which can alter aquatic life. Sites that rank high are required to have water quality tested, a site that ranks high means that the site has a small distance to the waterbody and also the site must be open and uncover, which promotes leachate production and transport into the waterbody.

Leachate

Landfill leachate is an environmental threat because it pollutes groundwater. In order to detect leachate runoff a soil core test is required because otherwise it goes unnoticed (Mor, Ravindra). The inactive landfills on the Seneca Lake watershed were not built in order to prevent leachate percolation because leachate problems were not premeditated, many of the landfills around the Seneca Lake watershed did in fact suffer leachate problems shortly after closing. Once the NYSDEC began landfill regulations it became mandatory for new and expanding landfills to have a plastic or rubber liner that would help prevent the percolation of leachate into the soil and eventually into groundwater.

Seneca Lake contamination

Before the DEC began implementing the new regulations on landfills Seneca Lake had 20 active landfills around the watershed, currently there are only two active landfills around the watershed. I chose to focus on five landfills that were shut down by the mid 1980's, the majority of these landfills were municipal waste dumps and only one was an open dump for heavy metals. Two of the landfills I chose, located on the Seneca County, Mill creek and Wilcox creek, reported leachate problems in the 1980's. The landfill on the Wilcox creek sub-watershed has a shorter distance to Seneca Lake, when this landfill was evaluated by the site ranking classification it had a medium overall pollution potential rank, which includes groundwater and surface water, while the landfill on the Mill creek watershed had a low overall rank. The next three landfill sites I focus on are classified as hazardous waste sites, these sites were also ranked for pollution potential. The data from the Genesee/Finger Lakes Regional Planning Council indicated that the Long point landfill in Yates County had a medium overall rank, the data also links this site to groundwater contamination. The town of Geneva in Ontario County and the town of Dix in Schuyler County both had a high overall rank. Data proves that the Geneva dump is responsible for ground and surface contamination, also the Schuyler county dump reported heavy metal in soil and surface water.

Seneca Lake contamination through landfill leachate requires slope involvement for contaminant transportation. In order to determine if the landfills were located in an area of high elevation, which is advantageous to contaminant transportation, I needed to create a map that shows the different elevation levels on the watershed. The map of Seneca Lake watershed elevation can be found in figure 2, the map demonstrates that in the northern part of the watershed elevation is fairly low and as you travel farther

south elevation increases. The landfills in Catherine Creek and Mill Creek sub-watershed were located in higher elevations on the watershed, whereas the other three landfills were located in lower elevations. The two landfills that were located in the higher elevations had problems with leachate runoff, groundwater is directly affected by leachate runoff, and the landfill in Catherine Creek poses a high risk for leachate runoff contaminating Seneca Lake.

The center for energy studies in the Indian Institute of Technology studied groundwater contamination due to landfill leachate. The landfills used in this study are not lined, meaning the percolation of leachate into the soil is very common. The results of this study, from the groundwater monitoring, indicated that landfill leachate is affecting groundwater quality in the areas surrounding the landfills. The Seneca Lake watershed once had many unlined landfills, which were shut down because of leachate issue, these landfills pose the same threat to groundwater on the watershed that the landfills monitored by the Indian Institute of Technology had.

Alternatives

Since the late 1980's the number of landfills has declined immensely, waste disposal alternatives have some contribution to the rapid decrease of landfills (figure 3). The main three waste disposal alternatives are composting, incineration and the three R's, which are reuse, reduce and recycle (Halfman 2009). Similar to landfill leachate the landfill alternatives also have their own downfalls, for example, incineration causes air pollution with the release of toxic ash, which contributes to global warming because of the carbon dioxide release, incineration also can cause uncontrolled fires and acid rain.

Recycling is a waste disposal alternative that is a bit more environmentally friendly, there are a number of positives attached to recycling, it saves energy and reduces pollution inputs into the environment. Recycling is imperfect as well, certain recycled material degrade the quality when they are reprocessed, paper and steel are two materials that cause problems for the recycling alternative.

What can be done to investigate and remediate the problem?

The regulations implemented by the NYSDEC in the 1970's forced all new and expanding landfills to incorporate a liner that will stop leachate percolation. This will be beneficial in the long run because pollution problems due to landfill leachate runoff will not be such an issue in the near future. Currently there is a lack of data that monitors groundwater, in order to investigate the potential pollution of Seneca Lake because of landfill leachate groundwater needs to be monitored. Groundwater has a longer residence time than lakes, Seneca Lake has a residence time of 18 years (Halfman 2011), the groundwater that was once contaminated by landfill leachate might be flowing into the lake at this time. Monitoring both groundwater and surface water is a great way to begin pollution investigations, with more data on this issue we can determine a form of remediation.

Conclusion

Data proving groundwater contamination due to landfill leachate is abundant. Leachate percolates into the groundwater and eventually flows into surface water, there are many streams around the Seneca Lake watershed that drain into Seneca Lake and there is a high possibility that the water draining into Seneca Lake is contaminated with

landfill pollution. With the help of the NYSDEC regulations leachate prevention and treatment remediate the production and release of new leachate, the problem of past leachate in the groundwater system may still be a major issue. Landfill leachate poses a threat to water quality and also human health, since Seneca Lake is important for both drinking water and fishing. With a number of abandoned landfills on the watershed, for which many classify as hazardous waste sites, pollution potential from leachate runoff is very high.

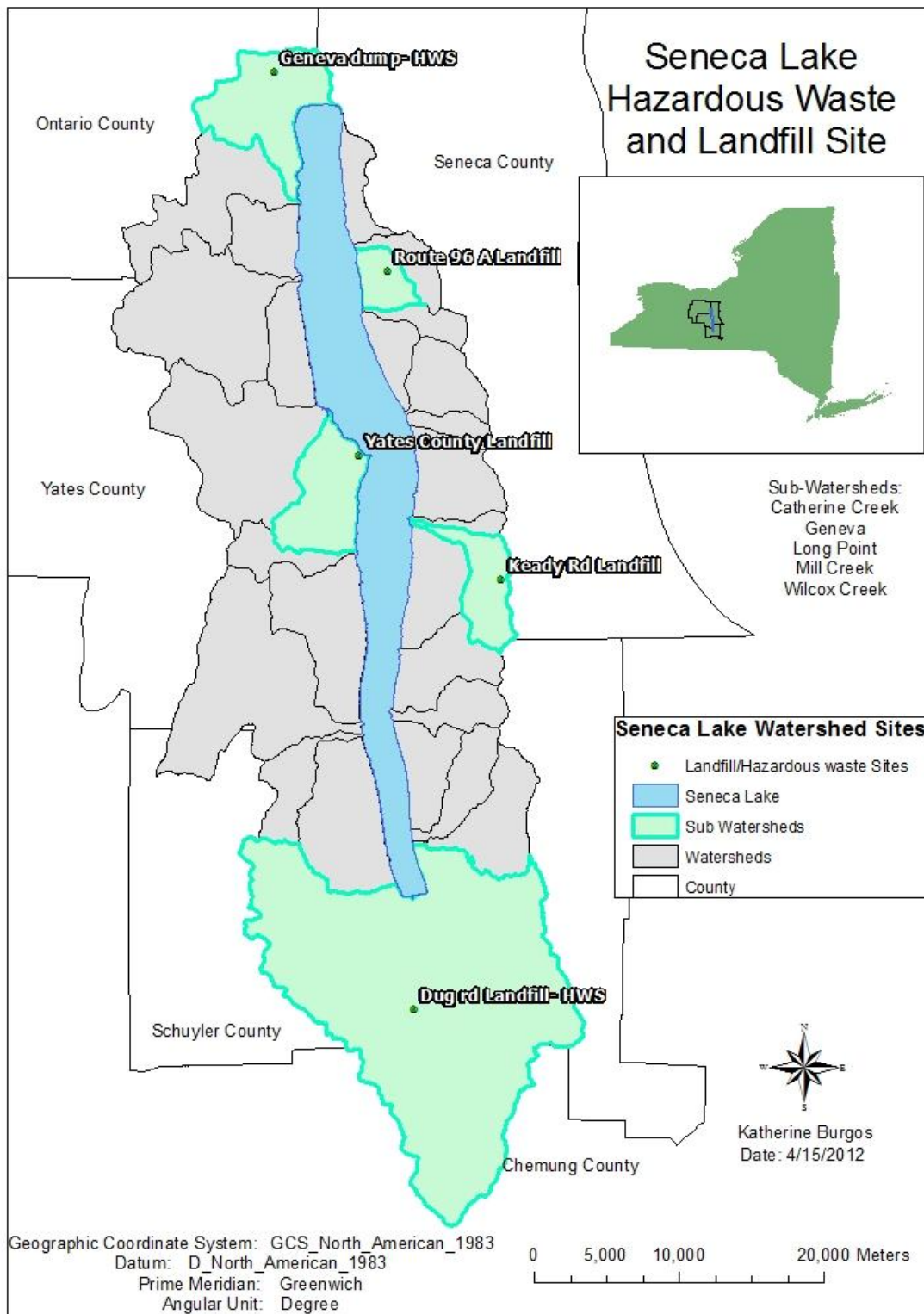


Figure 1

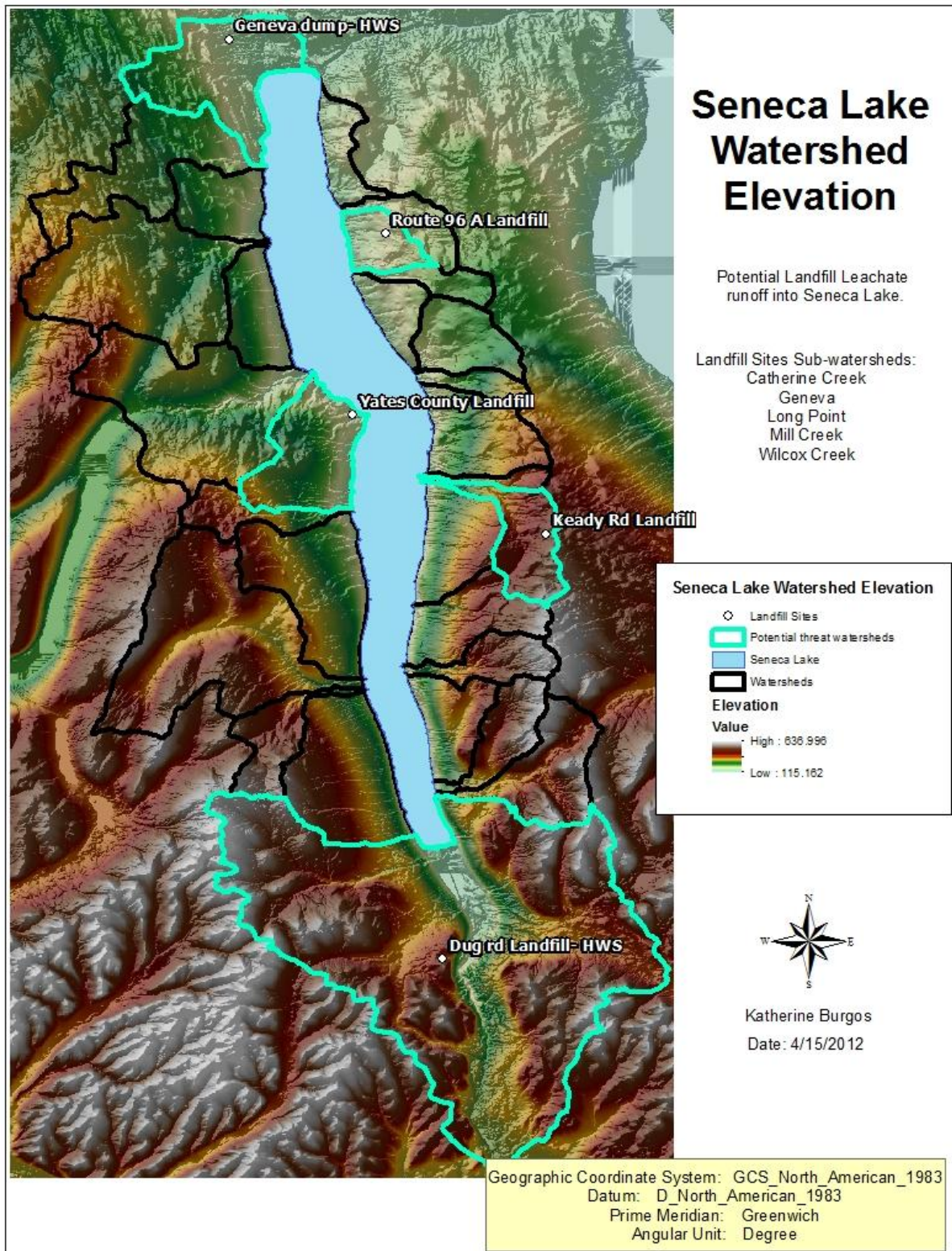


Figure 2

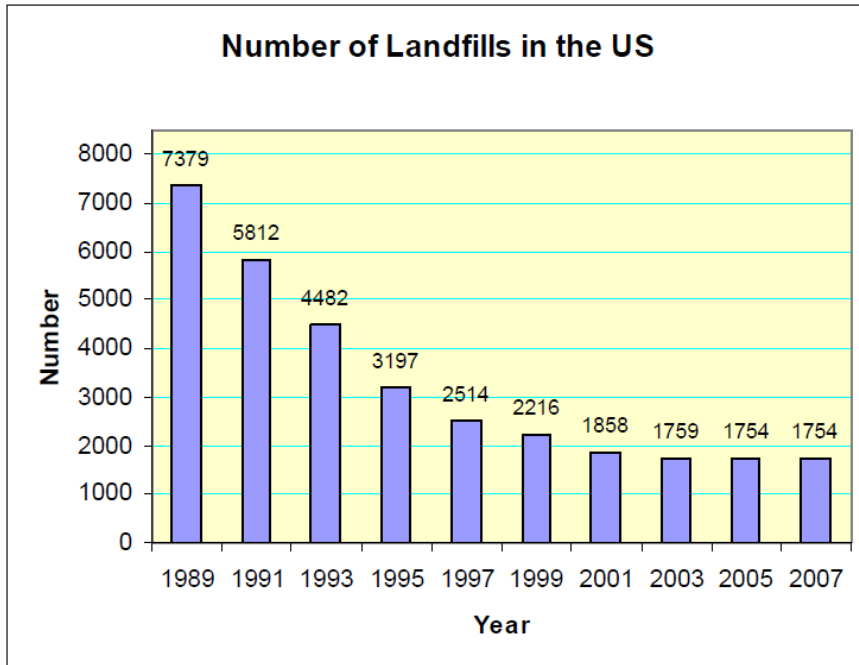


Figure 3 Number of landfills in the U.S. (EPA data)

References:

GFLRPC. 2010. Seneca Lake water management plan. Chapter 7D Source Pollution; Landfills, Dumps and Hazardous waste sites. <http://www.gflrpc.org/Publications/SenecaLakeWMP.htm>

Halfman, J.D. 2009. Landfills: Where does our trash go? Finger Lakes Institute, Hobart and William Smith Colleges.

Halfman, J.D. 2011. Water quality of Seneca Lake, New York. 2011 Update. Finger Lakes Institute, Hobart and William Smith Colleges.

Mor, S., K. Ravindra., R.P. Dahiya., and A. Chandra. 2006. Leachate characterization and assessment of groundwater pollution near municipal solid waste landfill site.

NYSDEC. Inactive Hazardous Waste Disposal Site Program. <http://www.dec.ny.gov/chemical/8439.html>