

SHIGELLA OUTBREAK AT SHANNON BEACH



By: Juliann Kibby & Carine Belizaire
Juliann.Kibby001@umb.edu
Carine.Belizaire001@umb.edu

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Professor Anamarija Frankic

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ABSTRACT

Bacteria and water quality can play a large role in human health and needs to be monitored in certain areas in order to maintain a healthy environment. In August of 2009 there was a Shigella outbreak at Shannon Beach in Winchester, MA. The Center for Disease Control and Prevention (CDC) says that Shigella is a group of bacteria that can cause an infectious disease known as shigellosis. After the first case of Shigella was reported and connected to the beach in early August, The Department of Public Health (DPH) began investigation to find the source of contamination. Gathered information as well as a survey that revealed the bathroom facilities was in poor conditions lead to the closing of the beach on August 21, 2009. Detailed investigations took place by the DPH and The Mystic River Water Association (MyRWA) in order to find the source of the bacteria. Water quality data and sampling on the surrounding waters as well as pipes in the area showed results that did not show any concern and did not identify a source. However, subjective reports on the use of the beach revealed that sanitary conditions were poor. Although not proved, these weak sanitary conditions in 2009 may have played a large role in the Shigella outbreak. Since then, slight improvements have been made to the recreational area and water quality levels are still acceptable for swimming, but many solutions and changes should still be implemented to improve the conditions and prevent this from occurring again.

INTRODUCTION

We as a team have been given the opportunity to become a steward and address a local environmental issue at selected project sites throughout the Mystic River Reservation in the Boston area. Within our investigation we are able to identify an environmental problem, research it, set goals and objectives, and propose alternative solutions in hopes of solving the issue or preventing the problem from occurring again. The problem was addressed from both a social and natural science perspective. With interest in water quality monitoring and environmental health issues, Shannon Beach in Winchester was the perfect project site for us to investigate. In late July and early August of 2009, an outbreak of Shigella infections was reported to the Bureau of Infectious Disease Prevention (BID) at the Massachusetts Department of Public Health (MDPH). Investigation revealed that exposure to Shannon Beach recreation area in Winchester, Massachusetts may have been the source of the infection (MDPH, 2010). On August 21, 2009, the Department of Conservation and Recreation closed the beach as a result of the outbreak (DCR, 2009). Small improvements were made to the beach since then, but much more can be done to make the area a safer and healthier environment.

HISTORY OF SHANNON BEACH

Shannon Beach recreation area, within the Mystic River Reservation, is located in the Upper Mystic Lake in Winchester, MA (Fig. 1). The beach was once known as “Sandy Beach” but was renamed “Shannon Beach” on September 13, 2008. The name was changed to honor Senator Charles E. Shannon who represented Winchester, Medford, and Somerville between 1991 and 2005 and swam at the beach as a child (Hassett, 2008). The beach borders the Mystic River and Upper and Lower Mystic Lakes in Medford, Somerville, and Winchester, and is

managed by the Massachusetts Department of Conservation and Recreation (DCR). DCR is the largest provider of recreation swimming opportunities in Massachusetts and manages over 50 beaches within the Commonwealth's State Park system and most are open to the public for swimming (DCR, 2011). Shannon beach recreational area is open between Memorial Day and Labor Day with access to a small public swimming beach, a picnic area, parking lot, a large grassy field, walking paths, and a playground. The park is well designed and the large open area is great for kids, soccer, volleyball, picnics, and many other activities. There is also one building with restrooms, changing rooms, and a common room, in which lifeguards hired by DCR are responsible for cleaning (MDPH, 2010).

Clean water is essential for safe swimming to protect the health of the public. The DCR does regular weekly water quality testing during the time the beach is open for swimming with standards set by the Massachusetts Department of Public Health (DCR, 2011). Bacteria can enter the swimming waters through a variety of sources and weekly testing ensures that the waters are safe and will not harm its users. After testing is complete, DCR will post a blue flag on the lifeguard chairs, contact stations, and main entry points, telling the public that the waters are safe for swimming. If a red flag is posted, this means the testing exceeded the standards and swimming is not allowed because it could potentially cause health risks. During red flag events, lifeguards also patrol the beach to personally warn the public and keep them from contacting the water (DCR, 2011). Testing is repeated until the bacteria levels return to normal and the beaches can be open for swimming again.

WHAT IS SHIGELLOSIS?

According to the Centers for Disease Control and Prevention, Shigellosis is an infection disease caused by a group of bacteria called *Shigella* (CDC, 2009). Symptoms of the infection range from diarrhea, vomiting, fever, and stomach cramps beginning a day or two after exposure to the bacteria. Although the infection rarely requires hospitalization and will usually resolve in five to seven days, a severe infection with high fever however can be dangerous in children less than two years old and may be associated with seizures (Agha and Goldberg, 2009). Some victims of the infections may show no symptoms at all but it can still easily be passed to others.

The bacteria can pass from one infected person to the next and is present in stools of infected people for up to a week or two after they have been in contact with the bacteria (Agha and Goldberg, 2009). There are several ways for a person to get the infection because the bacteria can be present among many common every day things. Most infections are the result of inadequate basic hygiene habits such as hand washing and the bacteria can be present on dirty fingers or stools of the contaminated person. This is particularly likely to occur among toddlers who are not fully toilet-trained or have not yet learned the importance of basic hygiene practices. Family members and playmates of such children are at high risk of becoming infected if the bacteria are present. Also, water can become contaminated if sewage runs into it or if someone with the infection swims or plays in it, especially in splash tables, untreated wading pools, or shallow play fountains used by small children (CDC, 2009). Another way for the bacteria to be passed is through certain types of sexual activity, most common among homosexual males (Agha and Goldberg, 2009). Finally, the infection may be acquired through eating contaminated food. Contaminated food will in most cases look and smell normal, but may become contaminated by infected food handlers who did not wash their hands with soap after using the bathroom.

Vegetables can also contain the bacteria if they are harvested from a field with sewage in it. Even flies can breed in infected feces and then contaminate food just by landing on it.

In order to prevent Shigellosis, it is important for the public health department to know about cases of shigellosis and for clinical laboratories to send isolates of Shigella to the City, County, or State Public Health Laboratory so that the specific type can be determined. If many cases occur at the same time, it may mean that a restaurant, food or water supply, has a problem that needs correction by the public health department. When a community-wide outbreak occurs, a community-wide approach to promote hand washing and basic hygiene among children can stop the outbreak. Improvements in workers hygiene during food picking, packaging, or serving may also prevent Shigellosis caused by contaminated produce. There are some current prevention measures in place in most communities to help prevent the infection. For example, making municipal water supplies safe and treating sewage are highly effective prevention measures.

Overall, Shigellosis is particularly common and causes recurrent problems in settings where hygiene is poor. Once the bacteria are present it can be easily passed to others and can sometimes sweep through entire communities. It is more common in summer than winter and children, especially toddlers aged 2 to 4, are the most likely to contract the infection. At Shannon Beach good hygiene can be described as almost non-existent because the bathroom facilities are old and dirty and the availability of running water isn't always consistent. The bacteria could have easily been spread at the beach by children or adults swimming or playing in the sand or water. Many cases are related to the spread of illness in public settings, similarly to Shannon Beach.

METHODOLOGY AND GOALS

Our goal with studying the area of Shannon Beach was to determine what the possible causes were that lead to the Shigella outbreak in 2009. Once we could determine this we wanted to address the problem by proposing solutions to prevent this from reoccurring again and to protect the health of the public and the beach environment. To begin the investigation we contacted Patrick Herron, Water Quality Monitoring Director from the Mystic River Watershed Association, as well as Karen Simpson from the EPA, and John Durant from Tufts University who has done significant amounts of research in the area. All were extremely helpful and provided us with written reports from the Massachusetts Department of Public Health on the outbreak of Shigella and the Bacterial Assessment on the outbreak from the Mystic River Watershed Association. Along with the reports, they were also able to provide us with water quality data sets, lab results, and their own personal opinion on what they believed the issue was and what was being done currently to improve the area. We also tried to contact the DCR directly but have yet to hear back from them. We were however, able to call a hotline where we expressed our concerns about the way the beach was being managed. Overall, we first researched the area and the environmental issue, made visits to our site to monitor change, and met up frequently to discuss information we gathered in order to propose solutions to the problem including education, upgraded facilities, and better management just to name a few.

RESEARCH AND FINDINGS

Massachusetts Department of Public Health

In late July and early August of 2009, the Massachusetts Department of Public Health reported 87 laboratory confirmed cases of Shigellosis, where investigation revealed that 31 of these cases reported exposure to Shannon Beach recreation area before becoming ill between July 17th and August 16, 2009 (fig. 2). The first positive case reported with exposure to Shannon Beach was on August 6, 2009. Of the remaining 56 cases, 39 did not have exposure to Shannon Beach, but did report having other beach exposures. The rest of the cases either did not reveal an exposure or did not follow up (MDPH, 2010). An investigation was immediately started with a focus on the beach in hopes of identifying a source of the outbreak.

To begin the investigation MDPH local health staff interviewed each of the confirmed cases of Shigella infections. Interviewers asked about recreational water use and where and when cases swam. Questions directly linking Shannon Beach recreation area to the infection were not asked in hopes to avoid biased answers. Each case was also asked about other household members or acquaintances that had joined them to the swimming area and were also ill (MDPH, 2010). These interviews are what lead to the total 31 confirmed cases being connected to Sandy Beach. Of the 31 confirmed cases, 23 were children less than 18 years of age where the mean age was 14 years and the median was 6 years. Also, all of these cases live in areas that have easy access to the beach (MDPH, 2010).

On a weekly basis, the swimming water at Sandy Beach is sampled for *Enterococci* and *E. Coli*, testing to ensure levels are within acceptable water quality regulation. *Enterococci* and *E. Coli* are fecal bacteria indicators of possible sewage contamination in water. *Enterococci* levels shall not exceed a geometric mean of 61 colony forming units per 100 ml to meet the

standard of acceptable levels. *E. Coli* levels shall not exceed a geometric mean of 235 colony forming units per 100 ml (MyRWA, 2008-2011). If the levels exceed these numbers, the water may still be safe for boating and other recreational activities, but it is not safe for swimming and could cause harmful health side effects. Also to note, during the time the beach is open for swimming to the public between Memorial Day and Labor Day, the DCR also does regular water quality testing. However, outside of this time period, they do not conduct regular water quality testing (DCR, 2011). This testing by the MDPH began in May of 2009 and only one sample in early June caused the beach to close for a day due to high levels of *Enterococci* (MDPH, 2010). However, later tests revealed no further evidence of a problem. In response to the outbreak, MDPH Bureau of Environmental Health (BEH) collected additional water and sand samples for testing on August 17, 2009, prior to the beach closing. Samples were taken from five different areas of the beach and collected following BEH-approved methods (fig. 3). The water was tested for *Enterococci* and *E. Coli* and the sand was tested for *Shigella*. All of the sand samples tested negative for *Shigella* while two of the ten water samples had *E. Coli* levels above standard (fig. 4) (MDPH, 2010). After the beach closing, an additional twenty-five swab samples were taken from nearby surfaces including in the bathrooms, water fountain, lifeguard stands, handrails, benches, and the playground. All of the swabs collected also tested negative for *Shigella* but the bathrooms had been cleaned prior to the visit by DCR staff and may have impacted the results (MDPH, 2010; MyRWA, 2010).

Mystic River Watershed Association

The Mystic River Watershed Association (MyRWA) also got involved at the beach to conduct tests to identify the source of the bacteria when they felt the beach was being managed

in a way that was potentially allowing people to get sick. The MyRWA along with the DPH concluded that the beach and surrounding facilities were in poor sanitary condition. According to observations made by the DPH, the restrooms and changing room facilities were not well maintained and could have been a favorable location for transmission (MDPH, 2010). The MyRWA collected anecdotal reports that described the same poor conditions. Several of the reports stated beach users seeing diapers and clothes left behind on the beach and trash barrels being overfilled (MyRWA, 2010).

On August 26, the MyRWA also performed Hotspot sampling in the area of Shannon Beach that would lead to possible sewage contamination. Hotspot sampling can be used when the goal is to determine whether leaks or spills have occurred over a relatively large area. A “hotspot” is then defined as a localized area of relatively high contamination (Byrnes, 2001). The information required for this method includes the size and shape of the site, the size and shape of each hotspot, and the concentration level that defines a hotspot, and is designed to detect a single hotspot (Byrnes, 2001). Samples were taken from the shoreline, nearby sewage pipes, and from the middle of the river (MyRWA, 2010). The sampling however did not identify any pipes that might have caused the outbreak.

The hotspot results did however predict that in times of heavy rainfall or storm conditions bacterial contamination in the Aberjona River can result in high bacteria levels at the beach due to a pipe that releases sewage at a concerned level and contributes to poor water quality in the river (MyRWA, 2010). These overflows are referred to as combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs). Combined sewer systems collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe (EPA, 2011). During heavy rainfall or storm conditions, however, the wastewater volume in a combined sewer system can exceed

the capacity of the system or the treatment plant it is normally sent to. When this occurs, the system will overflow and discharge directly into nearby rivers, streams, or other bodies of water. CSOs are a major threat to the health of the water because they contain not only storm water but also untreated human and industrial waste, toxic materials, and debris. Similarly, sanitary sewer systems are designed to collect and transport all of the sewage that flows into them to a treatment works facility (EPA, 2011). Unfortunately, on occasion these sewers unintentionally overflow in communities in almost every system. SSOs occur due to several factors including severe weather, vandalism, or improper system design, operation, or maintenance.

In the case of the Aberjona River and Shannon Beach, CSOs are the overflows of concern. As a result of these overflows, water quality in the Aberjona River is poor and brought up the question whether or not it could have impacted the water quality at Shannon Beach. Since July 2000, MyRWA has been monitoring water quality across the watershed by collecting samples from fifteen different sites. The samples are analyzed for bacteria, suspended solids, nutrients, conductivity, dissolved oxygen, water temperature, and watercolor and odor. In 2007, the first Mystic River Baseline Index was released by MyRWA giving a summary of water quality and conditions in the watershed (MyRWA, 2008-2011). Two sites of interest include the Aberjona River at the USGS on Mystic Valley Parkway across from Mystic Avenue in Winchester, MA and the Upper Mystic Lake at the Mystic Lakes Dam by Medford Boat Club off of Mystic Valley Parkway in Medford MA. The Upper Mystic Lake site is only minutes from Shannon Beach. In sampling the watershed, *E. coli* is used as an indicator of the presence of human sewage. As previously stated, to meet the water quality standards, the number of *E. coli* should not exceed a geometric mean of 235 colony forming units per 100 ml (MyRWA, 2008-2011). In July of 2009 around the time of the Shigella outbreak, the number of *E. coli* bacteria at

the Aberjona River sampling site was 465 cfu/100 ml (fig. 5) (MyRWA, 2008-2011). These numbers were also high in previous months as well as in 2010 and greatly exceed the standard and are not acceptable for swimming. However, at the same time the number of *E. coli* bacteria at the Upper Mystic Lake were only 10 cfu/100 mL and remained at this level in previous and later months as well as into 2010 (fig. 6) (MyRWA, 2008-2011). These numbers do meet the water quality standard and therefore indicate that during this time and currently, the poor water quality in the Aberjona River was and is not negatively affecting the water quality at Shannon Beach.

Overall, while the hotspot data results did predict that in severe weather it is possible that contamination from CSOs in the Aberjona River could negatively affect water quality at Shannon Beach, the water quality data does not match and these weather conditions did not exist in the periods prior to the Shigella outbreak. Other facts also lead specialists to conclude there is a low chance that the Aberjona River is the source of the Shigella outbreak. These facts are based on the distance of Sandy Beach from the opening of the Aberjona River, the presence of two fore bays between the two locations, and the tendency of bacteria to be attached to solid material that settles out of the water column (MyRWA, 2010).

Personal Visits Made to the Beach

On June 29, 2010, about a year after the closing of the beach, a staff member of the MyRWA visited the area at 6 PM to investigate the condition of the beach. On this day, the majority of the people there were of Latino background, several barrels lined with plastic existed along the beach, and the bathrooms had been locked at 5 PM. There was no place to wash hands outside the facility but there was a working drinking fountain. There were also two port-o

potties on the beach, one with toilet paper and hand sanitizer, the other with neither (MyRWA, 2010). According to Patrick Herron who is Water Quality Monitoring Director at the Mystic River Watershed Association and is very familiar with the area, the plumbing in the facilities are out of date and resulted in leaking pipes in the ceilings as well as the outdoor showers being permanently turned off (Herron, 2011). At this time, the beach was being managed in a slightly better way with a cleaner beach and facilities. It appears that some measures were taken to improve the conditions of the beach, but they were still far from perfect. MyRWA had a meeting on the beach in 2010 with representatives of the DCR to discuss the need to upgrade the facilities (Herron, 2011). Herron informed us that since new facilities have not already been built they believe it is an environmental justice issue. It is difficult to measure environmental justice so it is unclear whether or not this is the case but the MyRWA is still currently advocating for upgraded facilities.

It was hard to tell whether conditions had improved when we visited the site in February of 2011, largely due to the fact that it was winter and most of the area was covered with snow. The area felt like a very safe environment. It is very open and located on a main road but also very peaceful. There are small wooded areas on either sides of the sandy beach and around the large field with walkways and paths throughout. It is a very beautiful place for walking, kayaking, fishing, swimming, and picnicking. The facilities were locked up and port-o-potties and barrels were removed for the off-season. Rules and regulations were visibly posted on the wall of the bathrooms, however they were not listed in any other languages other than English. Overall, the area is well designed and impressive. It seems like a very popular place for relaxing on the weekends and holidays and made me curious what it is like in peak season.

On the second visit, on May 9, 2011 when weather conditions were becoming warmer and more people were making visits to the recreational area, we were able to get a better visual of what the beach is like during the summer and what improvements could be made and have been made. First off, the facilities were still locked until Memorial Day but a clear sign was posted that the bath house closes at 6 pm. There is still not a place for hand washing for after the bath house closes and the water fountain had been turned off. There was however 3 port-o-potties all equipped with toilet paper and hand sanitizer. Beach rules and regulations were still only posted in English and only one overfilled barrel was present in the entire recreational area, close to the playground. There was also a box attached to a tree containing litter bags to clean up after your dog, only the box was empty and no more bags remained. Along the beach itself was scattered trash including plastic bottles, female sanitary pads, candy wrappers, and other similar paper and plastic products. The attached figures 7 through 10 show pictures taken during this visit of the problematic sanitary conditions. During this time in May, the recreational area is not as busy compared to the summertime and conditions at the beach are still not well maintained. Based on current observations certain issues need to be addressed and improvements can be made to help the sanitary conditions, appearance, and health of the beach and entire recreational area.

CHALLENGES

There were several challenges during the investigation of this outbreak in order to find the source. First off, although the testing methods followed the same patterns and were approved by the Bureau of Environmental Health and Mystic River Water Association, there is no established protocol for testing for Shigella and testing was improvised (MDPH, 2010).

Therefore, it is possible that the bacteria were present and not detected. Also, as already previously noted, the facilities had been thoroughly cleaned by the DCR between the time the beach closed and the swab samples were taken. This makes it very unlikely that the bacteria would still be present on the surfaces. Also, 17 cases never followed up and language and cultural barriers existed in some of the confirmed cases (MDPH, 2010). Biased answers are also always a possibility when doing interviews and trying to remember exact dates and locations from the past. Finally, hotspot sampling may all introduce a type of sampling bias. Since sampling occurs only at random selected locations, small areas of contamination may be missed if they are not entirely within the sample chosen, resulting in a possible underestimation of the contamination at the site. Therefore, careful judgment must be practiced when choosing the area of sampling to be used. Finally, the time in which our research took place consisted of the winter and spring. We were not able to see firsthand what the conditions are like when the beach is filled with users, and had to rely on our observations in the off season and personal observations of others in order to make comparisons.

WHAT CAN BE DONE?

The MDPH recommends several points to address the problem including maintaining, cleaning, and adequately supplying restrooms and changing rooms. They also recommend following the rules and regulations relating to hygiene at the beach, such as washing hands after using the rest rooms or changing diapers and using the designated area for diaper changing. Finally, it is recommended that ill people should not be using the public area and rules and regulations should be posted in English and other languages (MDPH, 2010). The MyRWA also suggests some other changes that could help the safety and health of the beach and its users.

Such changes include adding more barrels, dumping and cleaning them regularly, and making sure there is enough staff to monitor the beach (MyRWA, 2010).

Expanding on these thoughts, as well as introducing new solutions, we have come up with several ideas to help the future development of Shannon Beach. The most important solution is education. Full understanding and cooperation from the public is necessary for the problem to be resolved. Informing the public on environmental issues and asking for their help can improve the issues and protect the environment in future generations. Pertaining specifically to Shannon Beach, knowing the issues will drive people to practice better hygiene practices if they want to continue to use the beach area. Also, educating people and explaining the positive results of eliminating direct pollution, reducing, reusing, and recycling, flushing responsibly, and conserving water can improve the water quality at the beach as well as other bodies of water. People may be less likely to pollute the area directly by dumping trash into the river if they know they are impacting the area in a way that could potentially close the beach. Promoting reducing, reusing, and recycling as well as flushing responsibly will result in less garbage and hazardous wastes in CSOs that end up in the river. Finally, conserving water, especially during storm events, can reduce the flow in CSOs and possibly even avoid the overflow all together. Educating the public and the youth about the causes and effects of water pollution and other environmental issues will teach individuals what they can personally do to protect rivers, beaches, and other ecosystems.

As well as educating individuals, there are other solutions that can be done directly do the recreational area of Shannon Beach that will improve its conditions and health. The solution that will have the greatest positive effect will be building new bathroom and changing room facilities. The current ones are old and run down and need to be improved. New, clean facilities alone will

promote people to keep them clean. They can be equipped with motion sensor lights, sinks, soap dispensers, and hand dryers, as well as disposal boxes for all feminine protection products and diapers. This will keep users from touching surfaces and prevent the spread of bacteria and germs. Also, motion sensor lights and sinks will save energy and water and will help move towards a sustainable environment. Clivus multrum composting toilets are also a great way keep from polluting the environment and to save water and energy. These composting toilets are a self-contained, waterless, and odorless toilet treatment system. It uses no chemicals, heat or water, and fecal material and urine are deposited in a single chamber that allows decomposition so that when removed over a period of years can be put directly into the soil (Humanure Handbook, 1999). The waste that is put back into the ground provides nutrients to the soil and prevents sewage from being added to bodies of water. It can save from polluting 25,000 liters of water per year and costs far less than regular toilet systems because an entire sewage system does not need to be built (Humanure Handbook, 1999).

There are simpler solutions that can also be made to the beach that will have a large positive impact. For instance, since the beach house closes at 6 pm, an outdoor sink, drinking fountain, and port-o-potties are all necessary. Based on our visits, port-o-potties and a drinking fountain already exist. However, staff needs to ensure that they work properly and that the port-o-potties are fully equipped at all times with toilet paper and hand sanitizer. An outdoor sink does not exist at the beach and would be a good investment to allow people to wash their hands and prevent them from rinsing or washing them in the river. Also, since such a diverse population uses the beach area, the regulations should be posted in other languages. They currently exist only in English and some beach users may not even be able to read these and understand rules of the beach to keep people safe. Finally, it has been observed by others that

barrels are added to the beach during peak season, but based on our visit, the area is in need of several more throughout the entire recreational area. One barrel for the large area is simply not enough. As well as adding more barrels to prevent trash being piled up on the grounds, the barrels need to be monitored and emptied on a regular basis. A solution to make this an easy process would be to increase the staff of the beach and create a schedule to change the barrels, add toilet paper and hand sanitizer to the port-o-potties, and regulate the beach to make sure its users are keeping it clean and respecting the regulations of the area.

CONCLUSION

Although there were challenges to the investigation and environmental sampling and laboratory testing could not locate a source for the Shigella outbreak or prove that it came from Shannon Beach, there was enough information discovered to close the beach on August 21, 2009. The confirmed cases and poor sanitary conditions of the beach make it clear the area was connected. Where the bacteria can easily be passed from person to person and can survive for several days outside of a human host, the poor maintenance of the facilities and beach make it a desirable site for transmission and spreading (MDPH, 2010). The hot and humid weather conditions during the period of the outbreak could also have been an important factor. The hot weather leads to warmer water temperatures and more people attending the beach, which could easily assist in the transmission of an infection. There were no cases that began later than August 24, 2009, which supports the hypothesis that activity associated with Shannon Beach was the likely source of the outbreak (MDPH, 2010). In order to improve the conditions and prevent this from occurring again, changes to the beach area need to be made. Informing the public of issues and educating the youth can prevent harmful environmental issues and protect the environment

in the future. Building new facilities equipped with composting toilets and other motion sensor utilities such as lighting and bathroom sinks will give the users an incentive to keep the area clean as well as move towards a sustainable world by saving energy and water. Other small steps such as increasing the number of barrels in the area, adding more staff to monitor the beach and consistently clean and supply the restrooms, port-o-potties, and empty the barrels can much a large positive impact on the beach. Whereas the water quality at the beach has remained stable since 2009 and is still safe for swimming, the beach area needs to be better maintained to keep it a healthy environment. It is a beautiful area with great potential and should be protected. Out of curiosity and personal interest, I will continue to observe changes at the beach to see what the recreational area will be like during the summer. I hope steps are taken to improve the site and I will continue to do all that I can to advocate for a change.

Figure 1: Google map of Shannon (Sandy) Beach location.



Figure 2: Epidemic Curve of confirmed Shigella cases between 7/17/09-08/16/09 (MDPH, 2010)

Confirmed Primary Cases of PFGE-matched *Shigella sonnei* with Reported Exposure to Shannon (Sandy) Beach within Incubation Period
2009

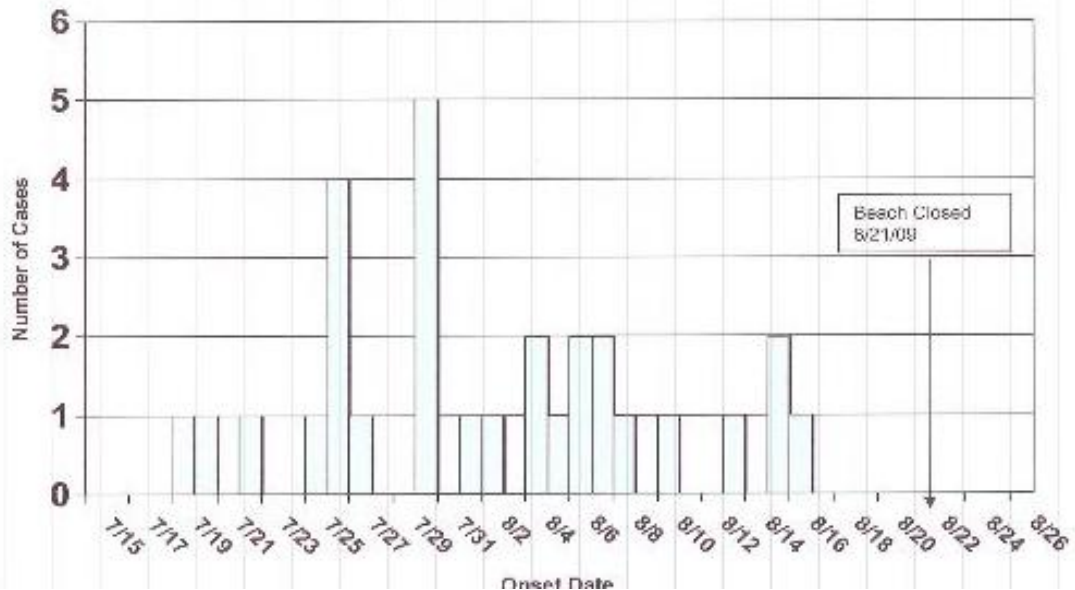


Figure 3: Sand sampling locations testing for Shigella (MDPH, 2010)



Figure 4: *Enterococci* and *E. Coli* sample results. (MDPH, 2010)

Sample Location	Sample Date	Indicator	Bacteria Level (cfu/100 mL)
Location 1	17-Aug-09	Enterococci	10
Location 1	17-Aug-09	E. Coli	220
Location 2	17-Aug-09	Enterococci	20
Location 2	17-Aug-09	E. Coli	260
Location 3	17-Aug-09	Enterococci	20
Location 3	17-Aug-09	E. Coli	290
Location 4	17-Aug-09	Enterococci	20
Location 4	17-Aug-09	E. Coli	55
Location 5	17-Aug-09	Enterococci	20
Location 5	17-Aug-09	E. Coli	50

The freshwater beach water Enterococci standard is 61 colony forming units/100 mL and the E. Coli standard is 235 colony forming units/10 mL

Figure 5: Water quality results in the Aberjona River (note: units are different than the units described in this report, but represent the same standards) (MyRWA, 2008-2011)

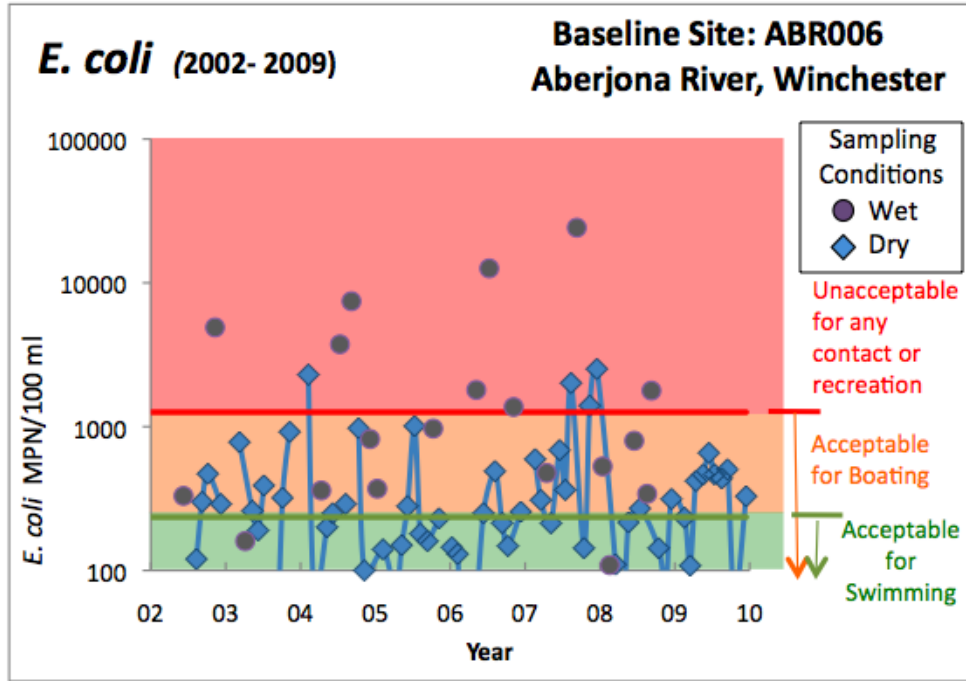


Figure 6: Water quality results in the Upper Mystic Lake (note: units are different than the units described in this report, but represent the same standards) (MyRWA, 2008-2011).

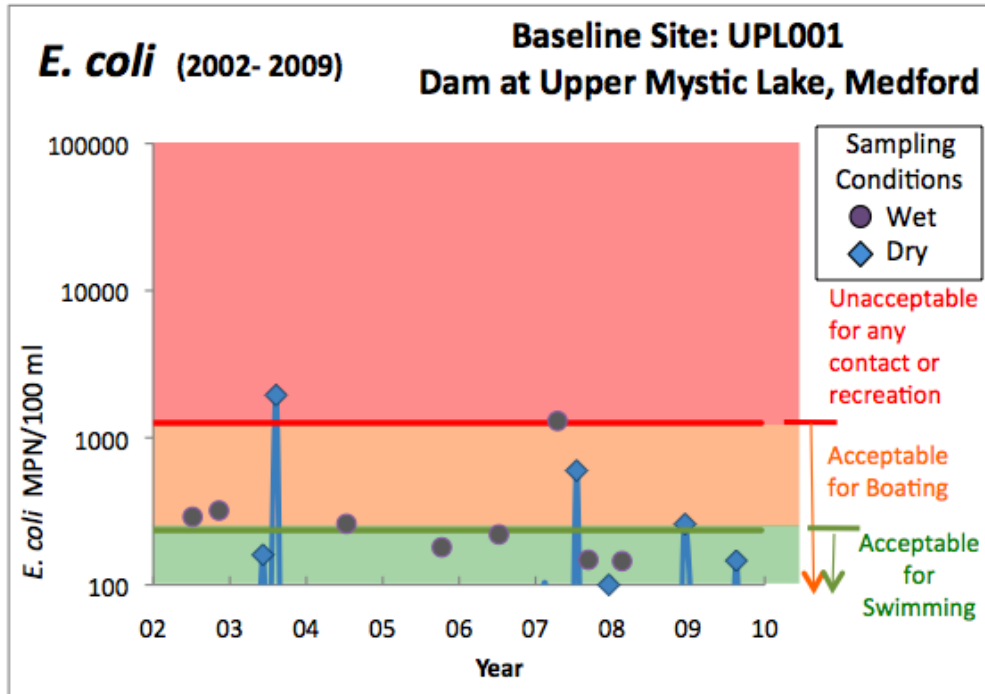


Figure 7: Empty box of litter bags
(Photo taken by Juliann Kibby, 5/9/11)



Figure 8: Single overfilled trash barrel.
(Photo taken by Juliann Kibby, 5/9/11)



Figure 9: Candy wrapper along water
Shoreline (Photo taken by Juliann Kibby,
5/9/11)



Figure 10: Female sanitary protections along
beach shoreline (Photo taken by Juliann
Kibby, 5/9/11)



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